



Activity Report 2003–2006

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1. CTS Research Unit

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Foreword: The centre entered a re-structuring process and it is now organized on three research lines (instead of eight) with a concentration of resources (human mainly) and developing much more inter cooperation. The centre is rapidly increasing in number of PhD researchers. The international interface diversifies and is becoming increasingly rewarding. Financially the situation is quite satisfactory. Graduation figures are increasing.

1.1. General Objectives

The centre aims to develop research recognized at international level in all the research lines and groups. The centre encourages technology transfer mostly supported by spin offs and dip involvement in international R&D projects. Scientific results are expected to contribute to improve the graduate training in the academia and contribute to internationalization of our graduate students. We participated in about 400 specific international actions as joint papers, international events organization, etc. This effort will be intensified.

Research lines and research groups have different levels of scientific and organizational development. They still operate mostly isolated from each other but with strong international links. Existing potential, as cross cooperation examples shows, anticipates the possibility of stronger in house integration and creation of scientific synergetic valour.

For microelectronics the objective besides the recent integration of new skills on materials and processes, is to embrace microelectronics (analogue and digital), telecommunications and signal processing and to make directly technology available (materials and circuits) for further developments. Hosted activities are planned to incrementally contribute to integration of research.

Motivation supported by recent development after two years of careful preparation (under Galileo project, the EU alternative to GNSS, with ESA and CAST, the Chinese Space Agency) is to promote joint research activities in microelectronics, telecommunication and signal processing backed by UNINOVA, FCT/UNL and several aerospace Chinese Institutes. Plans to foster PhD and MSc thesis are consistent with the recent signed protocol relative to the graduating training of Portuguese engineers for activities in Galileo ground segment.

The research line on Computational Intelligence, Decision, Modelling and Control has a strong interface with space activities and with astrophysics (projects GAIA- mapping of the galaxy and Solar information system). Also pos-docs involved in data mining and knowledge discovering are meant to contribute to that research. Cooperative links have a chance to develop within the microelectronics/telecommunications merge, mainly at graduation level (new foreign PhD students). Intelligent control deals with the development of advanced control algorithms for distributed parameter systems, that is, systems modelled by partial differential equations addressing transport phenomena. An interface with space related activities is expected to occur.

Research on Collaborative Networks, hopes to contribute to establishing the topic as a scientific discipline, targeting two new domains at model formalization level: telecommunications and energy. Reference curriculum for education in CN and launching of the SOCOLNET will be pursued. The objective is the continuous reinforcement of the group reputation, strengthening it as a world reference but also to bridge activities with the two identified fields.

Concerning Interoperability, dynamic evolution of systems based on models supported by standards creates a challenge, how can interconnectivity be updated automatically still assuring conformance of information. Also research on distributed interoperable context-aware-service architectures will benefit from previous developments. Building & Construction, furniture, telecommunications and aero spatial industry will continue to be our target domains. Besides the economical, industrial and societal impact we want to continue contributing to establish a more solid and rigorous base of science in those domains of research.

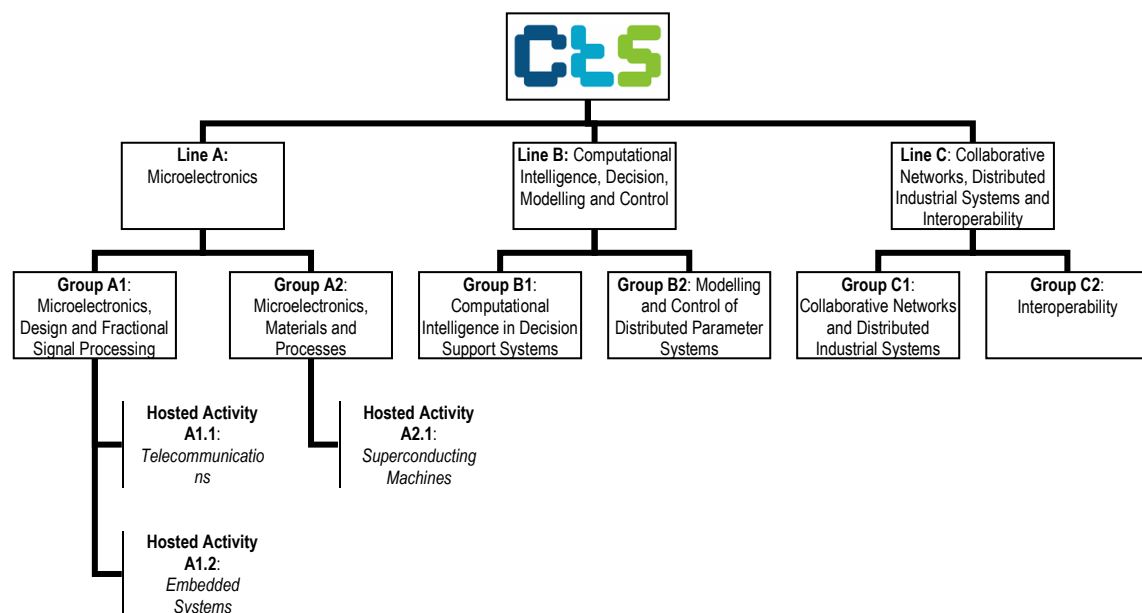
1.2. Organisational Structure

The Centre encloses 3 Research lines, 6 Research groups and additional 3 Hosted activities.

Research line A (Microelectronics) focuses on advanced design of Systems-on-Chip and Sensors. Research Line A encloses the Research Group A1 (Microelectronics, Design and Fractional Signal Processing), which by its side hosts the activities of Telecommunications, Embedded systems; and the Research Group A2 (Microelectronics, Materials and Processes) that holds hosted activity Superconducting Machines.

Research line B (Computational Intelligence, Decision, Modelling and Control) focuses on soft computing and non-linear models for predictive adaptive control. Research line B encloses two Research Groups: B1) Computational intelligence in Decision Support Systems; and B2) Modelling and Control of Distributed Parameter Systems.

Research line C (Collaborative Networks, Distributed Industrial Systems and Interoperability) focuses on building the foundations of Collaborative Networks and to respond to systems' interoperability. Research Line C is composed by Research Group C1 (Collaborative Networks and Distributed Industrial Systems) and Research Group C2 (Interoperability).



A set of individuals and teams work towards managing the centre activities:

- Centre Director;
- Research Line coordinators;
- Research Group coordinators;
- Centre scientific council (all the PhDs full members);
- Research Group scientific commission (all the research group PhDs full members);
- Research Group advisory board (a selected distinguished set of external experts).

Services Support: Secretary (2); UNINOVA accounting services; Networking.

Facilities: UNINOVA Building (1000 m2); equipments dedicated to research; meeting rooms, etc.

1.3. Management

The Director has close contacts with the research group's coordinators. The centre strategy is defined at the scientific council. Local resources are allocated according with specific needs for the main activities and aligned with on-going projects. UNINOVA overheads are 12.5 % and 10% for international and national multi-annual projects. Management of research projects is done directly by the researchers and is highly decentralized. Scholarships are available for young researchers, most of them supporting an MSc or PhD program. Research group cross cooperation either for projects execution or proposals submission as well as inter group mobility is encouraged and is frequent.

The centre maintains a database for publications and for structure description (<http://oa.uninova.pt>), a centre web site (<http://www.uninova.pt/cts>) and an overview. To improve visibility the centre make available a continuous updated individual short CV (last six years), highlighting the publication record, the research projects, PhD and MSc thesis finished and ongoing, relevant boards they participate, etc. A summary of research lines and group scientific achievements is regularly up dated as well as internal reference indicators. The centre established a publication policy, identified major journals for all the research areas and encourages publishing there. Rewards will be available.

The centre is promoting hosted activities aimed at being fully integrated (or not) in the near future. Medium and long term research is planned to be mostly financed by international projects of R&D (EU average success rate is less than 10% and ours is about 30% for the last 15 years) and a few national ones. The centre encourages inclusion of spin-offs in international and national projects, as well as other research groups.

The centre tries to build up a vision for future development based on the contributions and potential of the different research areas and also stimulates strongly cross cooperation and internationalization of young researchers.

1.4. Main Achievements

Strong effort publishing in books and major journals: Journals/conferences/books/chapters (554): 261 articles and papers indexed at ISI Web of Science; 105 articles and papers in IEEE and IEE journals, as IEEE Transactions on Circuits and Systems I and II and IEE Electronics Letters and in Computational Intelligence, Decision Modelling and control, IEEE Trans. Control Systems Technology, IEEE Trans. Control Systems Technology, Journal of Intelligent and Fuzzy Systems, Fuzzy Sets and Systems and in Collaborative Networks and Interoperability, Computers in industry, I. J. Computer Integrated Manufacturing, and in major IEEE conferences (VLSI'2004 and in ISSCC'2006).

Journal- editorial board's participation -43.

Conference organizing (chairs, co-chairs, scientific chair, session organizer) -95.

Graduation: PhD thesis-13 concluded and 26 ongoing; 100 MSc thesis on going (2006/7) and 23 concluded.

More than 50 international projects (and 36 national projects) with a success rate larger than 30%.

Four patents submitted: Methods of ergonomic work; EP 1 473 836; A Novel Self-Calibration Technique for ADCs; Control System based on electronic pole changing.

Development of novel Integrated tools for designing, optimizing and simulating integrated circuits.

Development of state of the art circuit prototypes (8) (design, materials and processes) supported by FCT research projects (rated excellent or very good) as Optical transducer non-pixelled architecture based; a Laser Scanned p-i-n Photodiode (LSP) for Image Detection; tandem photocells for image sensing application; 10b-50MS/s Parallel Pipeline ADC; Highlights: First silicon-proved time-interleaved pipeline ADC employing low-voltage techniques. The published fastest and the most energy efficient Parallel Pipeline ADC. IEEE VLSI Circuits Conference. Proj: ADOPT (Excellent); Gaussian and Uniform High-amplitude Broadband Noise Generators. Highlights: Power dissipation of the Gaussian Noise Generator reduced by one order of magnitude when compared with the state-of-the-art for increased performance; First Practical Uniform Noise Generator reported up to date. Proj: SECA (Excellent); 10b-4MS/s Parallel Pipeline ADC for fingerprint sensors. Highlights: Very low power dissipation; No special process layers used for implementing the capacitors. Project: S2A (Excellent); First fully-integrated CMOS UWB radar transceiver Project: Watermon (EU),. Highlights: Novel architecture using new fully-differential circuits for pulse generation and new receiver topology (PhD thesis). Invitation (accepted) by Springer to edit the PhD thesis as a book.

Development of novel algorithms for empirical mode decomposition, decision making, data mining, image processing, etc

Development of a framework to assist implementation of multilevel standard protocols and interoperability (PhD thesis). Introduction of semantic conformance to enhance interoperability through ontological harmonization of organizational models. Introduction of ontology-based model-morphisms for product reference model data.

Development and successful submission of ISO standard AP236.

Elaboration of a EU study on "specific policy needs for ICT standardization".

Development of a new 3G core model, improving significantly the handover performance for 3G/WLAN networks. Development of a first 802.11 MAC layer model, handling mixed unicast and broadcast traffic, and saturated and non-saturated networks.

Spin-offs: Launching of the spin-off Acacia Semiconductor SA, (intellectual property) and recent successful integration on S3.

Coordination and development of a comprehensive Training Programme on Interoperability. Participation on the development of a European Master Programme on IT in Construction.

Scientific research on Collaborative Networks (CN): contribution to establishing CN as a new scientific discipline; progress towards a reference model for CN; a formal benefits model for collaborative networks (PhD thesis); a contract-based approach for agile manufacturing; a system architecture for the ICT infrastructure for CN; integrated service-oriented collaborative networks applied to elderly care; COBASA prototype for distributed assembly systems; negotiation wizard for CN creation.

International Awards: Outstanding Service Award from IFIP; the International William J. Conroy Standards Professional award; the Intelligent Manufacturing Systems Highly Successful Completion Award; and the Best international interoperability project in Public Administration Award.

1.5. Vision for the Future (2007-2010)

The centre has a new designation on line with the existing and planned activities. It was decided to re align research in three main lines each of them with two research groups and one hosting three activities. That led to a concentration and optimization of resources and to a clarification of the research scope and was done simultaneously with the enlargement of microelectronics spectrum of activities. A symbiotic approach was settled embracing microelectronics, telecommunications, and fractional signal processing.

The centre shows a sound record of cooperative internationalization (about 400 actions) and is highly competitive for international funding (EU, ESA, FCT and some other national/international programmes) reaching around 5M€ in reporting period.

The publication's record shows over 550 items (around 100 in international journals). Graduation had an increment of MSc ongoing thesis (20 to around 80) and PhD candidates (16 to 26). The number of PhD full members reached 26 and will rise (30%) in the near future as well as graduation.

Under microelectronics research line much of the activity was based on the development of "circuits and components". Time is up to address multidisciplinary "system's development", typically SoCs. Cooperative research on "superconductive systems" and "materials and processes", on "power electronics" is also progressing. Coming from 130nm and 95 nm to 65 nm, microelectronics design is now looking at 'nanotechnology based semiconductors devices' as part of the future strategy. More research on optical communications, UWB microelectronic design (new PhD thesis starting) and telecommunications, is needed and a new researcher specialized in high frequencies will reinforce the research line. Tools for design, optimization and simulation of microelectronic circuits, will be realigned.

We will trim this effort with recent developments in the Galileo program (network of satellites to support the European GNSS system) with the partnership of CAST (equivalent to ESA and NASA) of the People's Republic of China. We were asked to cooperate tailoring the graduation program and supervising future Portuguese engineers that will integrate the ground segment facilities in Madeira. R&D projects with aerospace Chinese institutes are planned to be looked for, and several proposals for PhD thesis were prepared for scientific collaboration in telecommunication, microelectronics and signal processing.

Under Computational Intelligence, Decision, Modelling and Control research line, we share a common interest in soft computing and non linear models for predictive adaptive control. One of the groups being more focused in space activities will certainly be influenced by the previously reported activities and developing scenarios. Besides the ongoing program to Mars (were landing problems are addressed), the GAIA (mapping the galaxy) and the Solar Information system projects will bring new visibility to the group and the centre. Recent re-located pos-docs also will have the opportunity to promote their research, in the area. The second research group, more dedicated to non linear models for predictive adaptive control will reinforce naturally its research core (quite successful in EU projects) and will be attentive to further developments.

The third research line is fully aligned with recent EU directives and concerns, both in building the foundations of Collaborative Networks and to respond to systems' interoperability challenges and will bridge to telecommunications (notice the recent cross involvement preparing the recent study on 'specific policy needs for ICT standardization') and energy domains as targets for modelling cooperative networking. Novel contributions to establishing CN as a new scientific discipline and progress towards a reference model for CN including a unified based approach for manufacturing system and to give interoperability a sounder

scientific base, are expected. Also domains as context awareness, service oriented architectures and collaborative environments will be object of additional research (PhD thesis). Production and diffusion of additional advanced training materials will complement and extend the existing scenario (12 courses on interoperability as e-learning materials and supporting an EU MSc degree).

As a global result, research will be more cooperative and multidisciplinary and aimed to reinforce:

1. publishing, mostly in major journals and a selected niche of conferences;
2. internationalization;
3. research mostly supported by international funding;
4. the graduation figures, mainly through much more PhD thesis;
5. internationalization of young researchers.

As a natural process, hosted activities will be fully integrated during the next term. Also the centre researchers must have a scientific productivity compatible with the highest international standards or leave.

2. Key Indicators

Follows a summary of the key indicators for the centre in respect to the reporting period.

Staff and Students

- PhD Researchers: **21 individuals**;
- PhD Students: **48 individuals**;
- MSc Students: **95 individuals** (registered in 2006/2007 scholar year);

Scientific Production

- Book: **4 items**; Book Edition: **3 items**; Book Chapters: **43 items**
- Articles in International Periodicals (Refereed): **102 items (74 @ Web of Science)**
- Ratio WoS Articles/PhD Researcher: **3,52 articles/PhD**; National ratio ⁽¹⁾: **1,21**
- Papers in International Conferences (Refereed): **378 items (187 @ Web of Science)**
- Ratio WoS Papers/PhD Researcher: **8,90 papers/PhD**; National ratio ⁽²⁾: **4,49**
- Paper Citations (based on GoogleScholar analysis): **+1000**

1 National Ratio of WoS Articles/PhD researcher computed based on the total of WoS (Web of Science) articles (in Science Citation Index Expanded / SCI-EXPANDED) for Portugal during period 2003-2006 in the considered relevant top 500 subjects "ENGINEERING, ELECTRICAL & ELECTRONIC" (#423), "COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS" (#164), "COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE" (#161), "AUTOMATION & CONTROL SYSTEMS" (#95), "TELECOMMUNICATIONS" (#82), "COMPUTER SCIENCE, THEORY & METHODS" (#70), "COMPUTER SCIENCE, INFORMATION SYSTEMS" (#58), "COMPUTER SCIENCE, SOFTWARE ENGINEERING" (#56), "COMPUTER SCIENCE, HARDWARE & ARCHITECTURE" (#48), "COMPUTER SCIENCE, CYBERNETICS" (#9), totaling #1166 items, divided by the number of PhD researchers reported by to FCT by the associated centers in the domain of "Informatics, Electronic and Electrotechnical Engineering" in the period 2003-2006 (#963), i.e. $1166 / 963 = 1,21$ articles per PhD researcher.

2 National Ratio of WoS Papers/PhD researcher computed based on the total of WoS (Web of Science) proceedings papers (in the Conference Proceedings Citation Index-Science / CPCI-S) for Portugal during period 2003-2006 in the relevant top 500 subjects "COMPUTER SCIENCE, THEORY & METHODS" (#878), "COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE" (#876), "ENGINEERING, ELECTRICAL & ELECTRONIC" (#716), "COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS" (#428), "COMPUTER SCIENCE, INFORMATION SYSTEMS" (#385), "TELECOMMUNICATIONS" (#355), "AUTOMATION & CONTROL SYSTEMS" (#305), "COMPUTER SCIENCE, SOFTWARE ENGINEERING" (#230), "COMPUTER SCIENCE, HARDWARE & ARCHITECTURE" (#123), "COMPUTER SCIENCE, CYBERNETICS" (#34), totaling #4330 items, divided by the number of PhD researchers reported to FCT by the associated centers in the domain of "Informatics, Electronic and Electrotechnical Engineering" in the period 2003-2006 (#963), i.e. $4330 / 963 = 4,49$ papers per PhD researcher.

Scientific Production (continued)

- International awards: **4 awards**
- Patents: **4 patents**
- Prototypes, Demos, etc.: **30 items**

- PhD students: **48 individuals**; PhD theses submitted (in period): **13 theses**
- Ratio PhD theses/PhD Researcher: **0,62 theses/PhD**; National ratio ⁽³⁾: **0,32**
- Ration PhD students/PhD Researcher: **2,29 PhD students / PhD researcher**

Projects & Funding

- International: **52 projects**; International Own Funding (in period): **4.419.574,27 € ⁽⁴⁾**
- National: **36 projects**; National Own Funding (in period): **630.868,50 € ⁽⁴⁾**
- Own Funding (in period): **5.050.442,77 € ⁽⁴⁾**; Average per Year: **1.262.610,69 € ⁽⁴⁾**

International Cooperation – Worldwide & Regional (European)

- Conference organization (chairs, co-chairs, sessions, etc): **95 items**
- Books: **2 items**; Book Chapters: **19 items**; Book Edition: **3 items**
- Articles in Periodicals: **54 items**; Papers in Conferences (refereed): **119 items**
- Journal's editorial boards: **43 items**

³ National Ratio of PhD theses/PhD Researcher computed based on the total of PhD theses produced in period 2003-2006 in Portuguese universities in "Informatics, Electronic and Electrotechnical Engineering" domain (#309 according to GPEARI - Gabinete de Planeamento, Estratégia, Avaliação e Relações Internacionais) divided by the number of PhD researchers reported by the FCT associated centers in the same domain in the period 2003-2006 (#963), i.e. $309 / 963 = 0,32$ PhD theses per PhD researcher.

⁴ The calculation of the own funding in period was based on a pro-rata computation, given the actual project start and finish date.

2.1. Personnel

The centre research team is composed of 78 individuals, divided in between integrated personnel, scholarship researchers and collaborators. The research team ensures the research and development activities at the centre.

The key personnel figures are the following:

- Integrated Personnel: 43 individuals (of whose 21,00 PhD eligible fraction);
- Scholarship Researchers: 21 individuals;
- Collaborators: 14 individuals.

Integrated Personnel (42 individuals)

Full Name	Academic Degree	Professional Category	% time	Eligible fraction
Adolfo Sanchez Steiger Garção	PhD	Professor Catedrático	30	1,00
Amadeu Leão Santos Rodrigues	PhD	Professor Catedrático	40	1,00
Luis Manuel Camarinha Matos	PhD	Professor Catedrático	50	1,00
Manuel Martins Barata	PhD	Prof. Coordenador	30	1,00
Armando José Pires	PhD	Prof. Coordenador	30	1,00
Fernando Jose Almeida Vieira do Coito	PhD	Professor Associado	45	1,00
Manuel Duarte Ortigueira	PhD	Professor Associado	50	1,00
Paulo da Costa Luis da Fonseca Pinto	PhD	Professor Associado	30	1,00
Maria Rita Sarmento de Almeida Ribeiro	PhD	Professor Associado	50	1,00
Arnaldo Manuel Guimarães Batista	PhD	Professor Auxiliar	40	1,00
Isabel Maria Nascimento Lopes Nunes	PhD	Professor Auxiliar	30	1,00
Isabel Maria Silva Pinto Gaspar Ventim Neves	PhD	Professor Auxiliar	40	1,00
João Carlos da Palma Goes	PhD	Professor Auxiliar	40	1,00
Jose António Barata de Oliveira	PhD	Professor Auxiliar	40	1,00
Jose Manuel Matos Ribeiro Fonseca	PhD	Professor Auxiliar	40	1,00
Luis Filipe dos Santos Gomes	PhD	Professor Auxiliar	40	1,00
Luis Filipe Lourenço Bernardo	PhD	Professor Auxiliar	50	1,00
Maria Manuela de Almeida Carvalho Vieira	PhD	Professor Auxiliar	30	1,00
Mario Fernando da Silva Ventim Neves	PhD	Professor Auxiliar	30	1,00
Rui Alexandre Nunes Neves da Silva	PhD	Professor Auxiliar	50	1,00
Yuri Vygranenko	PhD	Investigador	50	1,00
João Paulo Branquinho Pimentão	MSc (*)	Professor Auxiliar	50	1,00
João Paulo Mestre Pinheiro Ramos e Barros	MSc (*)	Professor-Adjunto	30	1,00
Pedro Alexandre da Costa Sousa	MSc (*)	Professor Auxiliar	40	1,00
Ricardo Luis Rosa Jardim Gonçalves	MSc (*)	Professor Auxiliar	50	1,00
André Teixeira Bendo Damas Mora	MSc	Assistente	50	0,00
Anikó Katalin Horváth da Costa	MSc	Assistente	40	0,00
Antonio João Pina da Costa Feleciano Abreu	MSc	Assistente	35	0,00
João Almeida das Rosas	MSc	Assistente	40	0,00
João Miguel Murta Pina	MSc	Assistente	50	0,00
João Pedro Abreu de Oliveira	MSc	Assistente	30	0,00
Nuno Filipe Silva Veríssimo Paulino	MSc	Assistente	50	0,00
Pedro Miguel Negrão Maló	MSc	Assistente	30	0,00
Pedro Miguel Ribeiro Pereira	MSc	Assistente	35	0,00
Paulo Miguel de Araujo Borges Montezuma	MSc	Assistente	30	0,00
Raul Eduardo Capela Tello Rato	MSc	Outra	50	0,00
Rodolfo Alexandre Duarte Oliveira	MSc	Assistente	30	0,00
Rui Manuel Carvalho Pais	MSc	Assistente	30	0,00
Rui Manuel Leitao Santos Tavares	MSc	Assistente	50	0,00
Stanimir Stoyanov Valtchev	MSc	Assistente	30	0,00
Tiago Oliveira Machado de Figueiredo Cardoso	MSc	Assistente	35	0,00
Anabela Monteiro Gonçalves Pronto	PAPCC	Assistente	30	0,00
Pedro Miguel Figueiredo Amaral	Lic.	Assistente	30	0,00

(*) Recent PhD during the term

Scholarship Researchers (21 individuals)

Full Name	Academic Degree	Professional Category	% time	Eligible fraction
Maria do Carmo Correia Marques	MSc	Bolseiro	40	0,00
Ana Rita Gamito Bentes de Campos	Lic.	Bolseiro	60	0,00
Ana Sofia Fachada Fernandes	Lic.	Bolseiro	50	0,00

Bruno René Fernandes Monteiro dos Santos	Lic.	Outra	50	0,00
Bruno Miguel Nunes Januário Vaz	Lic.	Outra	50	0,00
Carlos Jorge da Costa Figueira	Lic.	Bolseiro	40	0,00
Carlos Manuel Melo Agostinho	Lic.	Bolseiro	55	0,00
Fernando Miguel Moitinho	Lic.	Bolseiro	40	0,00
Hugo Miguel de Pinho Vieira	Lic.	Bolseiro	100	0,00
João Filipe dos Santos Sarraipa	Lic.	Bolseiro	70	0,00
Marco António Da Luz Delgado	Lic.	Bolseiro	50	0,00
Orlando José Lourenço Fragoso Branco	Lic.	Bolseiro	40	0,00
Paulo Elvino de Sousa Pina	Lic.	Bolseiro	60	0,00
Pedro Nuno de Carvalho Goncalves Barroso	Lic.	Bolseiro	40	0,00
Ricardo Figueiredo Restolho	Lic.	Bolseiro	60	0,00
Ricardo Filipe Pires Nunes	Lic.	Bolseiro	100	0,00
Ruben Duarte Dias da Costa	Lic.	Bolseiro	55	0,00
Sérgio Miguel da Silva Onofre	Lic.	Bolseiro	55	0,00
Soraia Marisa Da Cunha Rocha	Lic.	Bolseiro	100	0,00
Tiago Henrique da Silva Merca Rodrigues	Lic.	Bolseiro	100	0,00
Pedro Miguel Silva Ramalhais	Lic.	Outra	50	0,00

Collaborators (14 individuals)

Full Name	Academic Degree	Professional Category	% time	Eligible fraction
Guiomar Gaspar de Andrade Evans	MSc	Assistente	20	0,00
Paula Maria Garcia Louro Antunes	MSc	Eq. Professor Adjunto	20	0,00
Luis Filipe Figueira Brito Palma	PAPCC	Assistente	30	0,00
Ana Inês da Silva Oliveira	Lic.	Bolseiro	40	0,00
Antonio Filipe Ruas da Trindade Maçarico	Lic.	Outra	30	0,00
Bruno Miguel Domengue Heliotrophe Miranda	Lic.	Outra	30	0,00
Carlos Eduardo Dias Coutinho	Lic.	Outra	30	0,00
Filipa Alexandra Moreira Ferrada	Lic.	Bolseiro	40	0,00
João Carlos Mouta Ferreira	Lic.	Outra	30	0,00
João Manuel Ferreira Martins	Lic.	Outra	30	0,00
Miguel Alexandre Sousa Ferro de Beça	Lic.	Outra	30	0,00
Pedro Tiago Saraiva Rodrigues da Fonseca	Lic.	Outra	30	0,00
António Jorge Teixeira Falcão	BSc	Bolseiro	100	0,00
Fernando Luís Lourenço Ferreira	BSc	Outra	30	0,00

2.2. Publications

Classification scheme for Publications is based on the FCT own classification with some add-on changes for enhanced resolution of the analysis of the centre publication performance:

- Book - Author: Authoring of a book;
- Book - Editor: Editing in a book;
- Book - Proceedings: Editing of conference/workshop volumes.
- Book Chapter: A chapter or section in a book;
- Periodical – International: Papers in international scientific periodicals with referees;
- Periodical – National: Paper in national periodicals with referees;
- Paper in Conference (Refereed): Papers in conference proceedings;
- Special Issue: Edition of a Journal Special Issue.

Count of publication		Line			
Type Table	Year	Line A	Line B	Line C	Grand Total
a) Book - Author	2003			1	1
	2005	2		1	3
a) Book - Author Total		2		2	4
b) Book - Editor	2003			1	1
	2004			1	1
	2005			1	1
b) Book - Editor Total				3	3
c) Book - Proceedings	2003			2	2
	2004	1		3	4
	2005			1	1
	2006	1		1	2
c) Book - Proceedings Total		2		7	9
d) Book Chapter	2003	1	3	1	5
	2004	1	1	9	11
	2005	4	2	7	13
	2006	5	7	2	14
d) Book Chapter Total		11	13	19	43
e) Periodical - International	2003	14	7	6	27
	2004	17		3	20
	2005	17	3	4	24
	2006	25	3	3	31
e) Periodical - International Total		73	13	16	102
f) Periodical - National	2004			1	1
f) Periodical - National Total				1	1
g) Conference Paper (Refereed)	2003	44	17	19	80
	2004	47	32	30	109
	2005	61	24	25	110
	2006	32	18	29	79
g) Conference Paper (Refereed) Total		184	91	103	378
h) Special Issue	2003	1	1	5	7
	2004			1	1
	2005			2	2
	2006	1		3	4
h) Special Issue Total		2	1	11	14
Grand Total		274	118	162	554

Table 1 – Publications by research line

Count of publication	Type Chart				
Year	Proceedings	Book	Periodical	Conference	Grand Total
2003	2	7	27	80	116
2004	4	12	21	109	146
2005	1	17	24	110	152
2006	2	14	31	79	126
Grand Total	9	50	103	378	540

Table 2 – Publication comparative analysis

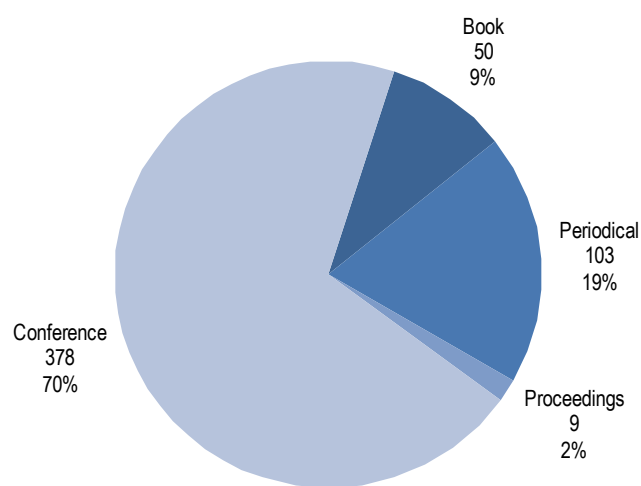


Figure 1 – Distribution of publication type

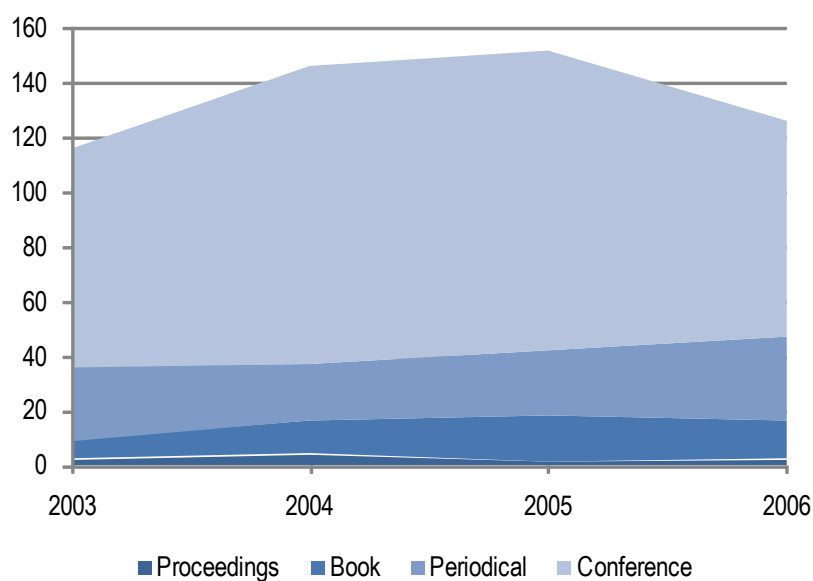


Figure 2 – Evolution of publication types by period year

2.2.1. Publications and Indexing

This section presents an overview of the centre publications that are indexed by scientific indexing services, which is one of reference – ISI Web of Knowledge.

Count of publication		Line			
Type Table	WoS	Line A	Line B	Line C	Grand Total
e) Periodical - International	No	16	2	10	28
	Yes	57	11	6	74
e) Periodical - International Total		73	13	16	102
g) Conference Paper (Refereed)	No	111	32	48	191
	Yes	73	59	55	187
g) Conference Paper (Refereed) Total		184	91	103	378
Grand Total		257	104	119	480

Table 3 – Publications at ISI Web of Knowledge Indexing Service

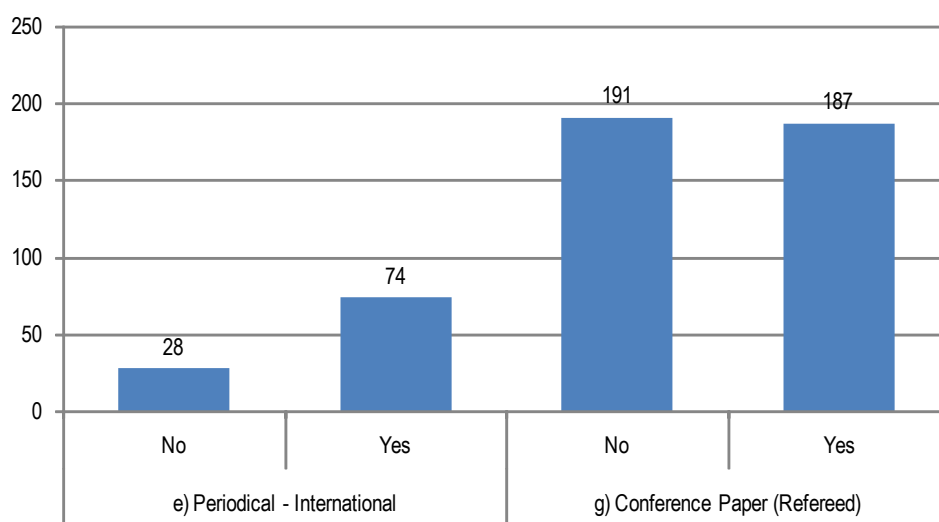


Figure 3 – Publications at ISI Web of Knowledge Indexing Service

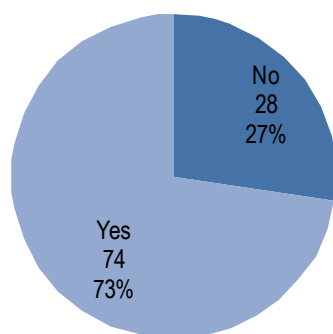


Figure 4 - Articles in Periodicals at ISI Web of Knowledge Indexing Service

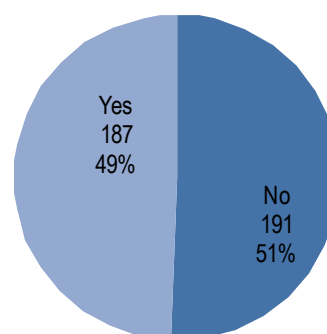


Figure 5 - Conference papers at ISI Web of Knowledge Indexing Service

2.3. Theses

This section outlines the Centre performance in terms of academic theses production.

Count of publication		Line			
Type Chart	Year	Line A	Line B	Line C	Grand Total
PhD	2003	0	1	0	1
	2004	1	0	2	3
	2005	2	0	1	3
	2006	2	2	0	4
PhD Total		5	3	3	11
MSc	2003	3	0	0	3
	2004	0	0	1	1
	2005	4	2	0	6
	2006	4	4	5	13
MSc Total		11	6	6	23
Grand Total		16	9	9	34

Table 4 - Theses production by research line (*)

(*) Note that in 2007 (and after) the figures for MSc raises considerably (> 80) due to the transition to Bologna process.

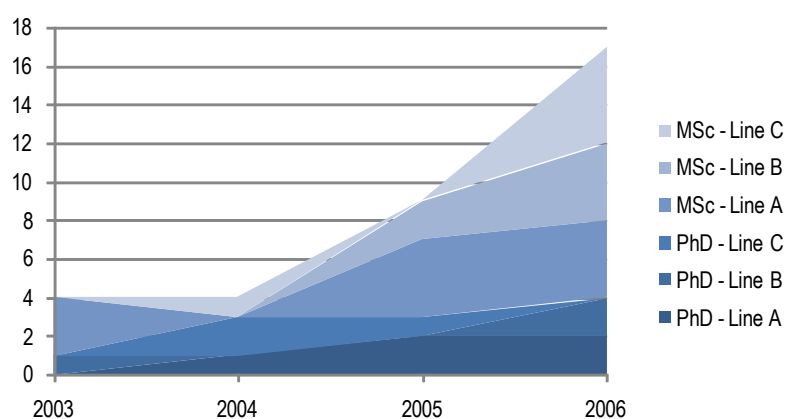


Figure 6 - Evolution of Theses Production

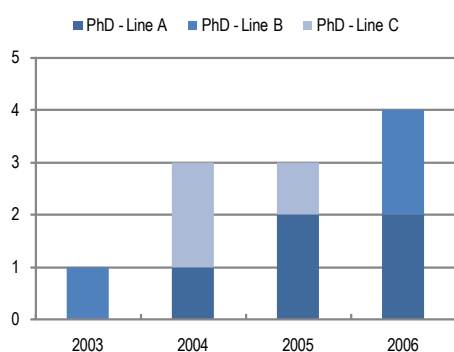


Figure 7 – PhD Theses Production by Line

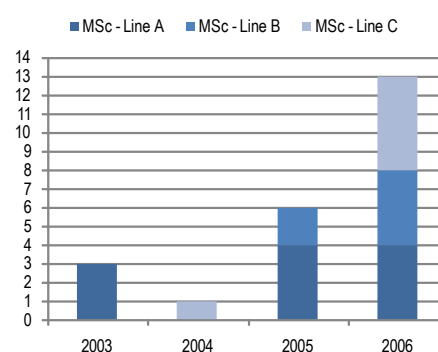


Figure 8 - MSc Theses Production by Line

2.4. Funding

This section summarises the figures of funding related projects that were active within the reporting period.

The following charts outline the projects distribution by Research Line, Type of Project (RTD and Network), Sponsor/funding agency and Scope (National and International).

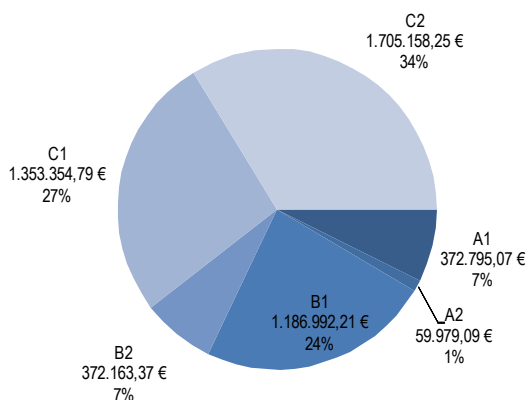


Figure 9 – Project distribution by line

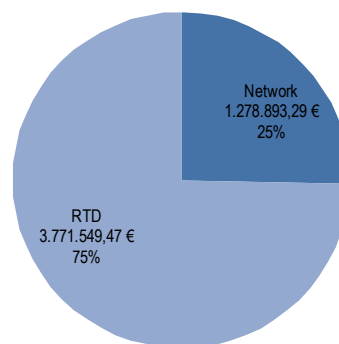


Figure 10 - project distribution by type

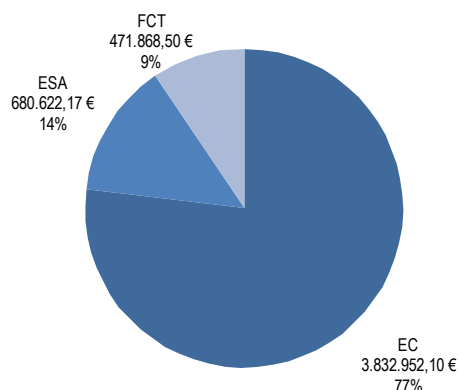


Figure 11 – Project distribution by agency

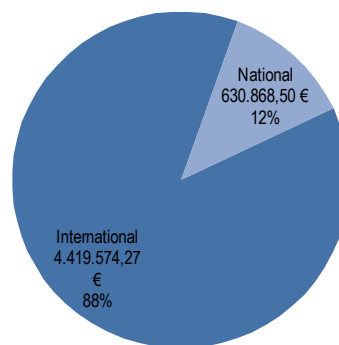


Figure 12 – Project distribution by scope

The following table presents the funding for each period year and separated by research line. The calculation of a year funding was based on a pro-rata computation, given the actual project start and finish date and the own funding (i.e. budget allocated to Centre for the whole project duration).

Line	Funding 2003	Funding 2004	Funding 2005	Funding 2006	Total Funding
Line A	90.796,60 €	86.374,49 €	133.291,79 €	122.311,27 €	432.774,16 €
Line B	326.698,19 €	385.353,16 €	394.334,77 €	452.769,44 €	1.559.155,57 €
Line C	566.192,04 €	868.674,52 €	812.270,83 €	811.375,65 €	3.058.513,04 €
Grand Total	983.686,84 €	1.340.402,17 €	1.339.897,39 €	1.386.456,36 €	5.050.442,77 €

Table 5 – Project funding by period year and research line

2.5. Patents

This section presents the registered patents within the reporting period:

1. [A Novel Self-Calibration Technique for ADCs.](#) A Novel Self-Calibration Technique for ADCs (SECA and ESA Projects): It consists in applying a White Gaussian Noise stimulus to the ADCs and calculating, in the digital domain, the calibrating-codes from the histogram of the output-codes. This technique allows on-chip built-in self-calibration and self-testing of Video-rate ADCs. A European Patent has been granted in 2006 under this subject (EP 1 473 836). This patent is a clear and successful demonstration of our interdisciplinary cooperation between researchers from microelectronics and signal processing areas.
2. [Patent on a new model and methodology in the area of ergonomics.](#)
3. [Preliminary registration for claiming another patent in the area of automation and security.](#)
4. [Control System based on electronic pole changing.](#) A recently developed control system (whose patent is still pending) is being developed by the Group. The motor is of axial flux type and the control system is based on electronic pole changing. It has 24 windings, two semi-stators and an YBCO plate as rotor, for it behaves as a hysteresis disc motor.

2.6. Awards

ISO International William J. Conroy Standards Professional Award

Jardim-Gonçalves, Ricardo. 2003; received the International William J. Conroy Standards Professional Award from the International Standardization Organization (ISO) -. Award defined by US Product Data Association (US PRO) Board of Directors.

IFIP Outstanding Service Award

Camarinha-Matos, Luís 2005; received an Outstanding Service Award, International Federation for Information Processing (IFIP), General Assembly of IFIP, held in Sep 4th - 5th 2005, Gabarone, Botswana.

Best international interoperability project in Public Administration Award

Research Group C2 "Interoperability" received in 2006 a *best international interoperability project in Public Administration award*. The international project SEEMseed, technically directed by Antara received the "iG" award from the 1st European summit on Interoperability in Administration for the best interoperability project in Public Administration. The Scientific Committee that awarded the prize is made up of Spanish and European experts on issues of information and communication technologies (ICTs) and the Technological and Knowledge Society, coming from both the collegiate, research, professional and university fields.

IMS SMART-fm Highly Successful Completion Award

Research Group C2 "Interoperability" received in 2006 an award from the International Steering Committee (ISC) of the Intelligent Manufacturing Systems Scheme, for the highly successful completion of the "A Standards Compliant Framework to Support Complete Integrated Product Life-Cycle Information Management and Electronic Commerce for the Furniture Manufacturing (Fm) Industry, in the Advent of the Smart Enterprises" project, commonly known as SMART-fm. The message was that: "The outcome, development of the ISO10303-AP236 International Standard, is a remarkable contribution to interoperability in the furniture industry, especially to SMEs".

2.7. Cooperation

This section is dedicated to the measurement of cooperation performance of the Centre. Cooperation levels can be distinguished into the following categories:

- None: no cooperation involved;
- Group: cooperation with the research group;
- Organisation: cooperation inside the scope of the Centre;
- National: cooperation performed inside the country borders;
- Regional: cooperation at regional level, i.e. European level;
- Worldwide: cooperation outside European boards and towards the whole globe.

Count of publication	Year				
ns1:cooperation	2003	2004	2005	2006	Grand Total
worldwide	29	26	20	26	101
regional	24	35	24	25	108
national	24	32	46	29	131
organisation	2	4	3	6	15
group	34	42	46	35	157
none	10	8	15	9	42
Grand Total	123	147	154	130	554

Table 6 – Cooperation levels by period year

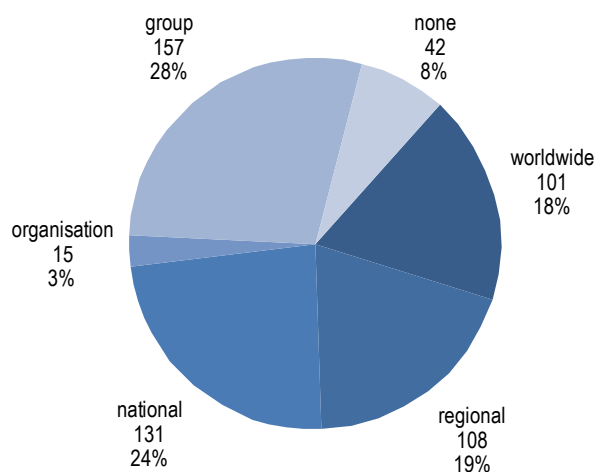


Figure 13 - Distribution of cooperation type

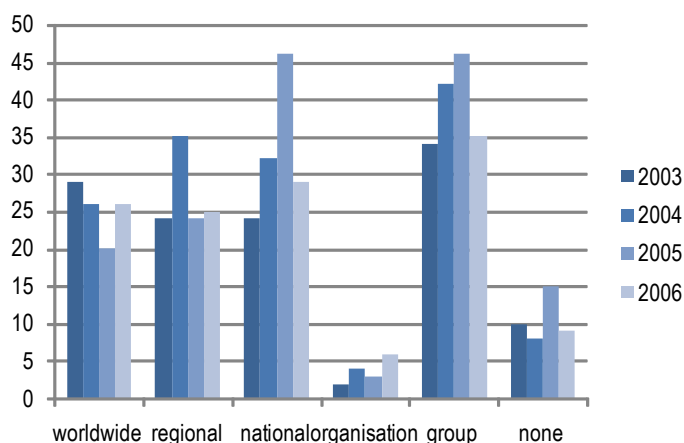


Table 7 - Evolution of cooperation type by period year

Cooperation – Publications

This section outlines cooperation in view of publications.

Count of publication	ns1:cooperation						
Type Table	worldwide	regional	national	organisation	group	none	Grand Total
a) Book - Author		2				2	4
b) Book - Editor		3					3
c) Book - Proceedings	2	4				3	9
d) Book Chapter	1	18	7		9	8	43
e) Periodical - International	37	17	26		15	7	102
f) Periodical - National						1	1
g) Conference Paper (Refereed)	57	62	98	15	127	19	378
h) Special Issue	4	2			6	2	14
Grand Total	101	108	131	15	157	42	554

Table 8 – Cooperation levels by publication type

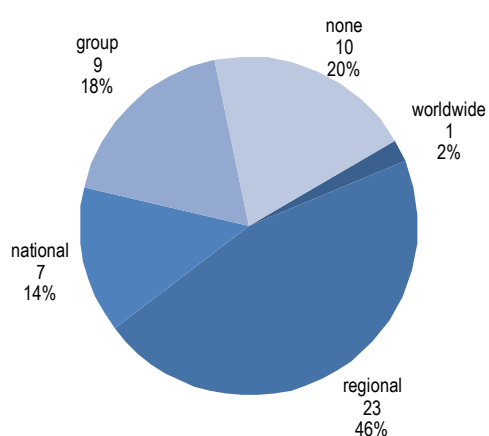


Figure 14 – Cooperation levels on Books

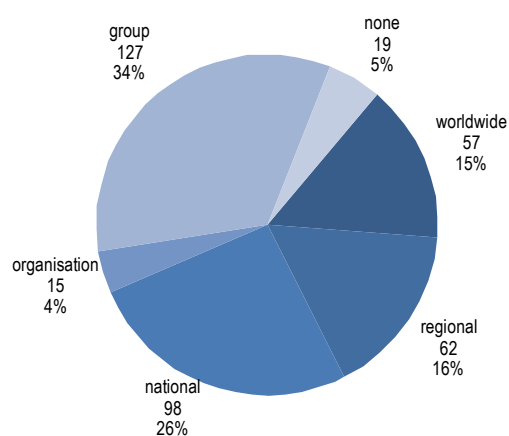


Figure 15 – Cooperation levels on Conference Papers

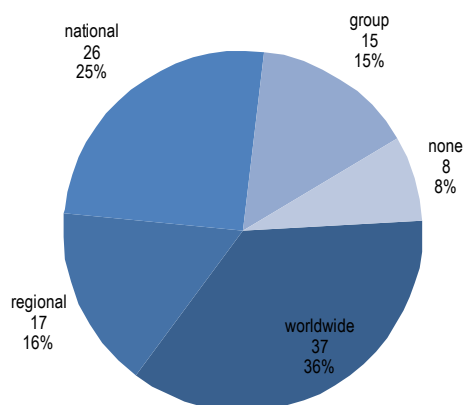


Figure 16 – Cooperation levels on Periodicals

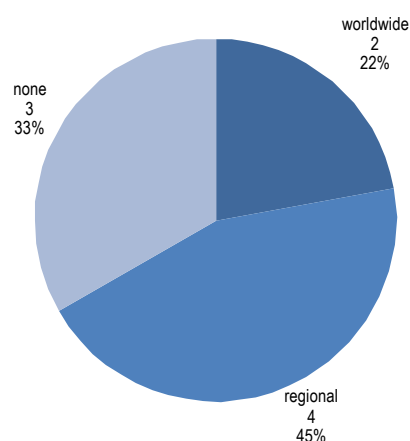


Figure 17 – Cooperation levels on Proceedings

3. Research Lines and Groups

3.1. Line A: Microelectronics

Research Line Coordinator: Prof. Adolfo Steiger Garção

Advisory Board

- Vitalii Dugaev, Frantsevich Institute for Problems of Materials Science, National Academy of Sciences of Ukraine
- Marckus Shubbert, IPE, University of Stuttgart, Germany

Organisation – Line A

- Group A1: Microelectronics, Design and Fractional Signal Processing
 - Hosted Activity A1.1: Telecommunications
 - Hosted Activity A1.2: Embedded Systems
- Group A2: Microelectronic, Materials and Processes
 - Hosted Activity A2.1: Superconducting Machines

Publications – Line A

This section focuses on the Publications performance of Research Line A.

Count of publication		Hosted					
Type Table	Year	A1	A11	A12	A2	A21	Grand Total
a) Book - Author	2005	1				1	2
a) Book - Author Total		1				1	2
c) Book - Proceedings	2004			1			1
	2006			1			1
c) Book - Proceedings Total				2			2
d) Book Chapter	2003		1				1
	2004					1	1
	2005			4			4
	2006	1	2			2	5
d) Book Chapter Total		1	3	4		3	11
e) Periodical - International	2003	2			6	6	14
	2004	2		1	12	2	17
	2005	4		2	7	4	17
	2006	5	2		14	4	25
e) Periodical - International Total		13	2	3	39	16	73
g) Conference Paper (Refereed)	2003	7		6	17	14	44
	2004	4	3	13	14	13	47
	2005	13	5	11	11	21	61
	2006	5	4	11	8	4	32
g) Conference Paper (Refereed) Total		29	12	41	50	52	184
h) Special Issue	2003	1					1
	2006	1					1
h) Special Issue Total		2					2
Grand Total		46	17	50	89	72	274

Table 9 – Publications by research group of research line A

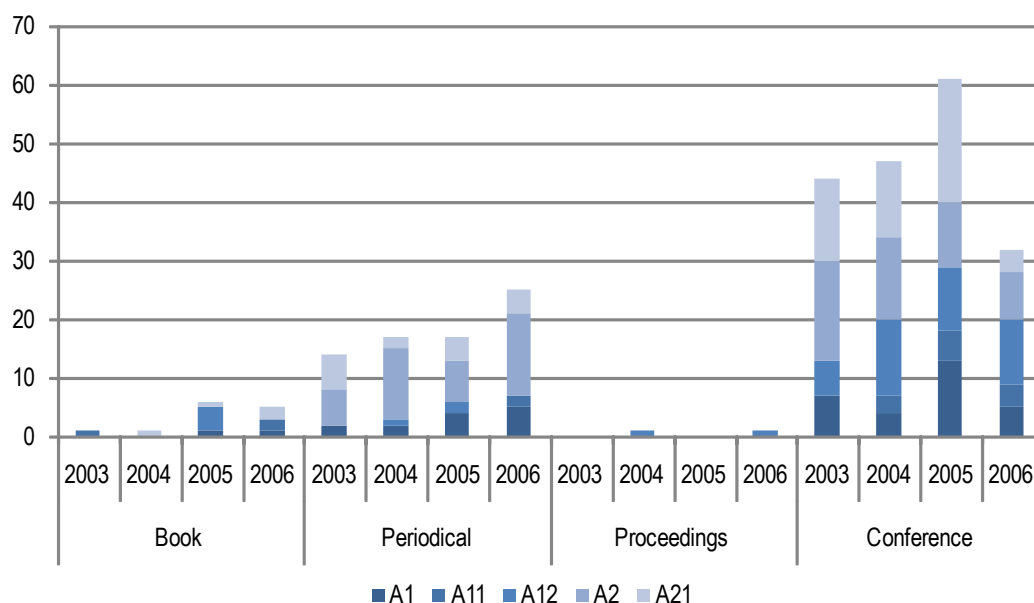


Figure 18 – Publication performance by period year and research group of research line A

Count of publication		Hosted					Grand Total
Type Table	WoS	A1	A11	A12	A2	A21	
e) Periodical - International	No	5		1	3	7	16
	Yes	8	2	2	36	9	57
e) Periodical - International Total		13	2	3	39	16	73
g) Conference Paper (Refereed)	No	10	2	25	33	41	111
	Yes	19	10	16	17	11	73
g) Conference Paper (Refereed) Total		29	12	41	50	52	184
Grand Total		42	14	44	89	68	257

Table 10 – Publications of research line A at ISI Web of Knowledge Indexing Service

Theses – Line A

This section presents the theses production figures of Research Line A.

Count of publication		Hosted					Grand Total
Year	Type Chart	A1	A11	A12	A2	A21	
2003	MSc	1	1	1	0	0	3
2004	PhD	0	0	0	1	0	1
2005	PhD	1	0	0	1	0	2
	MSc	0	0	3	0	1	4
2006	PhD	1	0	1	0	0	2
	MSc	1	2	0	0	1	4
Grand Total		4	3	5	2	2	16

Table 11 - Theses Production by Group of Line A

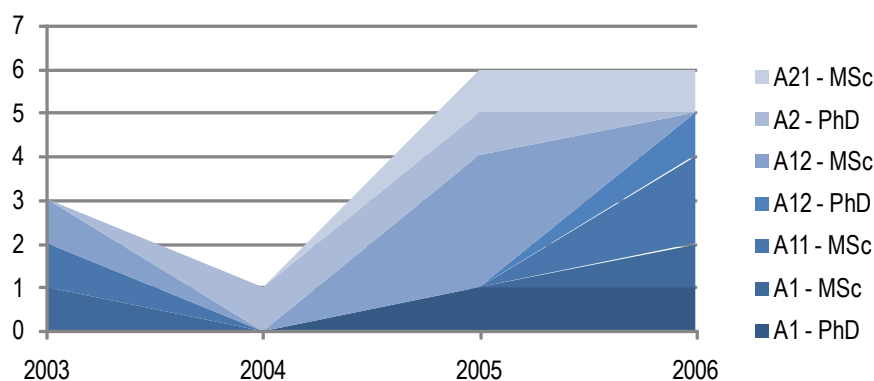


Figure 19 - Evolution of Theses Production of Line A

Funding – Line A

This section focuses analysis on the projects allocated to Research Line A.

Acronym	Hosted	Type	Total Funding	Own Funding	Period Funding
ADOPT	A1	RTD	93.125,57 €	93.125,57 €	23.281,39 €
ALFA	A2	RTD		0,00 €	0,00 €
BIOPATTERN (A1)	A1	Network	1.066.666,67 €	53.315,83 €	39.986,88 €
CERN2001	A2	RTD	20.000,00 €	0,00 €	0,00 €
CHINA	A1	RTD			0,00 €
CLIMBER	A21	RTD	99.759,58 €	99.759,58 €	24.939,89 €
CLSP	A2	RTD		0,00 €	0,00 €
COMPLETE (A1)	A12	RTD	170.389,33 €	16.023,33 €	10.682,22 €
COMPLETE (A2)	A21	RTD	340.778,67 €	32.046,67 €	21.364,44 €
DRX2D	A2	RTD		0,00 €	0,00 €
DSCMI	A2	RTD		0,00 €	0,00 €
EIE-Surveyor	A12	Network			0,00 €
EUI-Net	A12	Network			0,00 €
FORDESIGN	A12	RTD	90.000,00 €	90.000,00 €	50.000,00 €
ICT Standardization	A11	RTD	289.900,00 €	32.850,00 €	13.140,00 €
IDENTITY	A12	RTD	332.639,00 €	20.970,00 €	2.621,25 €
LAXOR	A2	RTD	80.000,00 €	0,00 €	0,00 €
MINERVA	A1	RTD			0,00 €
mSiC2	A2	RTD	20.000,00 €	0,00 €	0,00 €
OPTAR	A2	RTD	108.000,00 €	0,00 €	0,00 €
OPTO-ESTÉTICA	A12	RTD	20.000,00 €	20.000,00 €	15.000,00 €
PUCARA	A2	RTD			0,00 €
PWAVE	A1	RTD	73.000,00 €	73.000,00 €	73.000,00 €
SAMBA	A1	RTD	53.000,00 €	53.000,00 €	39.750,00 €
SECA	A1	RTD	33.000,00 €	19.925,00 €	19.925,00 €
SICAL	A2	RTD	102.012,00 €		0,00 €
SIGAPANO	A11	RTD	81.000,00 €	18.000,00 €	14.250,00 €
SIMBA	A2	RTD	71.000,00 €	18.233,00 €	13.674,75 €
SIPHASE	A1	RTD	54.000,00 €	54.000,00 €	36.000,00 €
SPIN	A2	RTD	80.000,00 €		0,00 €
SUPERMACHINES	A2	RTD			0,00 €
THEIERE-DISS	A12	Network			0,00 €
VET-TREND (A1)	A12	RTD	289.742,00 €	12.795,50 €	533,15 €
VIRTUAL-ELECTRO-LAB	A1	RTD	600.000,00 €	54.411,00 €	34.625,18 €
Grand Total			4.168.012,81 €	761.455,48 €	432.774,16 €

Table 12 – Projects list for Research Line A

Hosted	Funding 2003	Funding 2004	Funding 2005	Funding 2006	Total Funding
A1	61.298,46 €	76.816,24 €	82.460,21 €	45.993,54 €	266.568,45 €
A12	0,00 €	5.000,00 €	30.341,11 €	43.495,51 €	78.836,62 €
A2	4.558,25 €	4.558,25 €	4.558,25 €	0,00 €	13.674,75 €
A21	24.939,89 €	0,00 €	10.682,22 €	10.682,22 €	46.304,34 €
A11	0,00 €	0,00 €	5.250,00 €	22.140,00 €	27.390,00 €
Grand Total	90.796,60 €	86.374,49 €	133.291,79 €	122.311,27 €	432.774,16 €

Table 13 - Project funding by period year and research group of Research Line A

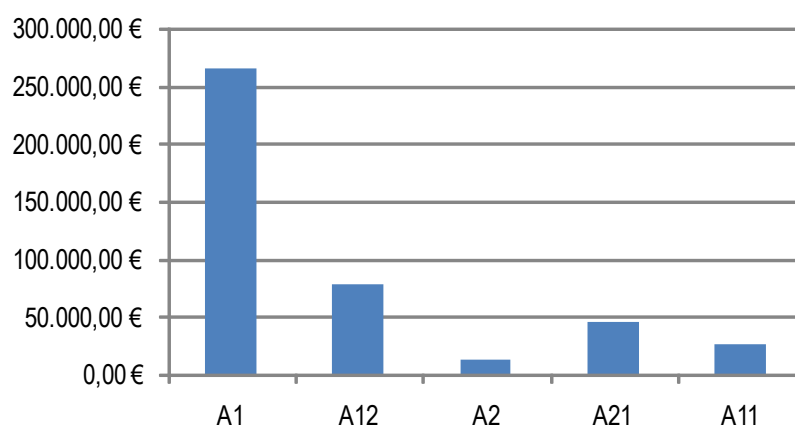


Figure 20 - Project funding by research group of Research Line A

Cooperation – Line A

This section presents the composite analysis of cooperation level for Research Line A.

Count of publication	Year				
	2003	2004	2005	2006	Grand Total
ns1:cooperation					
worldwide	23	25	17	21	86
regional	6	5	7	6	24
national	11	14	23	13	61
organisation		1			1
group	12	18	28	20	78
none	8	3	9	4	24
Grand Total	60	66	84	64	274

Table 14 – Cooperation levels by year for research line A

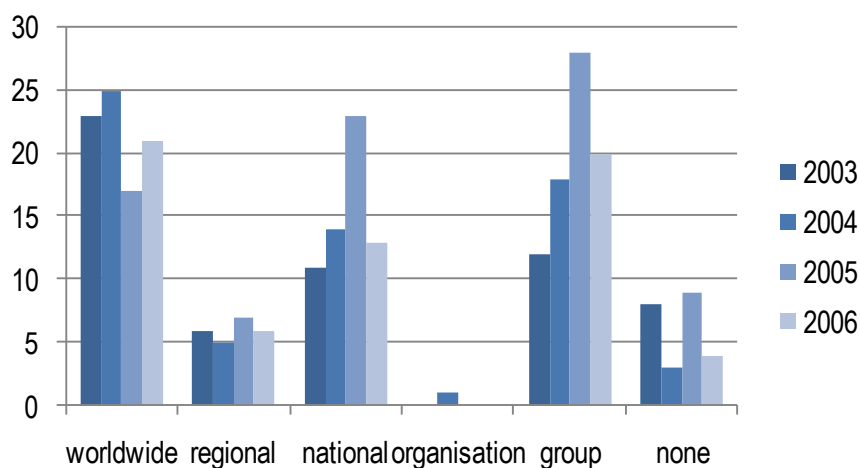


Figure 21 - Cooperation levels by year for research line A

3.1.2. Group A1: Microelectronics, Design and Fractional Signal Processing

Membership

Research Group Coordinator

- João Goes

Research Team

- Adolfo Steiger Garção, João Goes, Manuel Ortigueira, Arnaldo Batista, Nuno Paulino

PhD Students:

- Rui Tavares, João Pedro Oliveira, José Rui Barbosa Custódio, Acácio Galhardo, Bruno Esperança, Michael Figueiredo, Raul Rato, Carlos Matos, Carlos Mendes

Strategic view and pace

Time comes to consolidate an ambitious objective: starting the foundations of a sound interlaced alliance between microelectronics and telecommunications. At this point, microelectronics together with fractional signals and systems, are committed to be the merging driving force and actually represent the gravity centre of the envisage activities.

Background and future

A careful identification of needed skills, already developed, was a major concern. Also a precise evaluation of the existing technical and scientific competences, their differential evolution and their capability for working together, was fundamental.

The major difficulty lied on the asymmetry, including dynamics, of the different processes involving distinct players.

At the very beginning a sound work on microelectronics, fractional calculus oriented for signal analysis and embedded systems, was the basic existing scientific structure. During the last five years they proved their ability and interest on working together synergistically, achieving results far away from trivialities, documented by relevant joint publications, prototypes and even a patent.

A first level of inter cooperation was established.

An additional and crucial key factor was the ability to deal with information technology, successfully giving birth to a family of intelligent software tools (soft computing) aimed to assist modelling, simulating and optimizing complex integrated circuits and eventually systems. Very recent steps enlarged the research scope on microelectronics fostering high frequency domains (UWB first CMOS circuit was designed and produced) including optimization and stability and new designs on ADCs overleaping the frequency band until now only achieved by flash converters.

That was considered the adequate entry door aimed to establish a cooperative front end with telecommunications.

Telecommunications was a later addressed domain inside the centre. It took the needed time and pace to establish its own framework and boundaries (the group was established in 1999 and until 2004 had a strong effort in teaching at undergraduate level; since 2004 the research effort began to be visible and it is rising at an acceptable growing rate). In short, we can now assume, as areas of interest, the interconnection of wireless systems leading to 4G systems and ad-hoc networks. Two additional emerging topics, inter domain routing and line-coding systems are also addressed. Recent developments related with the Galileo initiative brought

the Chinese aerospace sector to interact strongly with our telecommunications research group. Several Chinese institutes, UNINOVA through CTS and FCT/UNL started discussing how to implement joint research activities covering microelectronics, telecommunications and signal processing. A protocol addressing graduation training of Portuguese engineers, for activities in Galileo's ground segment, was signed by us and the Madeira's authorities.

The so far mentioned three areas (microelectronics, fractional calculus for signal processing and telecommunications) seem now to have attained the precondition state that can lead positively to a progressive successful merge.

Finally and anticipating this merging occurrence, it is clear only the technology, the basic circuits and architectures will no longer cover the spectrum of activities, and the systemic component will emerge as a result of a interdisciplinary active cooperation. Design tools were planned to assist a less ambitious scope of research. Time comes to reshape the original tools introducing modelling structured top down capabilities. Recent developments on Petri Nets, suggest its adequacy to fulfil this gap. It will be a slower merging, but a needed one. Last but not the least, cooperation was also reinforced with the interoperability area and led to the production of a strategy study on specific policy needs for ICT standardization' under an EU project. This study risks to become an important tool to the EU.

These envisage conjugation of efforts, reinforced by the enlargement of the microelectronics scope (now addressing also materials and processes) will eventually lead to a mature area of microelectronics and telecommunications. Until now, the pace of the produced wise steps (microelectronics and fractional calculus, and recently telecommunication) originated scientific recognised added value. We are committed to enlarge and consolidate those achievements, extending this merge and using the new opportunities.

We will introduce in this document microelectronics including fractional signals and systems. There will be individualised description of activities as well as cross-references to cooperative work and results. A unified consolidation map of research activities will be presented. The contributions related to telecommunications, Petri nets and embedded systems will be mentioned as separated reports.

A short list of major journals in which we publish in a regularly base, will be made available, also.

Research Activities on the sub-area of Design of Mixed-Mode Integrated Circuits

Research activity development and scientific achievements

Since the beginning of 1999 when the group of design of mixed-mode integrated circuits was created, the situation has evolved to the quality steadily and consistent production of high-level research results at world-class. These progress can briefly be described, on one hand, by the first 2 Ph.D.'s recently completed in the Electrical Engineering Department, in 2005 and 2006, respectively, followed by another 7 on-going Ph.D.'s (2 to be completed in 2007, 2 in 2008 and 3 in 2009). On the other hand, the research activities led to the publication of many papers in IEEE International conferences and *leading* IEEE and IEE archival, such as the *IEEE Transactions on Circuits and Systems I and II* and the *IEE Electronics Letters*. Thus, our results are *compatible with research carried-out at an international state of the art level*. The latest submitted PhD thesis (UWB) was recently invited, by Springer Editors, to be published as a book during 2008.

The overall funding of this sub-group results mostly from National R&D projects, funded by the FCT/MCTES and a few international ones. The success-rate of approved national projects is 100% and the evaluation grade, established by an international panel of reviewers is, on the

average, excellent. These evaluations demonstrate *the level of recognition of the on going research*.

Towards Excellence

It is also worth to emphasize as relevant achievements, design results that led to a publication in the *International Symposium on VLSI Circuits – VLSI'2004* and, quite recently, a publication in the *International Solid-State Circuits Conference – ISSCC'2006*. These two conferences are representative of the highest standards of scientific publications in our field and are complementary to the paper publication in major journals.

Seven fully-functional prototypes (silicon) operating beyond the state-of-the-art* of IC's have been produced during the past 3 years (the first chip was produced in 2003) and, under the seven on-going Ph.D. programs it is expected to keep an average of 2 tape-outs of IC's per year. The strategy is to submit, regularly (every year), such silicon results to ISSCC. Thus, it is planned to submit evaluation results of a high-performance 13-bit 80MS/s 90nm CMOS self-calibrated ADC to *ISSCC'2009*. The main goal is to become one of the top-four R&D groups in Europe that publish, on a regular basis, in ISSCC (the others are at KU-Leuven, Belgium, at ETH-Zurich in Switzerland, and at TU-Delft in Holland).

What are the fundamental research directions?

The fundamental research activities of the Micro-Electronics sub-group (MESP) are centred on the optimal designs of Low-Voltage and Low-Power analogue and mixed-signal integrated circuits. In order to pursue this goal, the group is committed to the following three design guidelines:

1. Prototype low-cost circuits through intensive use of advanced (deep-submicron, e.g. 90nm) CMOS technologies and minimization of the occupied silicon area;
2. Design for low-power dissipation and low-voltage operation by developing efficient optimization design methodologies developing home-made powerful CAD platform also aimed to support the concept of interoperability between circuits and also systems;
3. Obtain first-silicon-right by automating the design-flows as much as possible.

This last issue is of major importance. Productivity in circuit's analogue design is depending strongly on the concept of circuit re-use and re-engineering.

*(Indicators and demonstrators are available)

The five integrated circuits fabricated during the past 3 years have impact spanning the areas of high performance A/D interfaces and low-cost UWB radar transceivers for telecommunications and medical imaging applications.

- Prototype #1: 10-b 50MS/s Parallel Pipeline ADC; Year: 2003; Highlights: First silicon-proved time-interleaved pipeline ADC employing low-voltage techniques! The published fastest and the most energy efficient Parallel Pipeline ADC. IEEE VLSI Circuits Conference. (Jun. 04). Associated Project: ADOPT (rated Excellent).
- Prototype #2: Gaussian and Uniform High-amplitude Broadband Noise Generators; Year: 2003. Highlights: Power dissipation of the Gaussian Noise Generator reduced by one order of magnitude when compared with the state-of-the-art for increased performance; First Practical Uniform Noise Generator reported up to date. Associated Project: SECA (rated Excellent).
- Prototype #3: 10-b 4MS/s Parallel Pipeline ADC for fingerprint sensors; Year: 2004. Highlights: Very low power dissipation; no special process layers used for implementing the capacitors. Associated Project: S2A (rated Excellent).

- Prototype #4: First fully integrated CMOS UWB radar transceiver for medical imaging applications; Year: 2004. Highlights: Novel architecture using new fully differential circuits for pulse generation and new receiver topology; experimental results will be published in a book edited by Springer. Associated Project: Internal Long Term Project following a previous EU project, WATERMON.
- Prototype #5: A 0.9 V 200 μ W 0.06mm² Sigma-Delta Modulator for biomedical applications; Year: 2005. Highlights: First switched-capacitor circuit reported using overlapping clock-phases (single-phase technique). Smallest ADC reported for the given performance. IEEE ISSCC Conference. (Feb. 06); IEEE TCAS-I (Dec. 05). Associated Projects: SAMBA and SIPHASE (both rated Very-Good).
- Prototype #6: A 1.2 V 14-bit 1.54MS/s 10mW Calibration-Free Pipeline ADC; Year: 2007. Highlights: This circuit is based on a novel mismatch-insensitive multiply-by-two amplifier. Associated Projects: LEADER (rated Very-Good).
- Prototype #7: Ultra Low-Power Comparators using embedded amplification based on MOS capacitors changing from inversion into depletion; Year: 2007. Highlights: This circuit is uses a new concept of "passive" amplification. Associated Projects: SPEED (rated Very-Good).

What are the new ideas?

Research activities have led to several novel circuits and techniques that, in our opinion, will be used intensively in the near future by the semiconductor industry designers (mixed-signal circuits).

- The Single-Phase Technique (SIPHASE Project): A novel single-phase scheme to be used in Switched-Capacitor circuits was proposed in the SIPHASE project. Exploiting the gap between the high conductance regions of PMOS preserves the signal integrity and NMOS switches at low power-supply voltages and the fast clock transitions that exist in advanced CMOS technologies. The main advantages are: 1. The clock-phase generator is simply implemented by a couple of CMOS inverters and the cumulative jitter noise introduced will be much smaller; 2. Duty-cycles of 50% can be achieved; 3. Only a single phase (plus its complementary version), is used for driving all switches rather than the conventional system that uses six or eight phases. Significant reductions in digital noise into the substrate as well as routing area are achieved. Papers published in ISSCC'06 and in TCAS-I, Dec. 2005.
- A Novel Self-Calibration Technique for ADCs (SECA and ESA Projects): It consists in applying a White Gaussian Noise stimulus to the ADCs and calculating, in the digital domain, the calibrating-codes from the histogram of the output-codes. This technique allows on-chip built-in self-calibration and self-testing of Video-rate ADCs. A European Patent has been granted in 2006 under this subject (EP 1 473 836). This patent is a clear and successful demonstration of our interdisciplinary cooperation between researchers from microelectronics and signal processing areas.
- A Novel Mismatch-Insensitive Switched-Capacitor MDAC (LEADER Project): A new mismatch insensitive amplifier with an accurate gain of two and with compensated parasitic effects. It is based on associating four sets of two capacitors in series during the amplification phase. The amplifier operates within a single clock cycle and uses only one amplifier. This technique allows extending the resolution and integral linearity of Pipeline ADCs up to 15 bits without requiring any kind of self-calibration. A paper has been published in IEEE Trans. on CAS – II in Jan. 2007.

- Novel Rail-to-rail Low-Stress Switch Linearization Control Circuit (Internal Project): A new linearization technique for low-distortion high-swing CMOS switches based on a new method of improving the linearity of the NMOS and PMOS conductance. This method has the advantage over conventional clock-boosting techniques of avoiding large gate voltages thus reducing the stress on the gate capacitance. In our opinion, in the near future, this new circuit is aimed to replace all existing clock-bootstrapping circuits in CMOS, due to reliability issues.
- Extending the Conversion-Rate of Pipeline ADCs to the GS/s (SPEED Project): The major goal of this research area consists on designing, integrate in a 90nm CMOS technology and experimentally evaluate a calibration-free 2-channel time-interleaved 6-bit 1GS/s CMOS Pipeline ADC with an EE better than 0.2-to-0.3 pJ per conversion step and at the same time achieving a very low die area (beating all existing state-of-the-art Flash-type ADCs). Many novel techniques will be addressed to reach such goal such as, intensive use of passive structures, amplifier sharing, simple amplifier topology and exhaustive circuit optimization.
- CAD platform for efficient optimization and automatic sizing of highly complex amplifiers in advanced CMOS technologies (Internal Project): Integrate our homemade optimization Kernel based on genetic algorithms with the open-source BSIM3v3 code from UC-Berkeley. A new design methodology for optimum sizing and compensation of highly complex amplifiers based on a time-domain approach is then used. This methodology allows the analysis of topologies of amplifiers with an unlimited number of poles and zeros.
- Multi-bit Sigma-Delta Modulators based on Non-Linear DACs to be used in Hearing-Aid Applications (Joint Work with Technical University of Denmark under a Ph.D. program): Achieve higher dynamic-range without increasing the OSR, using a novel approach based on non-linear DACs.

What can be the novel applications?

- High-Speed Nyquist-Rate Low-Power ADCs with resolutions ranging from 6 to 14-bits and with 10MS/s to 1GS/s sampling frequencies. *Applications*: WPAN, WiFi 802.11.a/b/g, WiFi 802.11n, WiMAX 802.16, Satellite Communications, 3G/UMTS, HDTV, Digital Video, Set-top-boxes, xDSL, Flat Panel Displays, Digital Imaging.
- Ultra Low-Power ADCs (Nyquist-Rate and Delta-Sigma), with resolutions ranging from 8 to 16-bits and signal bandwidths from 10 kHz to 1 MHz frequencies. *Applications*: DAB, DMB, DVB-H, DVB-T, CCD and CMOS Digital Imaging, Sensor Interfacing, Finger Print Readers, Portable Video and Digital TV Receivers, GPS Receivers, Power Management, Biomedical Acquisition Interfaces and Hearing Aids.
- Ultra-Wide-Band Radar Transceiver with high accuracy (around 30mm without any signal processing but with much more accuracy using averaging techniques) for distances up to 15 meters and compliance with FCC rules. *Applications*: Accurate Measurements and Medical Imaging and space oriented applications (ESA project).

Summary of the overall research strategy and scientific quantitative and quality results

Considering the already existing and the planned merge of activities, Microelectronics represents about 70% of the overall research effort. Fractional calculus (SP) and complementary activities comprising applicative biomedical signal processing represent 10% of the effort. The remaining 20% are devoted to research activities including telecommunications (10%) and embedded systems (10%).

A senior researcher of the signal-processing area has actively contributed in the field of BIST/BISC of ADCs. A significant demonstration of this collaboration can be found in the European Patent application submitted in 2003 and accepted and published in 2006 (a new method for BISC of video-rate ADCs). Moreover, it is expected in the near future that, passive structures derived from fractional calculus can lead to efficient designs of Active Filters and Oscillators. This research line is planned and will depend only on the availability of human resources.

Regarding merging of synergies between microelectronics and telecommunications, it is expected to use the UWB transceiver, presently under the design-enhancement phase, and evolve towards a system-level system, comprising a matrix of radar sensors (transceivers), with embedded signal processing and multi-layer control software. The set of applications is unlimited.

National and international cooperation

Is mainly done with research-oriented institutions as INESC-ID (Lisbon, Portugal), Dept. of Physics of the University of Lisbon, Institute for Telecommunications (IT, Lisbon), ISEL, Poznan University of Poland, Technical University of Denmark, University of Seville (Spain) and Tsinghua University (China) are of paramount importance. Its effectiveness has been supported by concrete actions as joint publications, common research projects and direct submission of proposals for national and/or international projects and PhD's co-supervising and acceptance of foreign students to pursue a research programs.

Technology transfer and National Industry

A spin-off Venture-Capital company, ACACIA SEMICONDUCTOR SA was founded in Sept. 2003. Access to its site (www.acaciasemi.com) elucidates its motivation, skills and policy. There is a direct link with our microelectronics R&D area, a protocol has been established and already implemented, aiming to facilitate common projects participation (ESA Project), training of young researchers, and access to silicon implementation foundries in advanced technologies and sharing of testing-equipment. It had been a successful joint venture. Recently Acacia was object of a friendly takeover (was acquired in October 2007 by Silicon and Software Systems LTD., from Ireland, www.s3group.com) aimed to reinforce the research effort and cooperation with the centre and the university. Protocols were signed.

All those orientations are under the overall behaviour pattern of the centre (culture) emphasising a model of a responsible decentralised organization very much based on inter-group cooperation (internally and externally).

Training Researchers

Supervision of Ph.D. students deserves an additional comment. Encouraging young researchers can be implemented in several ways. One of the most effective is helping them to be responsible for Ph.D. students supervising, assuring the continuation of their research. As an internal cultural rule, each time a new PhD is completed, and when possible, a transfer of supervising responsibilities is done. In this area all the recent PhDs supervise now new Ph.D. students. Scholarships for graduate students are made available through public audition and selection. Either national or international projects are the funding source.

Training young researchers, besides the scientific content, needs an important component of internationalization. That is achieved through participation on international projects and meetings, organization of scientific events, presentation of papers in international events and writing of proposals, reports and papers. International conferences are of major usefulness for this purpose, since many fruitful links and discussions focusing on common fields of research

can be established. The centre as a whole has a significant rate of young researcher involvement in those activities and this research group is one of the contributors.

The short list of journals (annex) documents a selected group of leading and well-known journals where we publish on a regular base. They are adequate to characterize the microelectronics area. At least the two already mentioned conferences have also to be considered for a wise coverage of the area.

The number of PhDs presently involved in microelectronics is rated 1.5 (a senior researcher is sharing his activity with another area) and the younger (is now at senior level with an enlarged level of autonomy) started his pos-doc with us since Q3 of 2000.

Specific Research Activities on Fractional Signal Processing

Scope

The research scope of Signal Processing area is the Fractional Signals and Systems. These are characterised by the fact that their main building block is the fractional differintegrator that is an elemental system with transfer function s^α . There are now available in the electronic market several devices with this behaviour – the so-called “constant phase elements”. The “ultracapacitors” are included in this class.

Objectives – Research, applications, and dissemination

1. Research is aimed to
 - a. Increase the knowledge on fractional linear systems;
 - b. Study and design fractional filters by revising the usual design rules;
 - c. Develop modelling and identification techniques;
 - d. Study the effect of inserting fractional elements in well known useful circuits and structures.
2. The applicative domain it is intended to
 - a. Apply the theory to obtain fractional systems using microelectronic design and implementation techniques;
 - b. Develop Biomedical Engineering applications.
3. Towards dissemination it is intended to
 - a. Give high level advanced training aimed to develop specific skills in the field – there is some difficulty in convincing young people to adhere to this field;
 - b. Contribute to its dissemination and increasing applications in other fields and find new areas of application.

Scientific Relevance

Fractional Signals and Systems are increasingly relevant due to the following:

- a) Their spectral representations increase/decrease by submultiples of 20 dB/dec, that is the behaviour that better fit with a lot of natural or man made systems – e.g. the electric power line;
- b) They seem to be suitable and accurate to model some natural or man made phenomena – e.g. the internet traffic;

- c) They manifest the so-called long-range dependence. In several social and economic activities we find examples of this behaviour – the fractional Brownian motion is the most well known.

On Fractional Calculus

The basic underlying theory is the so-called Fractional Calculus that some consider the XXI century calculus. It has been applied in Physics in solving differential equations obtained by “fractionalising” classic equations, as it is the case of the Schrodinger equation. Some interesting results have been obtained in Diffusion and Viscoelasticity. Besides that, it is possible to find other applications in areas ranging from Economy to Control and Robotics, from Electro-Chemistry to Internet Traffic, from Biology to Electromagnetic Theory. Microelectronics is also a promising area. There has been an increasing research activity in countries like France, Germany, United States of America, Spain, Russia, and Japan, to develop new applications. In the published special issues in the journals *Nonlinear Dynamics* and *Signal Processing* in the last few years have been relevant contributions to increment the knowledge on this field and to demonstrate the increasing interest in this area. Nevertheless the signal processing community still is far way of showing demonstration of interest proportional to the potential the domain deserves. Fractional signal processing is still at a level of an almost unexplored area. We have been contributing for a coherent approach to fractional linear systems, since 2000.

Past story and achieved results

Our objective is to bring to Fractional Calculus the features and concepts used in Signal Processing. With this in mind, we evaluated the available theory and started making contributions. This led us to generate several novel results that we believe will bring new perspectives to Fractional Calculus. Since 2000, we published results aiming to contribute to a revision of the current way of looking into Fractional Calculus. Summarising, we have the following understanding of our main innovative contributions:

- a) Establishment of a bridge between the two general formulations for fractional derivative: the limit of generalised incremental ratio and the Liouville integral. This was a 200 years old problem. In passing, we proved a generalised Cauchy formula. This approach allowed us to give a coherent base for the fractional signal processing that really appears as a generalisation of the current one (2000, 2001, 2003, 2004, 2005 and 2006).
- b) Development of a systematic approach to insert the initial conditions in computing the output of a linear system (2002, 2003).
- c) Introduction of new fractional central derivatives suitable for studying systems described by partial differential equations and that can be used in studies of diffusion. It was showed that they are equal to the so-called Riesz potentials that appear in wave propagation problems (2006).
- d) Interpretation of the fractional Brownian motion in terms of the fractional derivative of stationary white noise and presentation of a novel algorithm for its simulation (2004, 2006).
- e) Development of two discrete-time implementations for the fractional differintegrator (2004, 2006).
- f) Relevance for microelectronics can be in new design of filters and oscillators as well on system's stability.

Publication policy

Fractional Calculus, being a vertical area experiments an increasing interest in the last few years. It is not surprising the increment in the number of published papers in journals of Mathematics and Physics as:

- a) Applied Mathematics and Computation, Journal of Mathematics and Mathematical Sciences, and Journal of Fractional Calculus and Applications. The first is mainly devoted to computational algorithms; the second is directed by a Fractional Calculus researcher and is the second preferred journal for theoretical aspects. The last one seems to be the preferred journal of Fractional Calculus Community.
- b) Physica A: Statistical Mechanics and its Applications (important papers in this field refer to diffusion problems) and Nonlinear Dynamics.

However, since the beginning, our main interest was to contribute to bridging Fractional Calculus towards the Signal Processing Community. After reviewing the actual publications we actually notice, the number of contributions appearing in IEEE journals in this domain has been, in volume under our expectations. In that particular, Transactions on Signal Processing published a few interesting papers on the area, but referring almost exclusively to the fractional Brownian motion. Investigating other possibilities, Signal Processing (Eurasip) appeared as a target journal. The interest demonstrated by the scientific board of Signal Processing and the density of published papers, turned it in a emergent reference journal for fractional signal processing, during the last few years. Since 2003, over 50 papers were published.

Conferences and specialised scientific meetings:

- a) Only in recent years, specific meetings were realized supported by the International Federation of Automatic Control (Technical Committees on Linear Control Systems and on Modelling, Identification, and Signal Processing). The 1st IFAC Workshop on Fractional Differentiation and its Applications FDA'04 took place in Bordeaux, France in 2004 and the 2nd, FDA'06 took place in Porto in 2006, Portugal.
- b) Recently, relevant conferences started including in their programs special sessions on Fractional Calculus. This was the case of the Fifth EUROMECH Nonlinear Dynamics Conference, Eindhoven University of Technology, The Netherlands, 2005. It was the 2nd theme in terms of number of papers.

Applications

As was said before, we find signals with fractional spectrum in a diversity of application areas. As a demonstration field, biomedical applications are a target. As a partner of the European NoE (network of excellence) Biopattern we are making contributions to the analysis of EEG signals as well as in the POSI/CPS/48314/2002 project "High Resolution Analysis of the P wave with Wavelets".

National cooperation

The research in Fractional Calculus in Portugal was done by Prof. Costa Campos in the Mechanical Department at Instituto Superior Técnico, during the eighties and nineties. This work has been continued by Prof. José Sá da Costa in the same Department having in mind Control and Robotics applications. This happens also with Prof. J. Tenreiro Machado at the Instituto Superior de Engenharia of Porto. Theoretical research is also done at the Algarve University by Prof. Stefan Samko. We have a regular cooperation that manifests in several realizations as the Special Issues in Signal Processing, the IFAC workshop, the participation in Ph.D Juries and cooperative publications.

International cooperation

We have good relations with almost all the groups working in this subject, but specially with Prof. Vinagre (University of Extremadura, Spain), Dr. Kreml (AVL company, Austria), Prof. Nigmatullin (Kazan State University, Russia), and Prof. Espindola (Federal University of Santa Catarina, Brazil). In our prevision of activities for the next 3 years, we included their participation. On the other hand, we have regular cooperation in the revision of papers both for journals and conferences.

Biomedical Signal Processing

Processing of the High-Resolution Electrocardiogram (HR-ECG) for the prognostic and diagnostic of the Atrial Fibrillation

The following steps have been already achieved:

- HR-ECG acquisition on a shielded room with a High-Resolution system (gTec).
- Processing with continuous wavelets for the time-frequency localization of the abnormal atrial activity.
- Subsequent signal sub band reconstruction with wavelet packets.
- Integration in “all-in-one” software package for use in a clinical environment.
- Set up of a data-base of HR-ECG of (planned size: 20/20 normal/atrial fibrillation subjects). So far have been made 12/3 respectively.

The following steps are being pursued:

- Classification with Neural Networks and Blind Source Separation for an Atrial Activity presence factor.

Partners: Hospital Garcia de Orta (Serviço de Cardiologia) / Students: 1 PhD student

Electrocardiogram Derived Respiration signal. (EDR)

This project involves the detection of the sleep apnoea episodes through the Electrocardiogram signal, avoiding the plethysmography sensors that prevent the technique to be largely used in an ambulatory environment. The aim is to develop a simple sleep apnoea detector to be used in an ambulatory setting (home, etc) to be used by apnoea patients, namely children with sleep disorders.

The following steps have been already achieved:

- Software development of EDR synthesis with Wavelet Packets.

The following steps are being pursued:

- Development of the system set up for ambulatory use.

Partners: Hospital Pulido Valente (Serviço de Pneumologia)

Productivity

Since Q3 of 2000 and only considering the Microelectronics R&D work:

Finished PhD theses - 3 (BV, GE, NP)

On-going PhD theses – 9 (RT, AG, JPO, JRC, BE, MF, CM, RR, CM)

Finished MSc theses - 3 (MU, HP, MR)

On-going MSc theses - 12 (PF, NP, BE, PF, ES, BL, JH, DL, DB, PB, MN, LS)

Papers on international major journals – 20 (IEE Elec. Letters, TCAS-I and TCAS-II)

Books - 3 (Kluwer A. P. in 2001) + Springer (to come out in 2008)

International conferences – 47 (ISSCC'06, VLSI'04, ESSCIRC'00, ISCAS)

International projects participation – 2 (ESA + BioPattern-NoE)

National projects - 7 (3 rated Excellent and 4 rated Very-good)

Patents – 1 (EP 1 473 836)

Produced circuits (silicon) – 7 (5 tested and 5 are first-silicon-right)

Publications

Books (thesis)

Paulino, N. - UWB signals and systems

Evans, G. – Low-Power CMOS Noise Generators

Vaz, B. – Low-Power, Low-Voltage Time-Interleaved ADCs

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
a) Book - Author			1		1
d) Book Chapter				1	1
e) Periodical - International	2	2	4	5	13
g) Conference Paper (Refereed)	7	4	13	5	29
h) Special Issue	1			1	2
k) Patent				1	1
Grand Total	10	6	18	13	47

Table 15 - Publications by Year of Group A1

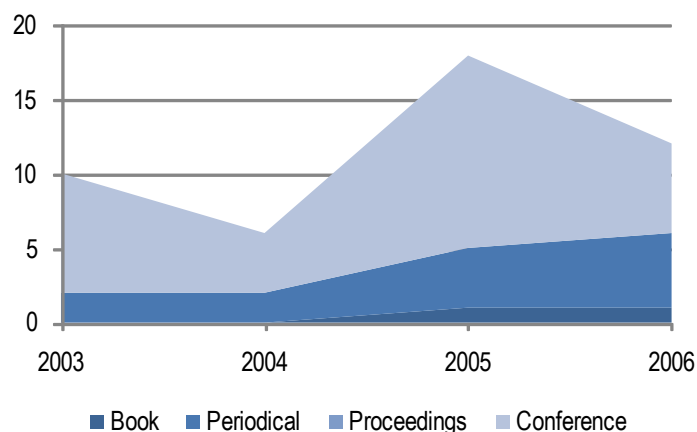


Figure 22 - Evolution of Publications by Year of Group A1

Count of publication	WoS		
Type Table	No	Yes	Grand Total
e) Periodical - International	5	8	13
g) Conference Paper (Refereed)	10	19	29
Grand Total	15	27	42

Table 16 - Publications of A1 at ISI Web of Knowledge Indexing Service

Book – Author

1. Ortigueira, Manuel. 2005. [Processamento Digital de Sinais](#). Fundação Calouste Gulbenkian..

Book Chapter

1. Ortigueira, Manuel. 2006. [Riesz potentials as centred fractional derivatives](#). In: Advances in Fractional Calculus: Theoretical Developments and Applications in Physics and Engineering, Springer..

Papers in International Scientific Periodicals with Referees

1. Evans, Guiomar and Goes, João and Paulino, Nuno. 2006. [Low-Voltage Low-Power Broadband CMOS Analogue Circuit for White Gaussian Noise Generation](#). JOLPE - Journal of Low Power Electronics.
2. Goes, João and Pereira, J. and Paulino, Nuno and Medeiros-Silva, M.. 2006. [Switched-Capacitor Multiply-By-Two Amplifier Insensitive to Component Mismatches](#). IEEE Transactions on Circuits and Systems II: Express Briefs, Vol. 54 (1). pp. 29-33. ISSN 1549-7747. Indexed at ISI Web of Science.
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7. Inácio, J. A. and Gerald, J. A. and Ortigueira, Manuel. 2005. [New PN Even Balanced Sequences for spread spectrum systems](#). EURASIP Journal on Wireless Communications and Networking, Vol. 2005 (3). pp. 447-458. ISSN 1687-1472. Indexed at ISI Web of Science.
8. Ortigueira, Manuel. 2005. [Two new integral formulae for the Beta function](#). International Journal of Applied Mathematics, Vol. 18 (1). pp. 109-116. ISSN 1992-9978.
9. Ortigueira, Manuel and Tenreiro-Machado, J.A. and Sá da Costa, J.. 2005. [Which Differintegration?](#). IEE Proceedings Vision, Image & Signal Processing, Vol. 152 (6). pp. 846-850. ISSN 1350-245X.
10. Ortigueira, Manuel and Batista, Arnaldo. 2004. [A Fractional Linear System View of the Fractional Brownian Motion](#). Nonlinear Dynamics, Vol. 38 (1-2). pp. 295-303. ISSN 0924-090X. Indexed at ISI Web of Science.
11. Ortigueira, Manuel and Coito, Fernando. 2004. [From Differences to Derivatives](#). Fractional Calculus & Applied Analysis, Vol. 7 (4). pp. 459-471. ISSN 1311-0454.
12. Ortigueira, Manuel. 2003. [A new symmetric fractional B-spline](#). Signal Processing, Vol. 83 (11). pp. 2311-2318. ISSN 0165-1684. Indexed at ISI Web of Science.
13. Ortigueira, Manuel. 2003. [On the initial conditions continuous-time fractional linear systems](#). Signal Processing, Vol. 83 (11). pp. 2301-2309. ISSN 0165-1684. Indexed at ISI Web of Science.

Papers in Conference Proceedings

1. Tavares, Rui and Paulino, Nuno and Goes, João and Oliveira, J.P.. 2006. [Optimum Sizing and Compensation of Two-Stage CMOS Amplifiers Based On a Time-Domain Approach](#). In: IEEE International Conference on Electronics, Circuits and Systems, France. Indexed at ISI Web of Science.
2. Xanthopoulos, P. and Golemati, S. and Sakkalis, V. and Ktonas, P. Y. and Ortigueira, Manuel and Zervakis, M. and Paparrigopoulos, T. and Tsekou, H. and Soldatos, C. R.. 2006. [Comparative analysis of time-frequency methods estimating the time-varying microstructure of sleep EEG spindles](#). In: Information Technology Applications in Biomedicine, 26-28 Oct. 2006, Ioannina - Epirus, Greece.
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11. Pinto, I. V. and Alves, L. B. and Ortigueira, Manuel and Batista, Arnaldo. 2005. [ECG Wave Detector and Delineation with Wavelets](#). In: International Conference on Computational Intelligence in Medicine and Healthcare, CIMED 2005, Costa Caparica (PT).
12. Rato, Raul and Ortigueira, Manuel. 2005. [A Modified EMD Algorithm for Application in Biomedical Signal Processing](#). In: International Conference on Computational Intelligence in Medicine and Healthcare, CIMED 2005, Costa Caparica (PT).
13. Galhardo, A. and Goes, João and Vaz, Bruno and Paulino, Nuno. 2005. [Design of Low-Voltage Low-Power Pipeline ADCs using a Single-Phase Scheme](#). In: Fifth IEE International Conference on A/D and D/A Conversion Techniques and Their Applications, Ireland.
14. Vaz, Bruno and Goes, João and Paulino, Nuno and Steiger-Garção, Adolfo. 2005. [Design of a 1.8V, 10-bit 130+MS/s Time-Interleaved Non-Scaled Pipeline ADC in 0.18mm CMOS](#). In: Fifth IEE International Conference on A/D and D/A Conversion Techniques and Their Applications, Irlanda.
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16. Goes, João and Vaz, Bruno and Paulino, Nuno and Pinto, H. and Monteiro, R. and Steiger-Garção, Adolfo. 2005. [Switched-Capacitor Circuits using a Single-Phase Scheme](#). In: IEEE International Symposium on Circuits and Systems, Kobe, Japan. *Indexed at ISI Web of Science*.
17. Vaz, Bruno and Goes, João and Piloto, R. and Neto, J. and Monteiro, R. and Paulino, Nuno. 2005. [A Low-Voltage 3 mW 10-bit 4MS/s Pipeline ADC in Digital CMOS for Sensor Interfacing](#). In: IEEE International Symposium on Circuits and Systems, Kobe, Japan. *Indexed at ISI Web of Science*.
18. Ricardo, C. N. and Gerald, J. A. and Ortigueira, Manuel. 2005. [Analysis of New Quasi-Orthogonal BCH-Derived Sequences for CDMA Applications](#). In: XX Conference on Design of Circuits and Integrated Systems (DCIS'05), 23-25 Nov 2005, Lisboa, Portugal. *Indexed at ISI Web of Science*.
19. Goes, João and Vaz, Bruno and Paulino, Nuno and Pinto, H. and Monteiro, R. and Steiger-Garção, Adolfo. 2004. [Low Power Low-Voltage CMOS A/D Switched-Opamp SD Modulator for Bio-Potential Signals using a Single-Phase Scheme](#). In: IEEE International Workshop on Biomedical Circuits and Systems, Singapore.
20. Ortigueira, Manuel and Serralheiro, A.J.. 2004. [New Insights into Pseudo-Fractional ARMA Modelling](#). In: International Conference on Computational Cybernetics, 30 Aug - 01 Sept 2004, Vienna University of Technology. *Indexed at ISI Web of Science*.
21. Ortigueira, Manuel and Tenreiro-Machado, J.A. and Sá da Costa, J.. 2004. [Considerations about the choice of a differintegrator](#). In: International Conference on Computational Cybernetics, 30 Aug - 01 Sept 2004, Vienna. *Indexed at ISI Web of Science*.
22. Vaz, Bruno and Goes, João and Paulino, Nuno. 2004. [A 1.5-V 10-b 50 MS/s Time-Interleaved Switched-Opamp Pipeline CMOS ADC with High Energy Efficiency](#). In: 2004 Symposium on VLSI Circuits, Honolulu. *Indexed at ISI Web of Science*.
23. Mora, André and Fonseca, José and Steiger-Garção, Adolfo. 2003. [LIBS chemical images analysis for fatigue estimation in industrial materials](#). In: ISISPA-2003 Third International Symposium on Image and Signal Processing and Analysis, 18-20 Sept 2003, Rome (IT). *Indexed at ISI Web of Science*.
24. Barbosa, P. and Fonseca, José. 2003. [A Wireless Voting System for Large Assemblies](#). In: 8º Congresso Luso-Espanhol de Engenharia Electrotécnica, 3-5 Jul 2003, Vilamoura (PT).
25. Evans, Guiomar and Goes, João and Steiger-Garção, Adolfo and Ortigueira, Manuel and Paulino, Nuno and Sousa-Lopes, J.. 2003. [Low-Voltage Low-Power Broadband CMOS Analogue Circuits for Gaussian and Uniform Noise Generation](#). In: IEEE International Symposium on Circuits and Systems, Bangkok, Thailand. *Indexed at ISI Web of Science*.

26. Paulino, Nuno and Serrazina, Marco and Goes, João and Steiger-Garção, Adolfo. 2003. [Design of a Digitally Programmable Delay-Locked Loop for a Low-Cost Ultra-Wide-Band Radar Receiver](#). In: IEEE International Symposium on Circuits and Systems, Bangkok, Bangkok, Thailand. *Indexed at ISI Web of Science*.
27. Tavares, Rui and Goes, João and Paulino, Nuno and Vaz, Bruno and Steiger-Garção, Adolfo. 2003. [Design and Optimization of Low-Voltage Two-Stage CMOS Amplifiers with Enhanced Performance](#). In: IEEE International Symposium on Circuits and Systems, Bangkok, Thailand. *Indexed at ISI Web of Science*.
28. Unterweissacher, Martin and Goes, João and Paulino, Nuno and Evans, Guiomar and Ortigueira, Manuel. 2003. [Efficient Digital Self-Calibration of Video-Rate Pipeline ADCs using White Gaussian Noise](#). In: IEEE International Symposium on Circuits and Systems, Bangkok, Thailand. *Indexed at ISI Web of Science*.
29. Carvoeiras, P. and Rodrigues, M. and Batista, Arnaldo and Ortigueira, Manuel. 2003. [Um software protótipo para Diagnóstico da Fibrilhação Auricular](#). In: XXIV Congresso Português de Cardiologia.

Special Issues

1. Ortigueira, Manuel and Machado, J. A., eds. 2006. [Special Issue on Fractional Calculus Applications in Signals and Systems](#). Signal Processing, Vol. 86 (10). pp. 2503-2504. ISSN 0165-1684.
2. Ortigueira, Manuel and Machado, J. A., eds. 2003. [Special Issue on Fractional signal Processing and applications](#). Signal Processing, Vol. 83 (11). pp. 2285-2286. ISSN 0165-1684.

Patents

1. [A Novel Self-Calibration Technique for ADCs](#). A Novel Self-Calibration Technique for ADCs (SECA and ESA Projects): It consists in applying a White Gaussian Noise stimulus to the ADCs and calculating, in the digital domain, the calibrating-codes from the histogram of the output-codes. This technique allows on-chip built-in self-calibration and self-testing of Video-rate ADCs. A European Patent has been granted in 2006 under this subject (EP 1 473 836). This patent is a clear and successful demonstration of our interdisciplinary cooperation between researchers from microelectronics and signal processing areas.

Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
i) Thesis - PhD			1	1	2
j) Thesis - MSc				1	2
Grand Total	1		1	2	4

Table 17 – Theses by Year of Group A1

PhD Theses

1. Evans, Guiomar. 2006. [Geradores de Ruído Branco Gaussiano e Uniforme para a Realização de Teste e Calibração Automática de ADC'S em Circuitos Integrados CMOS](#). PhD thesis, FCUL – Faculdade de Ciências da Universidade de Lisboa/FCT-Faculdade de Ciências e Tecnologia.
2. Vaz, Bruno M.. 2005. [Conversores Analógico/Digital de Elevada Velocidade e Tensão de Alimentação Reduzida](#). PhD thesis, Faculdade Ciências e Tecnologia/UNL.

MSc Theses

1. Pinto, Hugo. 2006. [Modulador Delta-Sigma de baixo consumo e área reduzida para aplicações biomédicas utilizando técnicas de partilha e comutação de amplificadores](#). MSc thesis, (Goes, João, supervisor), Faculdade de Ciências e Tecnologia/UNL.
2. Unterweissacher, Martin. 2003. [A Digital-Domain Self-Calibration and On-Chip Self-Testing Technique for Pipeline A/D Converters using Gaussian-White-Noise](#). MSc thesis, (Goes, João and Soser, Peter, supervisors), Universidade Técnica de Graz.

Prototypes and Products

1. [A 0.9 V 200 uW 0.06mm² Sigma-Delta Modulator for biomedical applications](#). First switched-capacitor circuit reported using overlapping clock-phases (single-phase technique). Smallest ADC reported for the given performance. IEEE ISSCC Conference. (Feb. 06); IEEE TCAS-I (Dec. 05) [prototype]
2. [10-b 4MS/s Parallel Pipeline ADC for fingerprint sensors](#). Very low power dissipation; no special process layers used for implementing the capacitors. [prototype]
3. [First fully integrated CMOS UWB radar transceiver for medical imaging applications](#). Novel architecture using new fully differential circuits for pulse generation and new receiver topology; experimental results will be published in a book edited by Springer. [prototype]
4. [10-b 50MS/s Parallel Pipeline ADC](#). First silicon-proved time-interleaved pipeline ADC employing low-voltage techniques! The published fastest and the most energy efficient Parallel Pipeline ADC. IEEE VLSI Circuits Conference. [prototype]
5. [Gaussian and Uniform High-amplitude Broadband Noise Generators](#). Power dissipation of the Gaussian Noise Generator reduced by one order of magnitude when compared with the state-of-the-art for increased performance; First Practical Uniform Noise Generator reported up to date. [prototype]

Projects

1. ADOPT (POCTI/ESE/33311/99) - Optimisation of Parallel Pipeline Analogue-to-Digital Converters to High-Speed Applications - Dates: 01-01-2000/31-12-2003(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POCTI/ESE; Funding: 93.125,57€ (93.125,57€)
2. BIOPATTERN (A1) (508803) - Computational Intelligence for Biopattern Analysis to Support eHealth - Dates: 01-01-2004/31-12-2007(48 months); Type: Network; Role: Partner; Sponsor: EC; Programme: FP6/IST; Funding: 1.066.666,67€ (53.315,83€)
3. CHINA () - Novel architectures for radio receivers and transmitters for Multi-Standard Applications - Dates: 01-01-2002/31-12-2005(); Type: RTD; Role: ; Sponsor: ICCTI; Programme: MCT/Radio-Frequency Microelectronics; Funding: 0,00€ (0,00€)
4. LEADER (PTDC/EEA-ELC/69791/2006) - Low Energy Analogue-to-Digital converter with Enhanced effective Resolution - Dates: 01-09-2007/30-08-2009(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: PTDC/EEA-ELC; Funding: 44.994,00€ (28.512,00€)
5. MINERVA (87574-CP-1-2000-1-RO-MINERVA-ODL) - Artificial Intelligence and Neural Network Tools for Innovative ODL - Dates: 01-10-2000/01-09-2003(35 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: SOCRATES/SOC/ODL; Funding: 0,00€ (0,00€)
6. PWAVE () - - Dates: 01-03-2004/28-02-2006(); Type: RTD; Role: ; Sponsor: EC; Programme: FP6/?; Funding: 73.000,00€ (73.000,00€)
7. SAMBA (POCTI/ESE/41804/2001) - Smart Analogue-to-digital (A/D) interface Module for Biomedical Applications - Dates: 01-01-2002/31-12-2005(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POCTI/?; Funding: 53.000,00€ (53.000,00€)
8. SECA (POCTI/ESE/47061/2002) - A Low-Voltage Low-Power Digitally Self-Calibrated Pipeline ADC for Video-Frequency with On-Chip Self-Testing Capability - Dates: 01-01-2003/31-12-2006(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POCTI/?; Funding: 33.000,00€ (19.925,00€)
9. SIPHASE (POSC/EEA-ESE/61863/2004) - Design of switched-capacitor circuits in advanced CMOS technologies using a novel single-phase scheme - Dates: 01-05-2005/30-10-2007(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POSC/?; Funding: 54.000,00€ (54.000,00€)
10. SPEED (PTDC/EEA-ELC/66857/2006) - Low Power Ultra-High Speed Analogue-to-Digital Converter for Ultra-Wideband Wireless Communications - Dates: 01-09-2007/30-08-2009(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: PTDC/?; Funding: 61.732,00€ (14.619,00€)

11. U-BOAT (PTDC/EEA-TEL/67066/2006) - U-BOAT - Ultra-Wide Band Transmission for Ad Hoc Networks - Dates: 01-10-2007/10-01-2009(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: PTDC/?; Funding: 97.000,00€ (0,00€)

12. VIRTUAL-ELECTRO-LAB (RO/01/B/F/PP141024) - Using information & communication technologies in development of virtual & remote laboratories for initial & continuous education oriented on efficient professional (re)insertion in electrical domain - Dates: 01-01-2002/30-09-2004(33 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: Leonardo da Vinci/?; Funding: 600.000,00€ (54.411,00€)

3.1.3. Hosted Activity A1.1: Telecommunications

Membership

PhD Members

- Paulo Pinto (Coordinator) – Associate Professor – ppf@fct.unl.pt
- Isabel Ventim Neves – Assistant Professor – ivn@uninova.pt
- Luís Bernardo – Assistant Professor lfb@fct.unl.pt
- Paulo Montezuma de Carvalho – Assistant Professor (since June 2007) – pmc@uninova.pt
- A new senior PhD Member in the area of Digital Communication, Coding, and MAC protocols will join the group shortly (December 2007)

PhD Students

- Rodolfo Duarte Oliveira – Teaching Assistant – rado@fct.unl.pt
- Pedro Amaral – Teaching Assistant – pfa@fct.unl.pt
- Pedro Sobral – Teaching Assistant, University Fernando Pessoa, Porto – pmsobral@ufp.pt
- Teles Rodrigues – Teaching Assistant, Polytechnic Institute of Setubal – vteles@est.ips.pt

Background

The Group was established in 1999 and until 2004 had a strong effort in teaching at undergraduate level. Since 2004 the research effort began to be visible and it is rising at an acceptable growing rate.

Research activity development

Since 2004 the research situation in the group has evolved steadily with the launch of the PhD student activities. The results of the research are being published at leading IEEE conferences in the area (such as IEEE PIMRC – Personal, Indoor and Mobile Radio Communications, or WCNC Wireless Communications & Networking Conference) or journals (Computer Communications, Elsevier). It is expected that this effort will be more visible in the future.

The PhD member that is most likely to be integrated in the group next Winter has also his work published at higher level mainly on IEEE Transaction on Communications, IEEE Transactions on Vehicular Technology, and IEEE Communication Letters.

The funding of this group is mainly based on National R&D projects funded by FCT/MCTES and a few international activities.

Collaboration to the setting up of the European policy on ICT standardisation

The coordinator of the group participated in 2006/07 in a core team that made a consultation to the European Commission about the ICT standardisation policy in Europe. The consultation consisted on the study of the current reality and recommendations to the future. The study can be downloaded from www.ictstandardisation.eu⁵.

The study is being analysed by the Member States and it is very likely that it will be implemented (pursuing its recommendations and issuing communiqués from the Council). In socio-economic terms this effort is likely to have a strong impact in society.

⁵ During the first week after its publication this study was downloaded more than 2000 times.

Main research areas

The main research areas of the Telecommunications group are:

- interconnection of wireless systems leading to 4G systems;
- sensor and ad-hoc networks
- line coding systems and wireless communication;

Two emerging areas are:

- interdomain routing; and
- mobility on the Internet and distributed systems.

Relevance of the Scientific Activity

For the area of interconnection of wireless systems the work proposed a new architecture incorporating a controlling unit inside the 3G core to enable the interworking with other, non-3G, radio systems (e.g. WLAN). These non-3G radio systems can be used as data networks (the control remains in the cellular network), and handovers last the same time as horizontal handovers allowing for a seamless interworking. The sequence of publications was the longest one: 1 paper on a small conference (was included in the list of best papers and was published in a book by Springer), a second one in a conference with proceedings published in the Lecture Notes in Computer Science (Springer) and the presentation was chosen to be given at the starting plenary session, a third in "Computer Communications" (Elsevier), and a fourth and final one is being prepared to be submitted to another high-ranked journal. A PhD is finishing in this line (a fifth paper was published on a minor IEEE sponsored conference).

For the area of sensor and ad-hoc networks the work is at the stage of two thirds of the effort of a PhD. The work consists on the definition of a new traffic generalized model for CSMA/CA saturated and non-saturated single-hop networks able to describe the network behaviour in presence of both unicast and broadcast frames. The work is pursuing to the definition of a controlling module to manage the load a node might introduce into the network in order to keep the network out of saturation ratios. Two papers were published on small conferences (one of them was included in the list of best papers and will be published in a book by Springer) and three other papers have been published at the top conferences in the area (PIMRC'06, WCNC'07, and PIMRC'07). The plans are to publish a paper on a journal (it was submitted to IEEE Transactions on Networks), and publish the follow up of the work by the mid of 2008 also at a higher level. In terms of internationalization the student is about to leave to Greece for three months (to the group of Prof. Leandros Tassioulas) and at the final period of the PhD (mid 2008) the student will visit a foreign laboratory yet to be chosen (during six months).

This line of action was started by a young PhD (Luis Bernardo) and is the example of the Group's policy towards young PhDs – they are given freedom to start new research areas, make their own choices, but all the research is still discussed at Group level (mainly with the Group leader at the current stage).

The area of line coding and wireless communication has recently acquired his first PhD within the group (Paulo Carvalho) and will have a new senior PhD member with relevant work performed at another University. The strategy here is to join a young PhD with another one that has already a relevant curriculum in the area.

Organization

The main lines are headed by PhD researchers and include one PhD student and several undergraduate students performing their final year projects, or Master thesis. Each of these projects tries to achieve publications at small conferences as a mechanism to raise their quality and introduce a culture of demand, creativity, and innovation into the students. The Group has

an undergraduate laboratory and a graduate laboratory to support the research activities at these levels.

Internationalization

The past experience of the senior researchers includes joint publications with foreign researchers. However, given the short serious research period of the Group at CTS the launching of internationalization activities is just restarting.

The strategy is to consider direct contacts and short visits to foreign research groups as a more useful mechanism than the participation in joint (European) projects. In this sense the stay of the PhD student of the area of sensor and ad-hoc networks at his later stage of the PhD in a foreign laboratory will help to strengthen international links. The emerging area of interdomain routing will start already as a joint work with the Université Catholique de Louvain in Belgium. As a general policy for the future the aim for PhD students is to make them work on collaborative work based on short visits and have a longer stay at the end of his/her degree period.

The internationalization effort did not happen for the line of interconnection of wireless systems. The main reason was the fact that the PhD student is a teacher at one university in Porto (therefore not really a member of the Group) and the critical mass of the Group by the time he began the PhD that was relatively small.

The study on ICT standardisation is already an example of the start up of international cooperation as well.

Human Resources and Management

The recruitment policy of the Group is still based on the admission of lecturers to the Telecommunication Sector in the Electrical Engineering Department. It is still a fast growing Sector and the admission of persons holding the MSc degree to perform their PhD in the Group has been accepted in the past by the University. A new senior PhD member will join and the core group is expected to stabilise for some years now.

The strategy for the near future is to enlarge the group at CTS, not being part of the Telecommunications Sector of the Department. The opportunity of the scholarships given to senior PhDs by the FCT/MCTES is seen as a valuable mechanism to create a “tenure-track” carrier and enlarge the critical mass of the group.

Strategic Planning and Long Term Perspectives

In strategic terms the plans of the Group are to focus on research activities, mostly based on national research projects, as opposed to participation in European projects. The internationalization contacts will get the higher priority in the next three years period. Plans to establish the two of the three emerging areas as main lines will also be put in practice (three new PhD students will be working in these areas, but one of them is from another University).

Currently, amongst other submissions, the Group submitted a proposal for national funded research projects that covers the area of UWB (Ultra Wideband) with researchers from the Technical University of Lisbon (IST-UTL) and ISCTE (another higher education institution in Lisbon). The project covers interdisciplinary subjects from the radio signal, coding, MAC sublayer up to ad-hoc networks. This project also integrates some of the activities of the lines inside of the Group. This submission was approved.

Elements of National and International recognition

During the period under analysis members of the Telecommunications group had an active involvement in the national and international scientific community. The more relevant issues are:

- Reviews for journals – Computer Communications (Elsevier), IEEE Transactions on Parallel and Distributed Systems, IEEE Communication Letters, IEEE Computer, IEEE Network, IEEE Transactions on Industrial Informatics, IEEE Transactions on Industrial Electronics, IEEE Intelligent Systems, Journal of Wireless Communications and Mobile Computing, Wiley,
- Participation on TPC of relevant conferences – IEEE PIMRC (International Symposium on Personal, Indoor and Mobile Radio Communications); IFIP Networking; and some other minor ones.
- Reviews and evaluations of European Research projects – Evaluations of proposals for FP6 and FP7 (2007) programmes, as well as reviewing of projects.
 - Evaluation of calls:
 - 6th IST Call in the area of Key Action 4 (Essential Information Society Technologies and Infrastructures), E4: Mobile and personal communications and systems, including satellite-related systems and services.
 - IST FP6 Call 4 S.O. 2.4.5. Mobile and Wireless Systems beyond 3G
 - IST FP7-ICT-2007-1 – Theme: Information and Communication Technologies, for the Objective “The Network of the Future”.
 - DG Research – FP7 Research for SMEs proposals, Call 1 (FP7- SME-2007-1)
 - INFOS-IST-CALL2-1-6 - Objective 1.6 “New Paradigms and Experimental Facilities”
 - Reviewer Activities:
 - Review of Specific Support Action (SSA): MUSICLESSONS, NARTUS;
 - Review of Strategic Targeted Research or Innovation Projects (STREP): CAPANINA, FLEXINET, ADHOCYS;
 - Review of Network of Excellence (NoE): EURONGI, CRUISE, NEWCOM;
 - Review of Integrated Projects (IP): e-SENSE, U-2010;

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
d) Book Chapter	1			2	3
e) Periodical - International				2	2
g) Conference Paper (Refereed)		3	5	4	12
Grand Total	1	3	5	8	17

Table 18 - Publications by Year of Hosted Activity A1.1

Count of publication	WoS		
Type Table	No	Yes	Grand Total
e) Periodical - International		2	2
g) Conference Paper (Refereed)	2	10	12
Grand Total	2	12	14

Table 19 - Publications of A1.1 at ISI Web of Knowledge Indexing Service

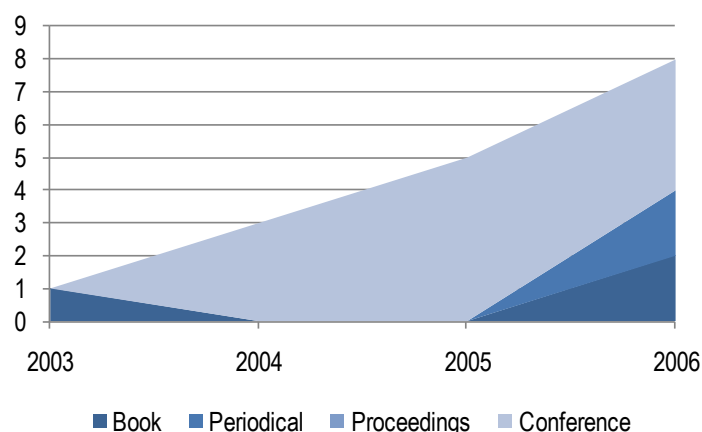


Figure 23 – Evolution of Publications by Year of Hosted Activity A1.1

Book Chapter

1. Bernardo, Luís and Pinto, Paulo. 2006. [A Decentralized Location Service: Applying P2P technology for picking replicas on replicated services](#). In: e-Business and Telecommunication Networks (Ascenso, João and Belo, Carlos and Saramago, Mónica and Vasiu, Luminita, eds.), Springer. ISBN 101402047606.
2. Pinto, Paulo and Bernardo, Luís and Sobral, P.. 2006. [Service Integration Between wireless Systems: A core-level approach to internetworking](#). In: in e-Business and Telecommunication Networks (Ascenso, João and Vasiu, Luminita and Belo, Carlos and Saramago, Mónica, eds.), Springer, pp. 193-200. ISBN 101402047606.
3. Sobral, P. and Pinto, Paulo. 2003. [As Comunicações Móveis no Contexto das Cidades Digitais: uma Arquitectura Híbrida para Acesso de Alto Débito](#). In: in Cidades e Regiões Digitais: Impacte nas cidades e nas pessoas (Gouveia, Luís B., ed.), Edições Universidade Fernando Pessoa. ISBN 9728830033.

Papers in International Scientific Periodicals with Referees

1. Pinto, Paulo and Bernardo, Luís and Sobral, P.. 2006. [Seamless continuity of PS-services in WLAN/3G interworking](#). in Computer Communication, Elsevier B. V., Vol. 29 (8). pp. 1055-1064. Indexed at ISI Web of Science.
2. Silva, J. and Souto, N. and Correia, A. and Cercas, F.. 2006. [Equalization Based Receivers for Wideband MIMO/BLAST Systems](#). Wireless Personal Communications, Vol. 40 (3). pp. 291-304. ISSN 0929-6212. Indexed at ISI Web of Science.

Papers in Conference Proceedings

1. Montezuma-Carvalho, Paulo. 2006. [Highly efficient encoded OQPSK signals: emission and reception design aspects](#). In: 25th Military Communications Conference, 23-25 October 2006, Washington, USA. Indexed at ISI Web of Science.
2. Oliveira, Rodolfo and Bernardo, Luís and Pinto, Paulo. 2006. [Performance Analysis of the IEEE 802.11 Distributed Coordination Function with Unicast and Broadcast Traffic](#). In: 17th IEEE Int'l Symposium on Personal, Indoor and Mobile Radio Communication, PIMRC'06, Helsinki (FIN). Indexed at ISI Web of Science.
3. Bernardo, Luís and Oliveira, Rodolfo and Gaspar, S. and Paulino, D. and Pinto, Paulo. 2006. [A Telephony Application for MANETS: Voice over a MANET-extended JXTA Virtual Overlay Network](#). In: Int'l Conf. on Wireless Information Networks and Systems (WINSYS 2006), 7-10 Aug 2006, Setúbal (PT). Indexed at ISI Web of Science.
4. Alves, J. and Oliveira, P. and Oliveira, Rodolfo and Pascoal, A. and Rufino, M. and Sebastião, L. and Silvestre, C.. 2006. [Vehicle and Mission Control of the DELFIM Autonomous Surface Craft](#). In: 14th Mediterranean Conference on Control and Automation, Ancona (IT). Indexed at ISI Web of Science.
5. Oliveira, Rodolfo and Bernardo, Luís and Pinto, Paulo. 2005. [Searching for resources in MANETS: a cluster based flooding approach](#). In: 2nd International Conference on E-business and Telecommunication Networks (ICETE'05), 3-7 October 2005, Reading (UK). Indexed at ISI Web of Science.

6. Oliveira, Rodolfo and Bernardo, Luís and Ruivo, N. and Pinto, Paulo. 2005. [Searching for PI resources on MANETs using JXTA](#). In: Service Assurance with Partial and Intermittent Resources (SAPIR'05), in "Telecommunications 2005", Lisbon (PT). *Indexed at ISI Web of Science*.
7. Sobral, P. and Bernardo, Luís and Pinto, Paulo. 2005. [Managing PI-resources in 4G Wireless Systems: the Opportunistic Way](#). In: Service Assurance with Partial and Intermittent Resources (SAPIR'05), in "Telecommunications 2005", Lisbon (PT). *Indexed at ISI Web of Science*.
8. Pinto, Paulo and Bernardo, Luís. 2005. [The Networking Area of the Telecommunication Group at the New University of Lisbon](#). In: 5th Conference on Telecommunications (ConfTele'05), 6-8 April 2005, Tomar (PT).
9. Oliveira, Rodolfo and Bernardo, Luís and Pinto, Paulo. 2005. [Flooding Techniques for Resource Discovery on High Mobility MANETs](#). In: International Workshop on Wireless Ad-hoc Networks 2005 (IWWAN'05), 23-26 May 2005, London (UK).
10. Pinto, Paulo and Bernardo, Luís and Sobral, P.. 2004. [UMTS-WLAN Service integration at core network level](#). In: Universal Multiservice Networks: 3 rd Europe Conf., ECUMN, 25-27 October 2004, Porto (PT). *Indexed at ISI Web of Science*.
11. Pinto, Paulo and Bernardo, Luís. 2004. [A decentralized location service: Applying P2P technology for picking replicas on replicated services](#). In: Proc. Of Int. Conf. on E-Business and telecommunication Networks (ICETE'2004), Setúbal (PT). *Indexed at ISI Web of Science*.
12. Pinto, Paulo and Bernardo, Luís and Sobral, P.. 2004. [Service integration between wireless systems: A core-level approach to internetworking](#). In: Proc. Of Int. Conference on E-Business and Telecommunication Networks (ICETE'2004), Setúbal (PT). *Indexed at ISI Web of Science*.

Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
j) Thesis - MSc	1			2	3
Grand Total	1			2	3

Figure 24 – Theses by Year of Hosted Activity A1.1

MSc Theses

1. Serrazina, Marco. 2006. [Técnica de Codificação/Recepção para Sistemas com Espalhamento Espectral](#). MSc thesis, (Bernardo, Luís and Montezuma-Carvalho, Paulo, supervisors), Faculdade Ciências e Tecnologia/UNL.
2. Amaral, Pedro. 2006. [Sistema de comunicação distribuída segundo usando agentes](#). MSc thesis, Faculdade Ciências e Tecnologia/UNL.
3. Oliveira, Rodolfo. 2003. [Supervisão e Controlo da Missão de Veículos Autónomos](#). MSc thesis, (Silvestre, Carlos, supervisor), IST - Instituto Superior Técnico.

Projects

1. ICT Standardization () - EU Study on the specific policy needs for ICT standardisation - Dates: 01-05-2006/31-12-2007(); Type: RTD; Role: Partner; Sponsor: EC; Programme: ?/?; Funding: 289.900,00€ (32.850,00€)
2. SIGAPANO (POSC/EIA/62199/2004) - Sensor Information GATHERing with PATrol NOdes - Dates: 01-06-2005/31-05-2007(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: POSC/?; Funding: 81.000,00€ (18.000,00€)

3.1.4. Hosted Activity A1.2: Embedded Systems

Current Membership

PhD members

- Luís Gomes (Coordinator), PhD, “*Professor-Auxiliar*” (similar to Assistant Professor) at FCT-UNL, lugo@uninova.pt
- João Paulo Barros, PhD (after July 2006), “*Professor-Adjunto*” (similar to Assistant Professor) at ESTIG-IPBeja

PhD Student members

- Anikó Costa, PhD Student, Professor Assistant
- Rui Pais, PhD Student, Assistant

PhD Students

- Starting 2nd semester 2007: José Rocha, José Ribeiro

MSc Students

- Conclusion expected till February 2008: Ricardo Nunes, Paulo Lima, Ruben Lima, Hugo Guerreiro, João Oliveira, Tiago Rodrigues, Soraia Rocha
- Conclusion expected till September 2008: David Guerreiro, João Lourenço, Tiago Reis, Luis João Carvalho
- Conclusion expected till February 2009: Francisco Gonçalves, Pedro Semeano, Bernardo Oliveira, Júlio Fonseca, Mauro Reis, Hugo Amaral, Gustavo Patrício, Bruno Serras

Goals and research lines

The main goal of the GRES research group addresses the design of embedded systems, emphasizing the use of reconfigurable computing platforms and integrating different aspects of its design, ranging from analysis and specification to verification and implementation, and relying in a model-based development attitude, where Petri nets and other models of concurrency play the main role.

Current research topics are:

- Petri nets modeling issues emphasizing structuring mechanisms, model composability and model partitioning issues.
- Hardware-software co-design of embedded systems and Petri nets and other models of concurrency (namely hierarchical and concurrent finite state machines based formalisms).
- Reconfigurable computing platforms.

For the period of 2003-2007, the main motto for the scientific work of the group has been to contribute to validate that Petri nets are adequate to be used as the underlying formalism within a methodology for hardware-software co-design of reconfigurable embedded systems, amenable to support specification, simulation, verification and implementation, including composition of sub-models, partitioning into components, co-simulation, co-verification and automatic code generation (which means covering the whole development flow). Several tools are under development supported by on-going post-graduation activities within the framework of FORDESIGN project.

Relevance of the Scientific Activity

The consolidated increase of resources made available at new developments at chip level (according with Moore's law, 1965, we still roughly double transistors per chip every 18 months) has not been balanced with identical increase at the productivity of the designer due to the lack of adequate methods and tools, leading to what is normally called by the "productivity gap". As much as the complexity of the design increases, the lack of capabilities to verify system's properties will be more notorious, leading to what we call the "verification gap". We argue that having the right tools and the right formalisms and computation models are key aspects to fight against the "productivity and verification gaps". Petri nets are in a very good position to help in this direction, even when used directly by the designer or as an underlying model to be used by engineering tools.

The lack of tools ready to be integrated within engineering development frameworks are one major drawback when considering Petri nets usage within specific areas of application. The set of tools under development has as its main target area of application the design of embedded systems, using (or not) co-design techniques. For that end a specific class of Petri nets was proposed, based on the well-known Place-Transition Petri nets class. The tools under development will be publicly available through the FORDESIGN project website (<http://www.uninova.pt/fordesign/>).

With the new developments at theoretical level, complemented by the set of tools under development, which should be concluded first half of 2008, we pursue two goals:

- To contribute to validate adequacy of usage of Petri nets in engineering flows within embedded systems design, from specification to implementation;
- To prepare a new level of collaboration with other academic groups and companies at international and national levels, including research projects and technology transfer projects as well, where the set of tools will be used as a demonstration test-bed.

Guidelines on research directions

During the referred period, the emphasis of the theoretical research carried on was on modularity and composability of Petri nets models, including composition by net addition and composition by hierarchical structuring (refinements & aggregations) and partitioning of models (in order to support distributed execution of Petri nets models and integration within methodologies for hardware-software co-design of embedded systems).

It is important to note that, in contrast with the common attitude within Petri nets works where composition and decomposition of nets should preserve model properties, we adopt a pragmatic attitude, in the sense that we do not impose preservation of properties within our composition and decomposition techniques. This could be of major importance whenever the designer wants to adopt cross-cutting requirements, which could be modelled through a specific Petri net model that should interact with different sub-models. This is also the case when facing partitioning of models into several parallel components in order to get distributed execution of Petri nets models, and when the designer needs to select an ad-hoc cutting set to decompose the initial model into components. However, even not preserving properties, we are aware of verification of properties after application of the composition and decomposition procedures.

Coming to more applied research emphasis during the referred period, it is important to refer the intended contributions to standards (namely to PNML – Petri Net Mark-up Language through the proposal of the extension OPNML – Operational PNML) and to the development of engineering tools to be integrated within design automation methodologies and with other Petri nets tools as well. Among the engineering tools under development, the following should be mentioned: editor of low level Petri nets, automatic code generator from PNML to C, automatic

code generator from PNML to VHDL, timing simulator for Petri nets models, state space construction, integration of Petri net executors and graphical user interfaces, tools for net operations (addition, splitting).

PhD works under preparation include exploitation of the referred works, enlarged with new contributions at the structuring mechanisms (exploring new ways of hierarchical composition/decomposition of Petri net models) and extensions to high-level Petri nets.

Guidelines on strategies

At the beginning of 2004, two main strategic goals were identified, and have been pursued since then, regarding defining “conference publication policy” and “international technical-scientific cooperation”. At the end of 2006, similar analysis was carried out regarding “journal publication policy”, where the identification of leading journals within the areas of research has been carried out; results are expected in the near future. Our conclusions are publicized at the group website at <http://www.uninova.pt/gres/>, in order to clearly give directions to our members.

Another key aspect to assure group sustainability is participation in R&D projects at different levels. For that, the group has been collaborating in several European level R&D projects (where synergistic participations with other groups of CRI were carried on) and networks, and supporting Portuguese level projects, both at the research area (FCT funded project) and technology transfer level (with Portuguese industry).

Conference publication policy

Regarding “conference publication policy”, we have been considering selected clusters of well-known conferences.

First cluster of conferences where most participants come from academia focuses on Petri nets, concurrency and methodologies (namely ATPN and ACSD).

Second cluster where industry also has a strong presence focuses on tools, methodologies and applications (namely Design Automation conferences, DAC and DATE, and IEEE-Industrial Electronics Society sponsored conferences, SIES, ETFA and INDIN).

A third cluster includes conferences on Education on Microsystems and Computer Engineering, in order to keep our curricula tuned with advances on scientific/technological issues (namely MSE, EWME and ITiCSE).

A fourth cluster includes national conferences, to assure interaction with other Portuguese groups (namely the Workshop on Reconfigurable Systems – REC series, and CONTROLO in a limited way).

According with this strategic policy, the group has published in ATPN (“the” Petri net conference, where no other Portuguese research group has published so far to the best of our knowledge), ACSD, SIES, ETFA, INDIN, MSE, EWME, ITiCSE, among others.

Journal publication policy

Regarding “journal publication policy”, we have selected specific clusters of well-known journals and periodicals within the same areas as for conferences. In this sense, we identified a set of top periodicals, most of them published by IEEE, ACM, Springer and Elsevier. As referred, the list is available through <http://www.uninova.pt/gres/>.

International scientific cooperation policy

Regarding our “international scientific cooperation policy”, we have been trying to establish strong links with selected communities.

First link, we consider the Petri nets community (scientific roots). Some achievements come out from this activity, including: membership of the Program Committee of ATPN (2005, 2007, 2008) and of CPN workshop (2006, 2007), member of the Editorial Board of ToPNoC (Transactions on Petri Nets and Other Models of Concurrency; sub-series of Lecture Notes in Computer Science (LNCS), Springer), workshop organizer for two satellite event of ATPN (Workshop on Teaching Concurrency'2006 and Workshop on Teaching Concurrency'2007). João Paulo Barros was invited to visit two reference Petri nets groups at Aarhus (Prof. Kurt Jensen, Prof. Soren Christensen) and at Hamburg (Prof. Rudiger Valk, Prof. Daniel Moldt). Collaboration within the development of the Petri nets editor was launched with the Petri nets group at Brandenburg University of Technology Cottbus (Prof. Monika Heiner).

Second link to strength is associated with the Industrial Electronics Society of the IEEE – Institute of Electrical and Electronics Engineers, where the coordinator of the group has been a member of the AdCom (Administrative Committee) from 2004 till 2006, is Vice President for Workshops and Small Conferences for 2007, also has been serving in several sponsored conference boards; recently he was appointed as Steering Committee Chair for the emergent IEEE Symposium on Industrial Embedded Systems (which was held in Lisbon at July 2007). He also has been an Associate Editor for the IEEE Transactions of Industrial Informatics (2005, 2006 and 2007). The research group organized ETFA'2003 – 9th IEEE International Conference on Emerging Technologies and Factory Automation, with more than 200 participants, and SIES'2007 – 2nd IEEE International Symposium on Industrial Embedded Systems with almost 70 participants.

A third link that the group wants to strength in the near future is with the design automation community, where the results of the on-going FCT sponsored FORDESIGN project are expected to produce evidences (prototypes) to support future co-operations, both at academic level and industry level as well. Achievements/recognition of work till now include membership to several Program Committees of conferences and workshops in the area of embedded software and embedded systems.

A fourth link addresses the synergistic relationship with education activities, where several collaborations were carried on within European Leonardo da Vinci and Socrates programs projects. Several papers were published as a result of international collaboration. The coordinator of the group served as Guest Co-Editor for a Special Section on IEEE Transactions on Industrial Electronics devoted to “e-Learning and Remote Laboratories within Engineering Education” and as Co-Editor for the book “Advances on remote laboratories and e-learning experiences”.

Organization of conferences

Within the referred period, the group was responsible for the organization of two IEEE sponsored conferences:

- ETFA'2003 - 9th IEEE Conference on Emerging Technologies and Factory Automation; 16-19 September 2003; Fundação Calouste Gulbenkian, Lisbon, Portugal, and
- SIES'2007 – 2nd IEEE International Symposium on Industrial Embedded Systems; 4-6 July 2007; Hotel Costa da Caparica, Lisboa, Portugal.

The group coordinator was co-organizer of two events co-located with the Petri nets conference, namely TeaConc'2006 - Workshop on Teaching Concurrency; Turku; Finland; 27 June 2006, and TeaConc'2007 – 2nd Workshop on Teaching Concurrency; Siedlce, Poland; 25 June 2007 and has been serving in several conferences and workshops in different roles, namely as General Co-Chair (ETFA'2003, SIES'2007, SIES'2008, ICELIE'2008), Program Co-Chair (DESDes'06, ICELIE'06, POWERENG'07), Track Co-Chair (ETFA'2005, ICESS'05, ISIE'06, ICIEA'07, INDIN'07, ICIEA'08), Work-in-Progress Co-Chair (SIES'06), Special Session

Co-Chair (ETFA'05, ETFA'06, ISIE'07, ETFA'07, ISIE'08), Special Session Organizer (several) and Program Committee member (several, namely at ATPN'05, ATPN'07 and ATPN'08).

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
c) Book - Proceedings		1		1	2
d) Book Chapter			4		4
e) Periodical - International		1	2		3
g) Conference Paper (Refereed)	6	13	11	11	41
Grand Total	6	15	17	12	50

Table 20 - Publications by Year of Hosted Activity A1.2

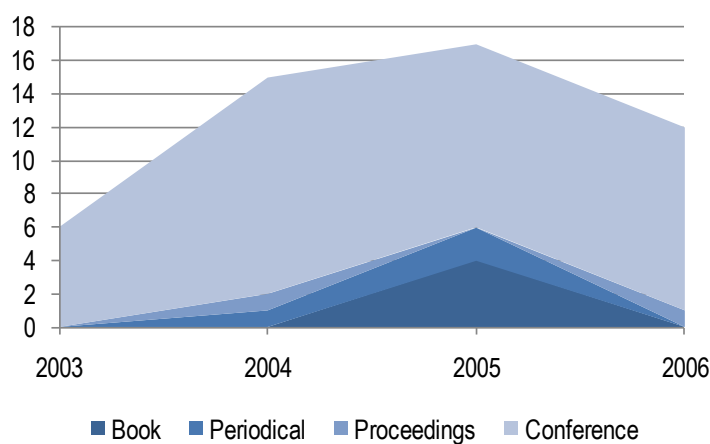


Figure 25 - A1.2: Evolution of Publications by Year of Hosted Activity A1.2

Count of publication	WoS		
Type Table	No	Yes	Grand Total
e) Periodical - International	1	2	3
g) Conference Paper (Refereed)	25	16	41
Grand Total	26	18	44

Table 21 - Publications of A1.2 at ISI Web of Knowledge Indexing Service

Book – Proceedings

1. Adamski, Marian and Gomes, Luís and Wegrzyn, Marek and Labiak, Grzegorz, eds. 2006. [Discrete-Event System Design 2006](#). In: 3rd IFAC Workshop on Discrete-Event System Design (DESDes'06), 26-28 Sep 2006, Zielona Gora, Poland.
2. Borza, Paul N. and Gomes, Luís and Scutaru, Gheorghe, eds. 2004. [VIRTUAL-LAB'2004 e-learning and Virtual and Remote Laboratories](#). In: 1st International Workshop on e-learning and Virtual and Remote Laboratories, 24-25 Aug 2004, Setúbal, Portugal.

Book Chapter

1. Gomes, Luís and Barros, João. 2005. [Models of Computation for Embedded Systems](#). In: The Industrial Information Technology Handbook (Zurawski, Richard, ed.), CRC, 83.1-83.17. ISBN 0849319854.
2. Gomes, Luís and Barros, João and Costa, Anikó. 2005. [Modeling Formalisms for Embedded Systems Design](#). In: Embedded Systems Handbook (Zurawski, Richard, ed.), CRC, 5.1-5.34. ISBN 0849328241.
3. Gomes, Luís and Barros, João and Costa, Anikó. 2005. [Structuring Mechanisms in Petri Net Models: From specification to FPGA based implementations](#). In: Design of embedded control systems (Adamski,

Marian and Karatkevich, Andrei and Wegrzyn, Marek, eds.), Springer, pp. 153-166. ISBN 10: 0-387-23630-9; 13: 978-0387-23630-8.

4. Gomes, Luís and Costa, Anikó. 2005. [Hardware-level Design Language](#). In: The Industrial Information Technology Handbook (Zurawski, Richard, ed.), CRC, 84.1-84.18. ISBN 0849319854.

Papers in International Scientific Periodicals with Referees

1. Gomes, Luís and Barros, João. 2005. [Structuring and Composability Issues in Petri Nets Modeling](#). IEEE Transactions on Industrial Informatics, Vol. 1 (2), pp. 112-123. *Indexed at ISI Web of Science*.
2. Barros, João and Gomes, Luís. 2004. [On the Use of Coloured Petri nets for the Object Oriented Design](#). Lecture Notes in Computer Science LNCS 3099. pp. 117-136. ISSN 0302-9743. *Indexed at ISI Web of Science*.
3. Barros, João and Jørgensen, Jens Bæk. 2005. [A Case Study on Coloured Petri Nets in Object-Oriented Analysis and Design](#). Nordic Journal of Computing, Vol. 12 (3). pp. 229-250. ISSN 1236-6064.

Papers in Conference Proceedings

1. Gomes, Luís and Costa, Anikó. 2006. [Emphasizing Graphical Modeling Formalisms within Digital Systems Design Course - ICELIE'2006](#). In: 1st IEEE International Conference on e-learning in industrial electronics, 18-20 Dec 2006, Hammamet, Tunisia. *Indexed at ISI Web of Science*.
2. Gomes, Luís and Costa, Anikó. 2006. [Petri nets as supporting formalism within Embedded Systems Co-design](#). In: IES'2006 - 2006 IEEE International Symposium on Industrial Embedded Systems, 18-20 Oct 2006, Nice, France.
3. Scutaru, Gheorghe and Borza, Paul N. and Gomes, Luís and Tollet, Ingmar and Lahti, Seppo. 2006. [Knowledge Management in Virtual-Electro-Lab: Course & Remote Experiment on Home Appliance System and Peripheral Components](#). In: 35th International IGIP Symposium Proceedings – Engineering Education – The priority for global development, 18-21 Sept 2006, Tallinn, Estonia.
4. Costa, Anikó and Gomes, Luís. 2006. [Partitioning of Petri net models amenable for Distributed Execution](#). In: ETFA'2006 - 2006 IEEE International Conference on Emerging Technologies and Factory Automation, 20-22 Sept 2006, Prague, Czech Republic. *Indexed at ISI Web of Science*.
5. Costa, Anikó and Gomes, Luís and Francisco, Helder and Silva, Bruno. 2006. [Internal event removal in Hierarchical and Concurrent State Diagrams](#). In: DESDes'06 – 3rd IFAC Workshop on Discrete-Event System Design, 26-28 Sept 2006, Rydzyna, Polónia.
6. Gomes, Luís and Costa, Anikó. 2006. [Removing ill-structured arcs in Hierarchical and Concurrent State Diagrams](#). In: ETFA'2006 - 2006 IEEE International Conference on Emerging Technologies and Factory Automation, 20-22 Sep 2006, Prague, Czech Republic. *Indexed at ISI Web of Science*.
7. Gomes, Luís and Costa, Anikó. 2006. [On exercising hardware-software logical equivalency using FPGAs](#). In: ISIE'2006 - 2006 IEEE International Symposium on Industrial Electronics, 09-13 Jul 2006, Montreal, Canadá. *Indexed at ISI Web of Science*.
8. Barros, João and Gomes, Luís. 2006. [Teaching Concurrency Through Petri Nets and Model Composition](#). In: TeaConc'2006 - Workshop on Teaching Concurrency, Turku, Finlândia.
9. Gomes, Luís and Costa, Anikó. 2006. [Using Concurrency Modeling Formalisms within System-on-a-Programmable-Chip Design](#). In: TeaConc'2006 - Workshop on Teaching Concurrency, Turku, Finlândia.
10. Gomes, Luís and Barros, João and Costa, Anikó and Pais, Rui and Moutinho, Filipe. 2006. [Redes de Petri no co-design de sistemas embutidos: o projecto FORDESIGN](#). In: REC'2006 – 2as. Jornadas sobre Sistemas Reconfiguráveis, 16-17 Feb 2006, Porto, Portugal..
11. Gomes, Luís and Costa, Anikó. 2006. [Sobre a equivalência lógica entre hardware e software](#). In: REC'2006 – 2as. Jornadas sobre Sistemas Reconfiguráveis, 16-17 Feb 2006, Portugal.
12. Gomes, Luís. 2005. [Programmable Logic Devices supporting Embedded System Design Curriculum](#). In: IECON'2005 – The 31st Annual Conference of the IEEE Industrial Electronics Society, 06-10 Nov 2005, Raleigh, North Carolina, USA. *Indexed at ISI Web of Science*.
13. Lino, Rui and Gomes, Luís. 2005. [Detecção de falhas de sensores em sistemas de automação utilizando redes de Petri](#). In: Terceiras Jornadas de Engenharia de Electrónica e Telecomunicações e de Computadores (JETC'05), 17-18 Nov 2005, Lisboa.
14. Gomes, Luís and Barros, João and Costa, Anikó and Pais, Rui and Moutinho, Filipe. 2005. [Towards Usage of Formal methods within Embedded Systems Co-design](#). In: ETFA'2005 - 10th International Conference on Emergent Technologies and Factory Automation, 19-22 Sept 2005, Catania, Italy. *Indexed at ISI Web of Science*.
15. Pais, Rui and Barros, João and Gomes, Luís. 2005. [A Tool for Tailored Code Generation from Petri Net Models](#). In: ETFA'2005 - 10th International Conference on Emergent Technologies and Factory Automation, 19-22 Sept 2005, Catania, Italy. *Indexed at ISI Web of Science*.

16. Gomes, Luís. 2005. [On conflict resolution in Petri nets models through model structuring and composition](#). In: INDIN'2005 – 3rd IEEE International Conference on Industrial Informatics, 10-12 Aug 2005, Perth, Austrália. *Indexed at ISI Web of Science*.
17. Gomes, Luís and Costa, Anikó. 2005. [Remote laboratory support for an introductory microprocessor course](#). In: MSE'2005 – 2005 International Conference on Microelectronic Systems Education, 12-13 Jun 2005, Anaheim, Califórnia, USA. *Indexed at ISI Web of Science*.
18. Gomes, Luís and Costa, Anikó. 2005. [Teaching Formal Methods within System-on-a-Programmable-Chip Design](#). In: MSE'2005 – 2005 International Conference on Microelectronic Systems Education, 12-13 Jun 2005, Anaheim, Califórnia, USA. *Indexed at ISI Web of Science*.
19. Gomes, Luís and Costa, Anikó and Meira, Paulo. 2005. [From Use Cases to building monitoring systems through Petri nets](#). In: ISIE'2005 - 2005 IEEE International Symposium on Industrial Electronics, 20-23 Jun 2005, Dubrovnik, Croatia. *Indexed at ISI Web of Science*.
20. Gomes, Luís and Costa, Anikó. 2005. [Redes de Petri no ensino de sistemas digitais utilizando dispositivos reconfiguráveis](#). In: REC'2005 - Jornadas sobre Sistemas Reconfiguráveis, 21 Feb 2005, Faro, Portugal.
21. Gomes, Luís and Costa, Anikó. 2005. [Statechart based component partitioning in hardware/software co-design](#). In: REC'2005 - Jornadas sobre Sistemas Reconfiguráveis, 21 Feb 2005, Faro, Portugal.
22. Gomes, Luís and Barros, João and Costa, Anikó and Pais, Rui and Moutinho, Filipe. 2005. [Formal methods for Embedded Systems Co-design: the FORDESIGN project](#). In: ReCoSoC'05 - Reconfigurable Communication-centric Systems-on-Chip, 27-29 Jun 2005, Montpellier, França.
23. Barros, João and Gomes, Luís. 2004. [A Unidirectional Transition Fusion for Coloured Petri Nets and its Implementation for the CPNTools](#). In: CPN'04 - Fifth Workshop and Tutorial on Practical Use of Coloured Petri Nets and the CPN Tools, 8-11 Oct 2004, Denmark.
24. Gomes, Luís and Barros, João and Pais, Rui. 2004. [From non-autonomous Petri net models to code in embedded systems design](#). In: DESDes'04 - 2nd International Workshop on Discrete-Event System Design, 15-17 Sept 2004, Zielona Gora, Poland.
25. Gomes, Luís and Costa, Anikó. 2004. [Statechart based embedded systems co-design](#). In: DESDes'04 - 2nd International Workshop on Discrete-Event System Design, 15-17 Sept 2004, Zielona Gora, Poland.
26. Barros, João and Gomes, Luís and Pais, Rui and Dias, Rui. 2004. [From Petri nets to executable systems: an environment for code generation and analysis](#). In: ICINCO'2004 – 1st International Conference on Informatics in Control, Automation and Robotics, 25-28 Aug 2004, Setúbal, Portugal.
27. Borza, Paul N. and Scutaru, Gheorghe and Gomes, Luís and Costa, Anikó and Laszlo, Lazar. 2004. [Implementation of a remote and virtual laboratory in the field of home appliance systems](#). In: VIRTUAL-LAB'2004 – 1st International Workshop on e-learning and Virtual and Remote Laboratories, 24-25 Aug 2004, Setubal, Portugal.
28. Gomes, Luís and Costa, Anikó. 2004. [Embedded Systems Introductory Course supported by remote experiments](#). In: VIRTUAL-LAB'2004 – 1st International Workshop on e-learning and Virtual and Remote Laboratories, 24-25 Aug 2004, Setúbal, Portugal.
29. Barros, João and Gomes, Luís. 2004. [Net Model Composition and Modification by Net Operations: a Pragmatic Approach](#). In: INDIN'2004 – 2nd IEEE International Conference on Industrial Informatics, 24-26 June 2004, Berlin, Germany. *Indexed at ISI Web of Science*.
30. Barros, João and Gomes, Luís. 2004. [On system's model transformation by Petri nets](#). In: CONTROLO'2004 – Sixth Portuguese Conference on Automatic Control, 07-09 June 2004, Faro, Portugal.
31. Barros, João and Gomes, Luís. 2004. [Operational PNML: Towards a PNML Support for Model Construction and Modification](#). In: Workshop on the Definition, Implementation and Application of a Standard Interchange Format for Petri Nets, Bolonha, Itália.
32. Gomes, Luís and Barros, João and Lino, Rui. 2004. [Addition of fault detection capabilities in automation applications using Petri nets](#). In: ISIE'04 - 2004 IEEE International Symposium on Industrial Electronics, 04-07 May 2004, Ajaccio, France.
33. Gomes, Luís and Borza, Paul N. and Costa, Anikó. 2004. [Home appliance systems and domotics course with multimedia support](#). In: EWME 2004; "Microelectronics Education - Proceedings of the 5th European Workshop on Microelectronics Education, 15-16 April 2004, Lausanne, Switzerland.
34. Gomes, Luís and Costa, Anikó. 2004. [Concurrent systems' hardware design using Petri nets](#). In: EWME 2004; "Microelectronics Education - Proceedings of the 5th European Workshop on Microelectronics Education, 15-16 April 2004, Lausanne, Switzerland.
35. Gomes, Luís and Maló, Pedro and Costa, Anikó. 2004. [From MSI modules to microprocessors: filling the gap with programmable logic devices](#). In: EWME 2004; "Microelectronics Education - Proceedings of the 5th European Workshop on Microelectronics Education, 15-16 April 2004, Lausanne, Switzerland.
36. Barros, João and Gomes, Luís. 2003. [Actions as Activities and Activities as Petri Nets](#). In: CSDUML'2003 – Workshop on Critical Systems Development with UML within UML'2003 – Sixth

- International Conference on the Unified Modeling Language, 20-24 Oct 2003, San Francisco, California, USA.
37. Barros, João and Gomes, Luís. 2003. [Towards the Support for Crosscutting Concerns in Activity Diagrams: a Graphical Approach](#). In: Fourth Workshop on Aspect-Oriented Modeling with UML within UML'2003 – Sixth International Conference on the Unified Modeling Language, 20-24 Oct 2003, San Francisco, California, USA.
 38. Gomes, Luís and Barros, João. 2003. [On Structuring Mechanisms for Petri Nets Based System Design](#). In: ETFA'2003 – 2003 IEEE Conference on Emerging Technologies and Factory Automation, 16-19 Sept 2003, Lisbon, Portugal. *Indexed at ISI Web of Science*.
 39. Barros, João and Gomes, Luís. 2003. [Modifying Petri Net Models by Means of Crosscutting Operations](#). In: ACSD'2003 - Third International Conference on Application of Concurrency to System Design, 18-20 June 2003, Guimarães, Portugal. *Indexed at ISI Web of Science*.
 40. Gomes, Luís and Costa, Anikó. 2003. [From Use Cases to System Implementation: Statechart Based Co-design](#). In: MEMOCODE'2003 - First ACM/IEEE Conference on Formal Methods and Programming Models for Codesign, 24-26 June 2003, Mont Saint-Michel, France. *Indexed at ISI Web of Science*.
 41. Gomes, Luís and Costa, Anikó. 2003. [On Lifting of Statechart Structuring Mechanisms](#). In: ACSD'2003 - Third International Conference on Application of Concurrency to System Design, 18-20 June 2003, Guimarães, Portugal. *Indexed at ISI Web of Science*.

Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
i) Thesis - PhD				1	1
j) Thesis - MSc	1		3		4
Grand Total	1		3	1	5

Table 22 – Theses by Line of Hosted Activity A1.2

PhD Theses

1. Barros, João. 2006. [Modularidade em Redes de Petri](#). PhD thesis, (Gomes, Luís, supervisor), Faculdade Ciências e Tecnologia/UNL.

MSc Theses

1. Conceição, Paulo. 2005. [Dos casos de uso às redes de Petri: uma aplicação à monitorização de edifícios](#). MSc thesis, (Gomes, Luís, supervisor), Faculdade de Ciências e Tecnologia/UNL.
2. Lino, Rui. 2005. [Detecção de falhas em sistemas de automação utilizando redes de Petri](#). MSc thesis, (Gomes, Luís, supervisor), Faculdade de Ciências e Tecnologia/UNL.
3. Pais, Rui. 2005. [Geração de Executores e Analisadores de Redes de Petri](#). MSc thesis, (Gomes, Luís, supervisor), Faculdade de Ciências e Tecnologia/UNL.
4. Costa, Anikó. 2003. [Estratogmas em Co-Design de Sistemas Embutidos](#). MSc thesis, (Gomes, Luís, supervisor), Faculdade de Ciências e Tecnologia/UNL.

Projects

1. COMPLETE (A1) (RO/04/B/F/PP-175016) - New Strategies of Competence acquisition for Lifelong Learning in Energy-Transport-Environment Engineering - Dates: 01-01-2005/31-12-2007(36 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: Leonardo da Vinci /; Funding: 170.389,33€ (16.023,33€)
2. EIE-Surveyor (225997-CP-1-2005-1-FR-ERASMUS-TN) - REFERENCE POINT FOR ELECTRICAL AND INFORMATION ENGINEERING IN EUROPE - Dates: 01-10-2005/30-09-2008(36 months); Type: Network; Role: Partner; Sponsor: EC; Programme: SOCRATES Thematic Network/; Funding: 0,00€ (0,00€)
3. EUI-Net (116343-CP-1-2004-1-RO-ERASMUS-TN) - European University-Industry Network - Dates: 01-10-2005/30-09-2008(36 months); Type: Network; Role: Partner; Sponsor: EC; Programme: Socrates Erasmus/; Funding: 0,00€

(0,00€)

4. FORDESIGN (POSC/EIA/61364/2004) - Formal methods for Embedded Systems Co-Design - Dates: 01-05-2005/30-04-2008(36 months); Type: RTD; Role: Prime Contractor; Sponsor: FCT-POSC; Programme: EIA/; Funding: 90.000,00€ (90.000,00€)

5. IDENTITY (MINERVA 229930-CP-1-2006-1-RO-MINERVA-M) - INDIVIDUALIZED LEARNING ENHANCED BY VIRTUAL REALITY - Dates: 01-10-2006/30-09-2008(24 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: SOCRATES/; Funding: 332.639,00€ (20.970,00€)

6. OPTO-ESTÉTICA () - Equipamentos para estética utilizando dispositivos opto-electrónicos - Dates: 01-01-2004/31-12-2007(48 months); Type: RTD; Role: Prime Contractor; Sponsor: ; Programme: /; Funding: 20.000,00€ (20.000,00€)

7. THEIERE-DISS (114040 - CP -1-2004-1- PT - ERASMUS – TND) - Thematic Harmonisation in Electrical and Information EngineerRing in Europe- DISSemination - Dates: 01-01-2005/31-12-2005(12 months); Type: Network; Role: Partner; Sponsor: EC; Programme: ERASMUS/; Funding: 0,00€ (0,00€)

8. VET-TREND (A1) (RO/06/B/F/NT175014) - Valorisation of an Experiment-based Training System through a Transnational Educational Network Development - Dates: 01-12-2006/30-11-2008(24 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: Leonardo da Vinci/?; Funding: 289.742,00€ (12.795,50€)

3.1.5. Group A2: Microelectronic, Materials and Processes

Membership

PI – Principal Investigator

- Maria Manuela de Almeida Carvalho Vieira: Manuela Vieira is the head of the group. In 1986 she received the Master of Science in Solid State Physics-Microelectronic and in 1993 the PhD in Semiconductor Materials both from the New University of Lisbon and in 2003 she became Professor with “agregação” in electronics by the New University of Lisbon. She is coordinator professor in Electronics inside the department of Electronics Telecommunication and Computers (ISEL, Portugal), invited associated professor DEEC-UNL and the head of GIAMOS/ M2P groups. She has several scientific papers and 20 years of experience in the field of thin films and devices, her research activities have been mainly related to the development of optical sensors.

Researchers in the Group (PhD, only) within the unit

- Yuriy Vygranenko
- Manuel Martins Barata
- Paula Louro

Other Researchers in the Group (PhD, only) not integrated in the unit

- Alessandro Fantoni
- Manfred Niehus
- Pedro Sanguino

Other Researchers in the Group (non PhD)

- | | |
|--------------------|-------------|
| • António Maçarico | PhD student |
| • João Martins | PhD student |
| • Miguel Fernandes | PhD student |
| • João Campos | PhD student |
| • Vítor Fialho | PhD student |
| • Hugo Silva | PhD student |
| • Carlos Mendes | MSc student |
| • André Balina | MSc student |

Group description

The M²P group (Microelectronic Materials and Processes) has successfully undertaken joint research or development project programs in the field of electronic and computers and development of new technologies, leading to the implementation of their own facilities through GIAMOS/ISEL (Group in Applied Research in Microelectronic Optoelectronic and Sensors/Instituto Superior de Engenharia de Lisboa), where they have running several research projects (national and international), covering the fields of electronic materials, optoelectronic devices, sensors and transducers. The research group integrates nowadays 10 Ph.D. researchers, 6 Ph.D. students and 2 technicians, having available structural, compositional and electro-optical characterization facilities. In the past three years the group produced more than 100 publications in scientific reviews, books and conference communications, besides 2 PhD thesis.

The group is highly specialized in thin films materials analysis and test (structure, composition, static and dynamic electro-optical properties). The scientific responsible, Manuela. Vieira, has

been involved in several national and international projects working in the field of solar cells and optoelectronic devices since 1987, with several scientific, technical and strategic papers published. The following facilities are available: *Deposition facilities*: Laboratories for support of Semiconductor Thin Film Development using the PECVD (Plasma Enhanced Chemical Decomposition) techniques. Laboratories for support of Electronic, Optoelectronic and Microelectronic Device Processing. *Characterization facilities*: UV-VIS-NIR and IR Spectrophotometers (Shimadzu), dark/photo conductivity as a function of temperature; spectral response; Flying Spot Technique-FST; Photothermal Deflection Spectroscopy-PDS; Space Charge Limited Current-SCLC; C(T)/C(V) measurements, Coatings uniformity test-bench, Characterization systems for devices (IV characteristics; annealing test chambers; degradation tests; interface characterization; Electroluminescence) and Solar simulator for small areas. Spectrometers (UV, VIS, NIR, IR) and Optical Characterization Systems (I-V, C-V), Electric Characterization Systems, Material Testing Bench.

In the group the following facilities are available:

Deposition facilities: Laboratories for support of Semiconductor Thin Film Development using the PECVD (Plasma Enhanced Chemical Decomposition) techniques; Laboratories for support of Electronic, Optoelectronic and Microelectronic Device Processing.

Characterization facilities: UV-VIS-NIR and IR Spectrophotometers (Shimadzu), dark/photo conductivity as a function of temperature; spectral response; Flying Spot Technique-FST; Photothermal Deflection Spectroscopy-PDS; Space Charge Limited Current-SCLC; C(T)/C(V) measurements, Coatings uniformity test-bench, Characterization systems for devices (IV characteristics; annealing test chambers; degradation tests; interface characterization; Electroluminescence) and Solar simulator for small areas. Spectrometers (UV, VIS, NIR, IR) and Optical Characterization Systems (I-V, C-V), Electric Characterization Systems, Material Testing Bench.

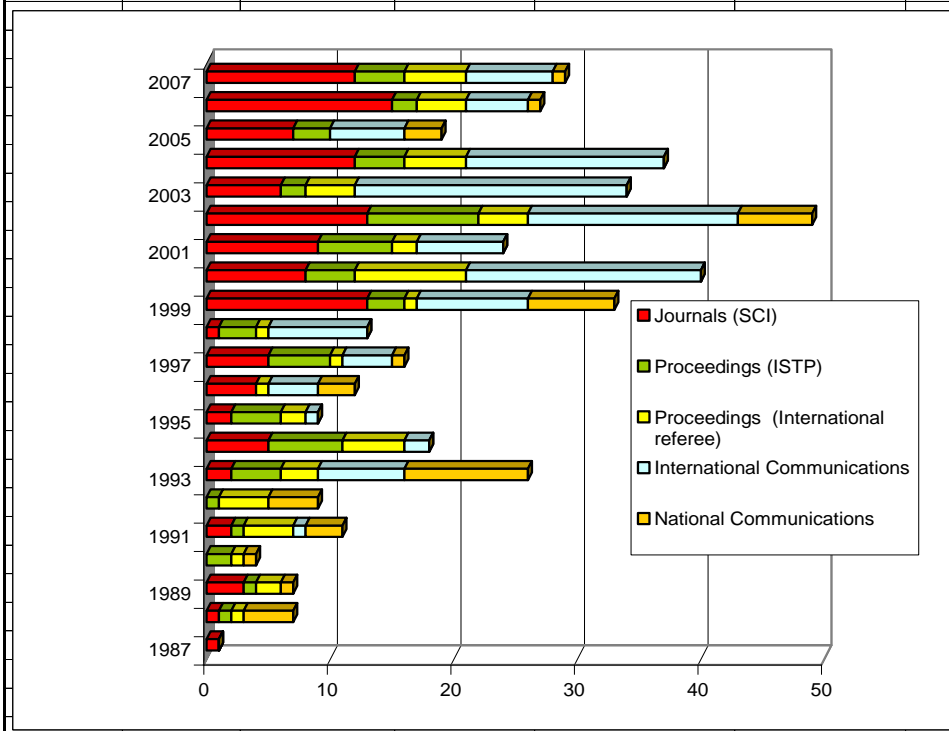
Previous publications in the area

The papers already published that constitute basic work for the above research are:

- M. Vieira, M. Fernandes, J. Martins, P. Louro, R. Schwarz, and M. Schubert, "Laser Scanned *p-i-n* Photodiode (LSP) for image detection" IEEE Sensor Journal, 1, no.2 (August, 2001) pp. 158-167. (IP=1.105; n°C=30)
- M. Vieira, M. Fernandes, P. Louro, R. Schwarz, M. Schubert "Image capture devices based on *p-i-n* silicon carbides for biometrics applications". J. Non Cryst. Solids 299-302 (2002) pp.1245-1249. (IP=1.477, n°C=8).
- V. K.Dugaev, V. I. Litvinov, J. Barnás, and M. Vieira, "Exchange interaction and ferromagnetism in *II-V* semiconductors" Physical Review B 67, 033201 Jan.15 (2003) pp. 1-4. (IP=3.121, n°C=8)
- V. K.Dugaev, Yu. Vygranenko, M. Vieira, V. I. Litvinov, J. Barnás, "Modelling of magnetically controlled *Si*-based optoelectronic devices". Physics E 16/3-4 (2003), pp. 558-562. (IP=2.317, n° C=8)
- M. Fernandes, Yu. Vygranenko, P. Louro, M. Vieira, "Non pixelled amorphous silicon based color sensors". Physics E. 16/3-4 (2003) pp.563-567. (IP=2.317)
- M. Vieira, A. Fantoni, M. Fernandes, P. Louro, G. Lavareda, C.N. Carvalho, "Imaging Applications Using Multispectral Structures and an Optical Readout", Fourth IEEE International Conference on Smart Systems and Devices Hammamet (Tunisia), March 19-22, 2007.in press
- M. Vieira, Y. Vygranenko, M. Fernandes, P. Sanguino, A. Fantoni, P. Louro, R. Schwarz, "Preliminary results on large area X-ray a-SiC:H multilayer detectors with optically

addressed readout" 2007 MRS Spring Meeting, April 9-13, 2007 , San Francisco, CA, USA, in press.

	Journals (SCI)	Proceedings (ISTP)	Proceedings (International referee)	International Communications	National Communications	Total
1987	1	0	0	0	0	1
1988	1	1	1	0	4	7
1989	3	1	2	0	1	7
1990	0	2	1	0	1	4
1991	2	1	4	1	3	11
1992	0	1	4	0	4	9
1993	2	4	3	7	10	26
1994	5	6	5	2	0	18
1995	2	4	2	1	0	9
1996	4	0	1	4	3	12
1997	5	5	1	4	1	16
1998	1	3	1	8	0	13
1999	13	3	1	9	7	33
2000	8	4	9	19	0	40
2001	9	6	2	7	0	24
2002	13	9	4	17	6	49
2003	6	2	4	22	0	34
2004	12	4	5	16	0	37
2005	7	3		6	3	19
2006	15	2	4	5	1	27
2007	12	4	5	7	1	29
Total	121	65	59	135	45	425
p/year	6,05	3,25	2,95	6,75	2,25	21,25



Goals, ongoing and planned projects, strategic development in future

Goals

Objectives To actively participate in research and development; to encourage our researchers to disseminate their research work and to develop international professional contacts in their respective areas of research the infrastructure built within previous or ongoing projects will be used and work and techniques of joint projects will be combined. To reach this goal, a group of experienced and young researchers was formed, covering the areas of materials and devices

processing; materials and devices characterization and optimization, well supported by the physics modelling of the devices and the corresponding software for information extraction, aiming to reach the expected achievements, concerning devices optimization and costs reduction.

The main benefits expected are: to use the acquired know-how, in: *Specialized teaching courses*, concerning the use of deposition processes, techniques, and technical features of the materials and devices; to use the work to be performed, as the basis to form Ph.D. students involved; to train graduate people in the new process technology and to publish scientific papers. *Training activities* will allow future easier integration in the national market of electronic and embedded digital processing techniques. It is planned to generate spin-offs toward the technology transfer. Other research sectors such as: optoelectronic communications and electronics/optics engineering will benefit.

Ambition of the future is to generate cross fertilization with other research lines in CTS, namely microelectronics circuits and systems design (front end), superconductivity devices and optoelectronics for telecommunications. Besides that, extending and ameliorating scientific results on going activities followed by incrementing the number of graduation students. All the activities are aimed to produce state of the art prototypes.

As publication policy, besides to focus in top journals in the microelectronic area, we intend to address good journal in those areas cross fertilization is expected to occur.

Main achievements since 1998 the group developed considerable experience in materials and semiconductors, namely on optoelectronics transducers and macro/micro electronics. The group integrates 11 Ph.D. researchers, 5 Ph.D. students and 2 technicians, having available structural, compositional and electro-optical characterization facilities. The main developments were done in semiconductors materials, optoelectronics, micro electronics and energy conversion. During this period sixteen research projects were successfully accomplished and ten additional ones are presently going on. Six more were submitted to the FCT for funding. Two PhD thesis were developed (one was already submitted, accepted and waiting for examination) and two were accomplished. The publication record refers to 144 articles in journals (SCI or Index to Scientific & Technical Proceedings), 50 publications in peered conferences (Proceedings) and 116 publications in International Congresses (Abstracts) and Seminars and finally 40 in national journals and conferences. The project approval success rate is close to 100% and the projects were rated excellent or very good.

To overcome problems associated with CCDs or with flat-panel arrays we have proposed as a optical transducer a non-pixelled architecture based on a large-area optical signal and image processing device. Several structures are possible, single and stacked, sharing the advantage of not needing special photolithography techniques for patterning or complex design as required by the active matrix approach, resulting in low cost and high reliability devices. By using the existing synergies: patented deposition techniques, development and optimization of thin film sensors together with the experience in the field of hardware and software, several application using this LSP technique were developed, namely: image sensors for biometric applications, image and color sensors and X-ray flat detector system with a level of performance far above the classic film-screen and with the additional capability of real time digital radiography.

Ongoing and planned projects

- LAXOR: *Large area X-Ray Detectors with an optical readout* POCTI/CTM/56078/2004, (2005- 2008) Funding: 80 000€
- OPTAR: *Non linear optical effects in wide band gap semiconductors* (2003-2006)POCTI/FAT/48822/2002 (2003-2008); Funding: 108 000€

- MSiC2: *Detetores de partículas e de perfil de feixe baseados no a-SiC-H* POCI/FP/50352/2003 (2005- 2008); Funding: 20 000€
- SICAL: *Deposição cíclica por CVD de filmes finos com ligas de Si e CPOCTI/CTM/41317/2001, (2003 -2007); Funding: 102 012€*
- SPIN: *Manipulation of spin and charge currents in magnetic nanostructures* POCTI/FIS/58746/2004, (2005 – 2008); Funding: 80 000€
- Biosensor *Desenvolvimento de um biosensor baseado no sistema de ISFET para doseamento de amidas tóxicas* PTDC/AGRAAM/73460/2006 Funding: 94300€
- PTDCFIS/70843/2003 *Transporte Electrónico e dinâmica magnética em sistemas magnéticos de baixa dimensionalidade e em nano-estruturas*; Funding: 109188€
- PTD/ENR/67616/2006-“*SDS silicon ribbons: a new path to low cost photovoltaic*”, Funding: 144000€
- CLSP: *Sensores de cor e de imagem com endereçamento e leitura óptica* IPL/5847/2004, (2006 – 2008); Funding: 21885€
- DRX2D, *Detector digital de raios X para radiografia digital* (2006 -2008); Funding: 42435€

They were submitted to FCT and are waiting for funding the following projects:

- PTDC/CTM/65902/2006: “Dual functional miniature metal thin film sensor for high temperature applications” (requested funding: 189900€)
- PTDC/CTM/70575/2006-“Optimized broad band highly bias sensitive unipolar nanocrystalline/nanostructured silicon based color detectors” (requested funding: 186900€)

Strategic development in future

Objectives Continuation of research on new image sensors including acquisition and processing, new optoelectronic devices, UV and IV detectors and colour sensors. We are particularly interested in exploring structural analysis and electrical and optical characterization. Design will follow an optimization strategy and stability, linearity, sensibility responsivity and signal to noise ratio will be tested and evaluated. Additionally we are involved in numerical and electrical modelling and simulation, mainly for p-n-i materials or systems either simple or piled up.

New ideas: Besides cross fertilization with the already mentioned areas new ideas can be summarized as follows:

-For *low-level light detection* applications a-Si:H/a-SiC:H heterojunction *n-i-p* photodiodes will be developed. A significant reduction of the leakage current down to ~ 10 pA/cm² will be achieved due to deposition device-quality materials, tailoring of defects at the *i-p* interface, passivation of the junction walls, and implementation of an novel front electrode consisted of a semi-transparent Cr film and a-SiN_x antireflection coating. Quantum efficiency up to 52% will be achieved for the optimized device.

X-ray flat detector system: The challenge to the medical imaging equipment industry is to combine the various components for image acquisition and image display into integral concepts that provide the user with the clinical information at the most favorable costs. It is proposed to design an X-ray flat detector system with a level of performance far above the classic film-screen and with the additional capability of real time digital radiography. Furthermore, high frame rate at very low dose for fluoroscopy are addressed. To overcome problems associated with CCDs or with flat-panel arrays we propose as an optical transducer a non-pixelled architecture based on a large-area optical signal and image processing device.

New image multi layer colour sensors with larger areas and improved efficiency, sensitivity and linearity; high speed silicon optical sensors (epitaxial growth); multi-layered positioning sensors; thin film and new devices produced either by thermal vaporization either by PECVD. Packaged

with the sensor are peripheral electronics, embedded programmed microcontrollers to provide system control, simplified communication to PCs and other devices; and a calibration of the sensor transfer curve with a digitally programmable calibration.

Biomedical applications are another research domain of interest for these type of devices, namely on x-ray digital radiography and on DNA labeling (using UV sensors).

Also *new devices* still need better models and adequate numerical and numerical simulation. New electronic devices based on nanotubes and transparent materials will need for further exploitation better electrical models.

As *transversal areas*, current suppressers and electrical machinery supported by superconductive materials opens a new set of possibilities.

Training of young researchers and students

Training: Along the development of the different projects, spin-offs for technology transfer were created. Training activities of the future Electronic and Communications engineers will allow young students to acquire knowledge and experience needed for future national and local industry integration.

For supporting other activities than research and technology transfer, proper receipts and documentation will be produced to disseminate the obtained results in the form of training activities, papers and presentations in conferences and specific oriented workshops. Internal workshops will be organized for result dissemination in the academic population. Patent are foreseen.

Funding: As can be observed we do need more financing for personnel and equipment, particularly for the research related with superconductor at low temperature, and new devices .We will keep doing our best efforts to find new sources of financing, however. The knowledge required cover distinct areas justifying the scientific employment of three doctors. Requirements for the positions are an excellent academic or industrial track record with at least three years of post-doctoral work and a keen interest to solid thin film technology. Seeking for an enthusiastic and well-motivated, preferably young scientist. The position may suit an experimentalist with a good knowledge of experimental systems and techniques used in solid thin film technology, and a good understanding of physics of the semiconductor devices. Candidates with a good background in electronics and vacuum equipment are desirably.

Organizations of workshops, colloquia, periodic seminars

Member of the scientific/advisory committee:

- CCTE2002, Conferência Científica e Tecnológica em Engenharia, ISEL, Lisboa, (May, 6-10, 2002).
- 2nd a-SiNet workshop on thin silicon, (Lisboa, Portugal, February 19-21, 2003).
- Eurosensors XVII-The 17th European Conference on Solid-State Transducers, Guimarães, Portugal, September 21 – 24, 2003
- JETC2005, Jornadas em Engenharia de Telecomunicações e Computadores, ISEL, Lisboa, (October, 6-10, 2005).
- “Liquid Crystal Displays” Cytet workshop, Fortaleza, Brasil Outubro, 5-7, 2003.
- 17th European Conference on Solid-State Transducers “Eurosensors XVII”
- “3rd a-SiNet workshop on thin silicon”, Bratislava, Sloven, February 25-27, 2004.
- SBMicro 2004, 19th symposium on microelectronics technology and devices, Porto Galinhas, Brasil, Setembro, 7-9, 2004.
- Ibersensor-2004, 27-29 October, 2004, Puebla, México.

- 11th Euroregional Workshop on Thin Silicon Devices, 2 -4 de February 2005, Delft, Holand.
- ICANS 21, 21st International Conference on Amorphous and Nanocrystalline Silicon, 5 -8 September 2005, Lisbon, Portugal.
- 5th Iberian Vacuum meeting, Univ. Minho, Guimarães, Portugal, Setembro 18-21 de 2005
- 5th IBERSENSOR 27- 29 September, Montevideo, Uruguay, 2006
- MPA-2007, International meeting on developments in materials, processes and applications of nanotechnologies, Belfast, UK, de 14 a 16 de Janeiro de 2007

Member of the organising committee:

- Rede temática IX-2-CYTED “.Microsensores de estado sólido para monitoração do meio ambiente TESEO” (2002-2004).
- Rede temática IX. G-CYTED “Rede de certificação de componentes e sistemas microelectrónicos -PUCARA” (2002-2004).
- CYTED, sub-programa IX2 (Microelectrónica) “Microsensores do estado sólido para o meio ambiente”.
- ICCTI/CNPq. “Desenvolvimento de sistemas de captação e monitoração de imagens” (2002-2005).
- ALFA, Programa de Cooperación Académica entre la Unión Europea y América Latina, Subprograma A: subprogram: Cooperación para la Gestión Institucional. “Enseñanza por Internet: Creación de una biblioteca digital de objetos de aprendizaje interoperables, accesibles y reutilizables, orientados a la formación en las Tecnologías de la Información” (2004-2006).

Interdisciplinary activities

The integration of different technologies, namely optical sensors, wavelength-division multiplexing, X-ray detectors and full digital medical imaging will be a synergetic factor contributing to the improvement of the day-to-day life with advantages in cost (inexpensive transducer fabrication, reduce running costs), easier and faster data transmission, processing and archiving, low voltage/low power, flexibility and distributed intelligence compliant with standards. Many application areas including static and dynamic medical imaging and other applications like non destructive tests or X-ray diffraction, optical communications, photovoltaic energy, color and image sensors, biometric applications are foreseen.

Other research sectors such as: optoelectronic communications and electronics/optics engineering will benefit from the group research.

Additional competence to the national industry in the field of the sensor technologies, electronic packaging, metal inspection electric power production and medical components, will be added.

Interactions wit other national and international research units

Industry contract research

- CQOTiP Project
- Controlo de Qualidade Óptico para Títulos de Portagem Manual-BRISA autoestradas de Portugal

Collaborative publications in international journals:

- V. K. Dugaev, V. I. Litvinov, J. Barnás, A. H. Slobodsky, W. Dobrowolski, and M. Vieira, “*Mechanism of ferromagnetism in diluted magnetic semiconductors at low carrier density*”, J. of Superconductivity: Incorporating novel magnetism, 16, 1 (2003) pp.67-70. Co-authors: Wurzburg University, Germany. Polish Academy of Sciences, Poland.

- M. Niehus, P. Sanguino, R. Schwarz, A. Fedorov, J. M. G. Martinho, M. J. Soares, T. Monteiro, F. Wünsch and M. Kunst, "Non-radiative and radiative properties of PLD-deposited polycrystalline GaN studied by UV ps-to-ns laser pulses", *Journal of Non-Crystalline Solids*, Volumes 338-340, (2004) pp 460-464. Co-authors: Solar Energy Division, Hahn-Meitner-Institut, Berlin, Germany.
- P. Louro, M. Vieira, M. Fernandes, M. Schubert "p-i-n flexible imaging devices with optical readout" *Sensor and Actuators A: Physical*, 120 (2005) pp.1069-1073. Co-authors: Stuttgart University, Germany.
- A. H. Slobodsky, V. K. Dugaev, M. Vieira "Ferromagnetic ordering in diluted magnetic semiconductors" *Condensed Matter Physics*, 5, 3 (31) (2002) pp.531-540. Co-authors: Wurzburg University, Germany. Co-authors: Institute of Semiconductor Physics, Ukrainian Academy of Science, Kiev, Ukraine. Co-authors: Institute of Physics, Polish Academy of Sciences, Warszawa, Poland.
- V.K. Dugaev, J. Berakdar, J. Barnaś, W. Dobrowolski, V.F. Mitin and M. Vieira, "Magnetoresistance due to domain walls in semiconducting magnetic nanostructures" *Materials Science and Engineering: C*, Volume 25, Issues 5-8, December 2005, pp. 705-709. Co-authors: Department of Physics, Adam Mickiewicz University, Poland, Institute of Molecular Physics, Polish Academy of Sciences, Poland.
- Yu. Vygranenko, P. Louro, M. Vieira, J.H. Chang and A. Nathan, "Low leakage current a-Si:H/a-SiC:H n-i-p photodiode with Cr/a-SiNx front contact" *Journal of Non-Crystalline Solids*, 352, 2006, 1837-1840. Co-authors: Giga to Nano Electronics Group, Univ. Waterloo, Canada
- V. K.Dugaev, Yu. Vygranenko, M. Vieira, V. I. Litvinov, J. Barnás, "Modelling of magnetically controlled Si-based optoelectronic devices". *Physics E* 16/3-4 (2003), pp. 558-562. Co-authors: Department of Electrical and Computer Engineering, University of Waterloo, Waterloo, Ont., Canada, WaveBand Corporation, California, USA.

Knowledge and technology transfer

In the past the following prototypes were designed, produced and tested and major achievements were published abundantly in relevant international journals:

Voltage Controlled Spectral Response in a-SiC:H p-i-n Photodiodes

Heterostructures based on p-i-n a-SiC:H were analyzed under different optical and electrical bias conditions.

Considerations about band misalignment, modified electrical field profiles and drift-diffusion transport mechanism were used to explain the atypical shapes of the light J-V characteristics, the enhanced ratio between the spectral responsivity in dark and under optical bias conditions and fine tune of the spectral sensitivity under high forward bias.

A Laser Scanned p-i-n Photodiode (LSP) for Image Detection

A new two terminal colour and image sensor was developed based on the LSP.

By carefully adjusting the electrical bias or the scanner wavelength it was possible to suppress the ac component of the photocurrent at each primary color. The high light to dark sensitivity presented by the structure under short circuit leads to a monochrome image while its forward voltage-dependent spectral sensitivity allows sequential color detection. Combining the information a full color image is obtained. The scanning technique for image acquisition was improved to reach a resolution of 5 lines/mm, a scan time of 3 s, spot size of <200 μm , signal-to-noise ratio >30 dB. Spatial resolution, modulation frequency, quantum efficiency and image lag will be also analyzed.

Tandem photocells for image sensing application

A wavelength-optimized image sensor was developed. A trade-off between sensor configuration and readout parameters (light pattern and scanner wavelength) was established in order to improve the resolution, colour rejection and the contrast of the image. Optical and carrier confinement was achieved. A B/W image was acquired under short circuit condition with improved resolution when compared with the single structure. Readout of 1000 lines per second was achieved allowing continuous and fast image sensing without the need of pixel patterning.

Biometric system based on one single large area a-SiC:H p-i-n photodiode

Based on the LSP we have presented an optical fingerprint reader for biometric authentication, where the capture device configuration and the scanning reader were optimized for this specific purpose.

Data reveals that the performance of the capture device is enhanced by a tight control of image brightness and applied electrical bias. A trade-off between flux range and image responsivity is required for a correct image reconstruction.

Basic image processing algorithms were applied for image enhancement and pattern recognition. Modules for brightness calibration and edge enhancement are still needed to improve the biometric system.

Stacked pinip structures with voltage-selectable spectral response

We investigate the use of a stacked p-i-n-i-p structure based on amorphous silicon as image sensing device. This multilayered device is composed by two stacked p-i-n-i-p structures produced by PE-CVD on a glass substrate and sandwiched between two transparent electric contacts, with a Molybdenum grid in between. The image is acquired through an optical readout technique. One of the p-i-n-i-p structures works as a sensing element where the optical image is projected, and the other one works as a reading structure. The grid is used for optical decoupling of both sensing and reading structures.

The single p-i-n-i-p structure exhibits a spectral response dependent on the applied voltage, which is reflected in the stacked device. This voltage controllable spectral sensitivity results enables the device to be sensitive to the wavelength of the incident light, and allows the detection of colour images. The effect of the applied voltage on the colour selectivity is supported by a physical model.

Multispectral tandem heterojunctions for image sensing application: A SPICE simulation

A SPICE model of a-SiC:H/a-Si:H p-i-n/p-i-n and a p-i-n/n-i-p image detectors with voltage controlled spectral sensitivity was developed. The equivalent electric circuit is composed of two series connected diodes, representing the p-i-n structures, with two nonlinear current sources in parallel, representing the photogeneration. Electrical simulations were performed for pinpin and pinip transducer configurations under different illumination conditions, and compared with the experimental data. The influence of the device configuration on the voltage controlled spectral sensitivity is analysed. A physical model supported by the electrical simulation gives insight into the methodology used for image representation and colour discrimination.

a-Si based p-i-n photodiodes with Cr/SiNx electrodes

a-Si:H/a-SiC:H heterojunction n-i-p photodiodes have been developed for low-level light detection applications. A significant reduction of the leakage current down to ~ 10 pA/cm² have been achieved due to deposition device-quality materials, tailoring of defects at the i-p interface, passivation of the junction walls, and implementation of a novel front electrode consisted of a semi-transparent Cr film and a-SiN_x antireflection coating. It is found that a new electrode induces lower leakage than transparent conductive oxide (TCO) films, which can

cause a degradation of the $p-i$ interface. Quantum efficiency up to 52% is achieved for the optimized device.

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
e) Periodical - International	6	12	7	14	39
g) Conference Paper (Refereed)	17	14	11	8	50
Grand Total	23	26	18	22	89

Table 23 – Publications by Year of Group A2

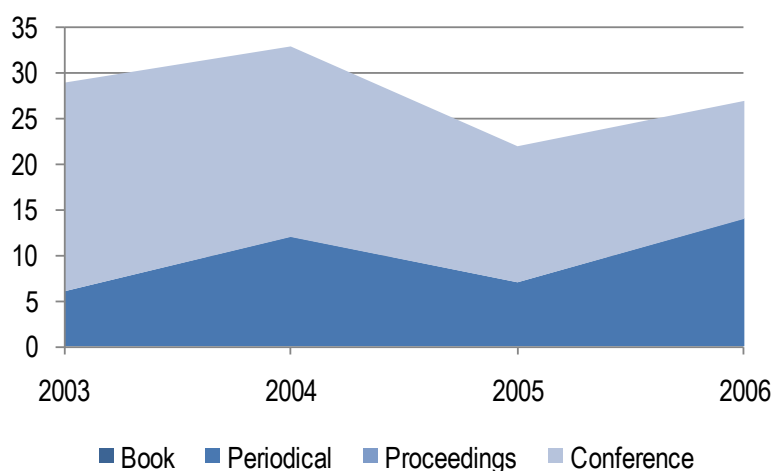


Figure 26 – Evolution of Publications by Year of Group A2

Count of publication	WoS		
Type Table	No	Yes	Grand Total
e) Periodical - International	3	36	39
g) Conference Paper (Refereed)	33	17	50
Grand Total	36	53	89

Table 24 – Publications of A2 at ISI Web of Knowledge Indexing Service

Papers in International Scientific Periodicals with Referees

1. Vieira, Manuela and Fantoni, A. and Louro, P. and Fernandes, M. and Martins, J. and Schwarz, R. and Lavareda, G. and Carvalho, C. N.. 2006. [Colour filtering in a-SiC:H based p-i-n-p-i-n cells: A trade-off between bias polarity and absorption regions](#). Sensors and Actuators A: Physical, Vol. 132 (1). pp. 218-223. Indexed at ISI Web of Science.
2. Fantoni, A. and Fernandes, M. and Louro, P. and Carvalho, C. N. and Vieira, Manuela. 2006. [Photocurrent profile in a-SiC:H monolithic tandem photodiode](#). Revista Mexicana de Fisica, Vol. (2 SUPPL.) (52). pp. 89-92. Indexed at ISI Web of Science.
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 49. Vieira, Manuela and Louro, P. and Fernandes, M. and Fantoni, A.. 2003. [Optical confinement in a Double Colour Laser Scanned Photodiode \(D/CLSP\)](#). In: European Materials Research Society Symposium, 10-13, June, 2003, Strasbourg, France.
 50. Vieira, Manuela and Fernandes, M. and Louro, P. and Lavareda, G. and Carvalho, C. N.. 2005. [Image and color sensitive detector based on double p-i-n/p-i-n a-SiC:H photodiode](#). In: Materials Research Society Symposium - Amorphous and Nanocrystalline Silicon Science and Technology — 2005, 28 Mar - 01 Apr 2005, San Francisco (CA), USA. *Indexed at ISI Web of Science*.

Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
i) Thesis - PhD		1	1		2
Grand Total		1	1		2

Table 25 – Theses by Year of Group A2

PhD Theses

1. Niehus, Manfred. 2005. [Disorder related optical properties and electronic transport in gallium nitride](#). PhD thesis, Instituto Superior Técnico/UTL.
2. Sanguino, Pedro. 2004. [Growth of Gallium Nitride with the Cyclic Pulsed Deposition System](#). PhD thesis, Instituto Superior Técnico/UTL.

Projects

1. 708434/2003 (PTDC/FIS/70843/2006) - Electronic transport and magnetic dynamics in low-dimensional magnetic systems and nanostructures - Dates: 00-01-1900/00-01-1900(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: PTDC/FIS; Funding: 109.188,00€ (0,00€)

2. ALFA () - Creación de una biblioteca digital de objetos de aprendizaje interoperables, accesibles y reutilizables, orientados a la formación en las Tecnologías de la Información - Dates: 01-01-2004/31-12-2006(); Type: RTD; Role: Partner; Sponsor: EC; Programme: EuropeAid/Regional Cooperation; Funding: 0,00€ (0,00€)

3. BIOSENSOR (PTDC/AGR-AAM/73460/2006) - Development of a biosensor based on ISFET system for assay of toxic amides - Dates: 00-01-1900/00-01-1900(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: PTDC/AGR-

AAM; Funding: 81.000,00€ (0,00€)

4. CERN2001 (CERN/ESE/43763/2001) - Resistência à radiação de detectores de SiC microcristalinos - Dates: 01-01-2002/31-12-2004(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: CERN/ESE; Funding: 20.000,00€ (0,00€)

5. CLSP (IPL/5847/2004) - Sensores de cor e de imagem com endereçamento e leitura óptica - Dates: 01-01-2006/31-12-2008(); Type: RTD; Role: ; Sponsor: ?; Programme: ?/?; Funding: 0,00€ (0,00€)

6. DRX2D (5822/2004) - Detector digital de raios X para radiografia digital - Dates: 01-01-2006/31-12-2008(); Type: RTD; Role: ; Sponsor: EC; Programme: FP5/?; Funding: 0,00€ (0,00€)

7. DSCMI () - Desenvolvimento de sistemas de captação e monitoração de imagens - Dates: 01-01-2002/31-12-2004(); Type: RTD; Role: Prime Contractor; Sponsor: ICCTI/CNPq; Programme: ?/?; Funding: 0,00€ (0,00€)

8. LAPLAS (POCTI/FAT/42185/2001) - Group III Nitrides Prepared by Cyclic Laser and Plasma Process (LAPLAS) - Dates: 00-01-1900/00-01-1900(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: POCTI/?; Funding: 80.000,00€ (0,00€)

9. LAXOR (POCI/CTM/56078/2004) - Large area X-Ray Detectors with an optical readout - Dates: 01-01-2004/31-12-2007(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POCI/?; Funding: 80.000,00€ (0,00€)

10. mSiC2 (POCTI/FP/FNU/50352/2003) - Detectores de partículas e de perfil de feixe baseados no a-SiC-H - Dates: 01-01-2005/31-12-2008(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: POCTI/?; Funding: 20.000,00€ (0,00€)

11. OPTAR (POCTI/FAT/48822/2002) - Non linear optical effects in wide band gap semiconductors - Dates: 01-01-2003/31-12-2006(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: POCTI/?; Funding: 108.000,00€ (0,00€)

12. PUCARA () - Rede de certificação de componentes e sistemas microelectrónicos - Dates: 01-01-2002/31-12-2004(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: ?/?; Funding: 0,00€ (0,00€)

13. SIMBA (37964) - Sensor Integration for Monitoring Biometric Applications - Dates: 01-01-2002/31-12-2005(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: ?/?; Funding: 71.000,00€ (18.233,00€)

14. SDS (PTD/ENR/67616/2006) - SDS silicon ribbons: a new path to low cost photovoltaics - Dates: 00-01-1900/00-01-1900(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: PTDC/?; Funding: 140.000,00€ (0,00€)

15. SICAL (POCTI/CTM/41317/2001) - Cyclic CVD of Thin Films of Si and C Alloys - Dates: 01-01-2003/31-12-2007(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POCTI/?; Funding: 102.012,00€ (0,00€)

16. SPIN (POCTI/FIS/58746/2004) - Manipulation of spin and charge currents in magnetic nanostructures - Dates: 01-01-2005/31-12-2008(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: POCI/?; Funding: 80.000,00€ (0,00€)

17. SUPERMACHINES (HPRN-CT-2000-00036) - Advanced rotating electrical machines exploiting high temperature superconducting components - Dates: 01-08-2000/31-07-2004(48 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: ?/?; Funding: 0,00€ (0,00€)

18. TIMOC (D/97/2/0648/PI/II.1.1c/FPI) - Time Modulated CVD Process for Preparation of Advanced Thin Film Materials - Dates: 00-01-1900/00-01-1900(); Type: RTD; Role: Prime Contractor; Sponsor: EC; Programme: INCO-COPERNICUS; Funding: 0,00€ (0,00€)

3.1.6. Hosted Activity A2.1: Superconducting Machines

Membership

PhD Members

- Amadeu Leão Rodrigues (Senior PhD)
- Mário Ventim Neves
- Armando Marques Pires

PhD Students

- Anabela Monteiro Gonçalves
- João Murta Pina
- Pedro Miguel Pereira
- Stan Valtchev

Research Activity

The Group core activities are focused on research and development of power systems employing High Temperature Superconducting (HTS) materials. HTS can be used in devices such as reluctance, hysteresis and linear motors, synchronous generators, current limiters and power transformers. Taking into account the special electromagnetic properties of HTS materials, novel design of these power devices, is the main activity of the Group.

Other tasks are also carried out by the Group's researchers, some imposed by the extreme temperatures related with HTS operation. Amongst these, highlights the study of ferromagnetic materials and power electronics in cryogenic environments.

The design of novel machines, not necessarily superconducting, but innovative in their design, control or materials employed, is also a parallel research theme of the Group.

Summing up, the Group's research activities, mainly supported in high temperature superconductivity, are clearly transversal to Electrical Engineering, and even multidisciplinary, for which a strong emphasis is put on the synergies created by the different researchers' fields of expertise. Amongst these can be clearly identified applied superconductivity, electrical machines and drives, simulation of electromagnetic systems, power electronics and materials engineering.

Brief description of superconductivity

Heike Kammerlingh Onnes, of Leiden University, Netherlands, discovered superconductivity in 1911, when mercury was cooled down to 4.2 K. Although this and other materials exhibiting superconductivity in the following decades - the so called type-I superconductors - showed in fact a peculiar behaviour (zero resistivity and perfect diamagnetism), their use was rather limited. This was mostly (but not only) due to the high cost related with cooling. However it wasn't until 1986 when Bednorz and Müller discovered superconductivity at 30 K in a ceramic material that this phenomenon started to have real potential in electrical engineering applications. This discovery was particularly significant, since ceramic are natural insulators and not a natural candidate to superconductor. This breakthrough triggered a fast discovery of new superconductors in these cuprate compounds, and a consequent increase in their critical temperature, T_C , surpassing 77 K provided by cheap and easily available liquid nitrogen.

All these HTS, i.e., superconducting materials with $T_C > 77$ K, are type-II superconductors. This means that a mixed state exists, between diamagnetism (or Meissner state) and normal state, where they present both superconducting and normal regions.

The commercial $\text{YBa}_2\text{Cu}_3\text{O}_x$ (or YBCO or Y-123) is a ceramic HTS that can be produced in various shapes, such as discs, rectangular blocks or rings as shown in the figures. However, due to their ceramic nature this material is very brittle and hard to produce in relatively large dimensions (e. g., single domains can only be growth up to a diameter less than 100 mm).



Figure 27 - Ceramic YBCO crystalline structure and the various shapes

Another commercial HTS material is the bismuth based compounds, BaSrCaCuO or BSCCO, in phase 2212 ($\text{Ba}_2\text{Sr}_2\text{CaCu}_2\text{O}_x$ or Bi-1112) or in phase 2223 ($\text{Ba}_2\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_x$ or Bi-2223). These are produced in bulk or wire form. In the latter, BSCCO filaments are embedded in a silver matrix, forming a tape, in order to provide not only higher mechanical flexibility but also electrical and thermal stability. BSCCO tape is called first generation HTS wire. These materials are shown in figure below.

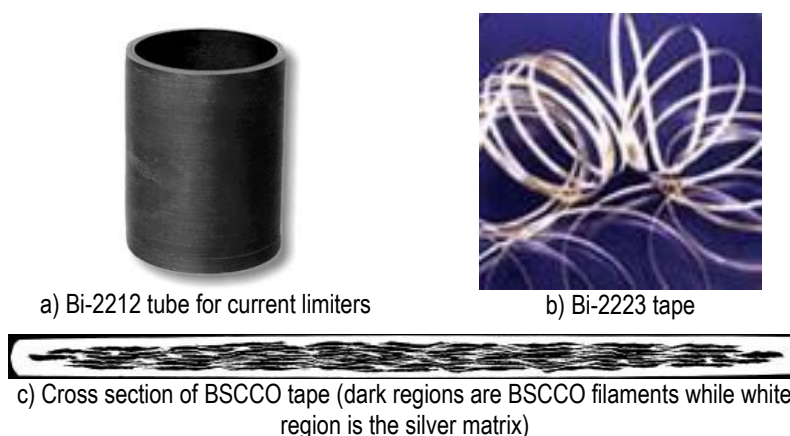
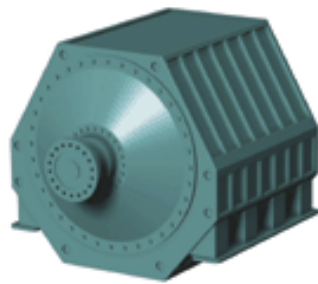


Figure 28 - BSCCO in bulk and wire forms

The progress in HTS materials gave a strong impulse for elaborating new layouts of HTS machines. These materials are potentially suited to applications where weight and size are very crucial. However, due to the strong electromagnetic forces involved in power superconducting devices and the brittle nature of HTS materials, careful and innovative design is needed. Theoretical and experimental researches show that the HTS electrical power devices possess higher values of specific output power, efficiency and power factor compared with conventional electrical devices. Figure shows the expected comparison in size for a conventional and HTS machine of the same power.



a) Conventional motor



b) Superconducting motor

Figure 29 - Conventional and HTS machines for the same power comparison

The most obvious advantage of superconductors is their ability to support high current densities (tens of $\text{kA}\cdot\text{cm}^{-2}$) with minimal losses when compared with conventional conductors. A second advantage, and the property exploited in their use in, e. g., reluctance machines is their ability to repel flux, or to act as flux barriers, due to their diamagnetic properties. Another property, only possible with type-II superconductors, is the mixed state, and related losses, which are in the nature of hysteresis machines operation.

These issues are very important for applications such as space vehicles and wind generators, where weight and volume are to be kept at a minimum.

Research themes within the group

Superconducting reluctance and hysteresis motors

The great disadvantage of the HTS materials in the construction of power devices, as was previously mentioned, is its brittle nature and thus the difficulty to be machined. When using HTS materials in electric motors much care must be taken in the design of the rotors in order to eliminate mechanical stresses in these fragile materials. This is one of the main tasks within the Group.

A – Reluctance motors

It is foreseen that reluctance rotors are one of the best candidates to employ HTS materials in their construction. Different configurations, with consequent different torques, are being designed within the Group.

During the last two decades many different reluctance rotor configurations have been considered in order to improve output power and efficiency of these motors. Recently, a number of international research groups, including the Supermachines Group, have explored the possibility of using HTS materials in the construction of electrical machines and in the particular of reluctance motors in order to increase their specific output power. In this way, smaller and lighter motors can replace their conventional counterparts (although the cooling system should always be considered).

As an example, the next figure shows the design of a HTS reluctance motor or “zebra” type motor. It consists of iron segments placed in alternating order with slices of YBCO or BSCCO elements. A strong and balanced rotor is then obtained.

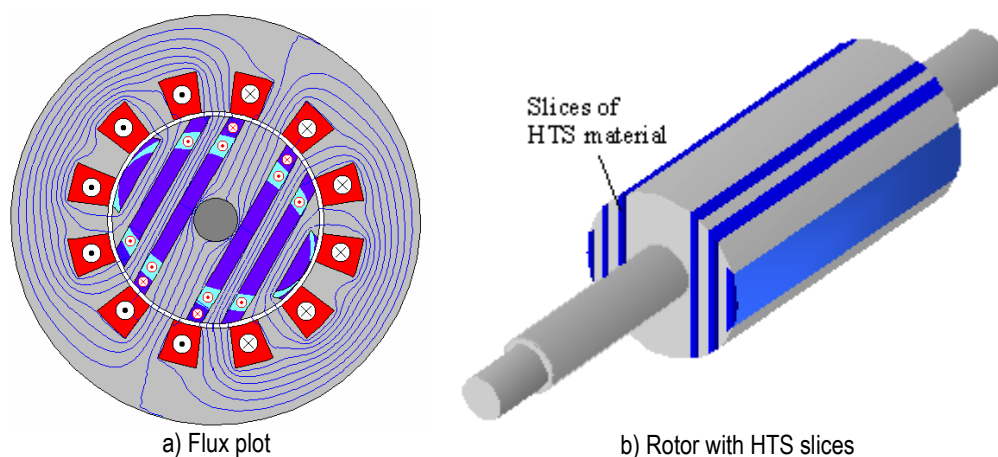


Figure 30 - "Zebra" type reluctance motor

Other reluctance motor designs have been proposed. The researchers experience with design and modelling of conventional electric motors and materials is fundamental to extend this field to superconducting machines, a subject where there is still few published work.

B – Hysteresis motor

Hysteresis motor [6] may be classified as a self starting special synchronous machine. The stator of a hysteresis motor may be single-phase or polyphase, as long as it produces a rotating magnetic field with a synchronous speed $N_s = f / p$, where f is the frequency of the applied voltage and p is the number of pole pairs. A conventional two-pole hysteresis motor layout is shown in the figure below. Replacing the magnetic ring by YBCO, as shown in same figure, a HTS hysteresis motor is obtained. The optimum magnetic hysteresis ring width was found to be 1/10 of rotor diameter.

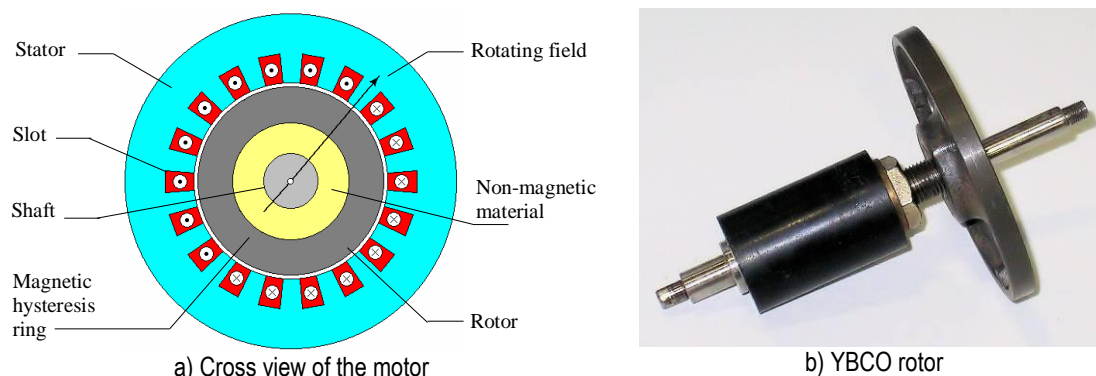


Figure 31 - hysteresis motor topology

In spite of the brittle nature of the HTS material the rotor layout proposed is mechanically very strong due to its special design.

HTS hysteresis motors are typically constructed in fractional horsepower sizes. Although they exhibit low torque/volume, low efficiency and poor power factor in comparison to conventional induction motors, the acceleration torque is essentially constant during starting. For fixed frequencies the hysteresis motor is a constant speed machine. These characteristics make this device very useful in several applications such as ac clock motors, tape drives, inertial navigation, phonograph turntables and other precision equipments. Publications on this type of motors are in references [7,8,9,10,11].

[6] A L Rodrigues, "Teoria e Cálculo do Motor de Histerese", *Electricidade*, nº 388, May-June 2001.

[7] A Gonçalves, M Ventim Neves, A L Rodrigues, "Hysteresis loop measurements at low temperatures", Internal report of the Supermachines project (www.supermachines.org), 2003.

A recently developed control system (whose patent is still pending) is being developed by the Group [12,13,14], see the following figure. The motor is of axial flux type and the control system is based on electronic pole changing. It has 24 windings, two semi-stators and an YBCO plate as rotor, for it behaves as a hysteresis disc motor.

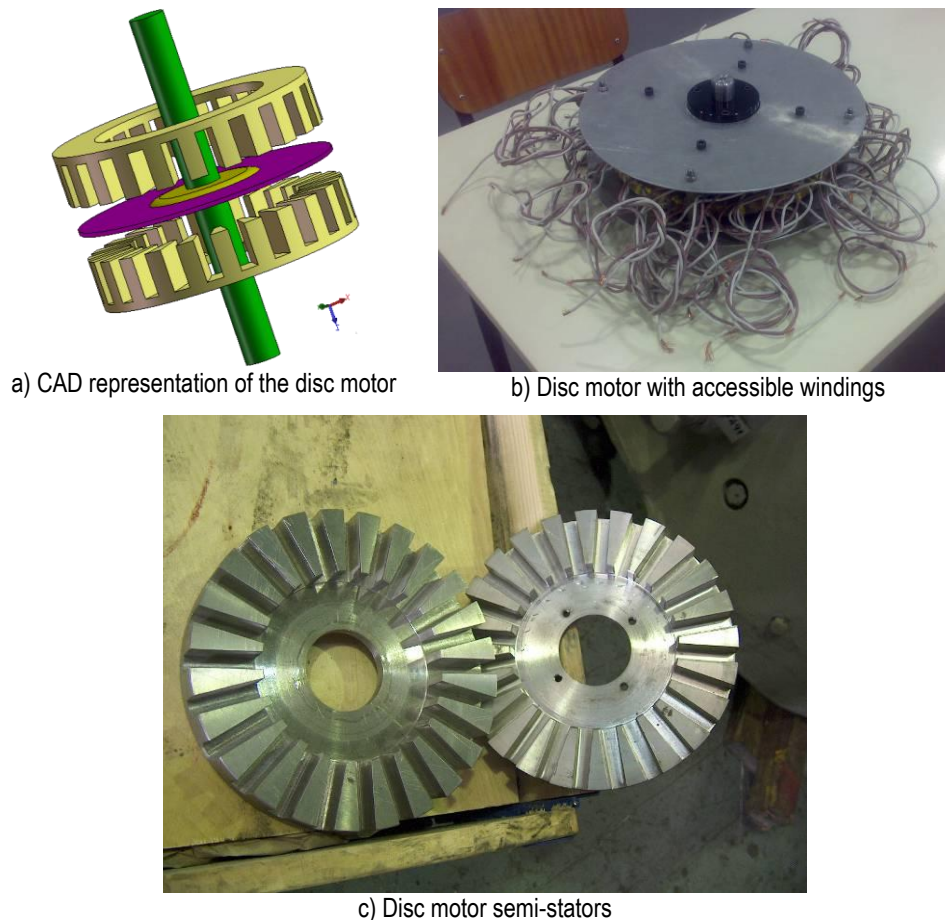


Figure 32 - YBCO Hysteresis disc motor

Superconducting synchronous generators

The following figure shows a cross section of a HTS synchronous machine, including the cryostat system, with a rated output power of 780 kW. The volume aspect ratio of this machine compared with a conventional one of the same characteristics is about six times less, giving to this design a near future application in aerospace and wind generators industry.

[8] A L Rodrigues, "Hysteresis motor with conventional and superconductor rotors", Proceedings of the International Conference on Electrical Machines (ICEM'2000), Helsinki, Finland, August 2000.

[9] A Sfetsos, J M Pina, A Gonçalves, M Ventim Neves, M D McCulloch, A L Rodrigues, "Flux Plot Modelling of Superconducting Hysteresis Machines", Internal report of the Supermachines project (<http://www.supermachines.org>), 2003.

[10] J M Pina, A Gonçalves, M Ventim Neves, A L Rodrigues, "High Temperature Superconductor Materials and their Applications in Electric Motors", Internal report of the Supermachines project (<http://www.supermachines.org>), 2003.

[11] S Inácio, D Inácio, J M Pina, A Gonçalves, M Ventim Neves, L Rodrigues, "Numerical and experimental comparison of electromechanical properties and efficiency of HTS and ferromagnetic hysteresis motors", Presented at the 8th European Conference on Applied Superconductivity (EUCAS), Brussels, Belgium, September 2007.

[12] S Inácio, "An Electrical Gearbox by Means of Pole Variation for Induction and Superconducting Disc Motors", presented at the Students Forum Dialogue Session, held in conjunction with the 2007 IEEE International Symposium on Industrial Electronics – ISI 2007, Vigo, Spain, June 2007 - Awarded best paper presented.

[13] S Inácio, J M, Pina, S Valtchev, M Ventim Neves, A L Rodrigues, "Topology of an Electrical Gearbox with Variable Poles for Induction and Superconducting Disc Motors", Proceedings of the 10th Portuguese-Spanish Conference on Electrical Engineering (XCLEEE), Madeira Island, Portugal, July 2007.

[14] S Inácio, D Inácio, J M Pina, S Valtchev, M Ventim Neves, L Rodrigues, "An Electrical Gearbox by means of pole variation for induction and superconducting disc motor", Presented at 8th European Conference on Applied Superconductivity (EUCAS), Brussels, Belgium, September 2007.

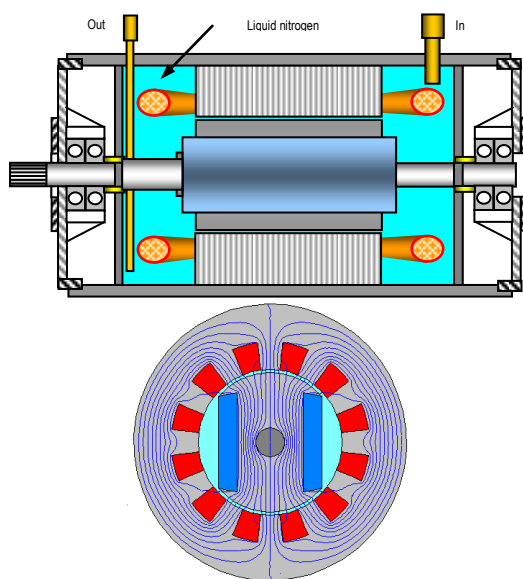


Figure 33 - HTS synchronous machine

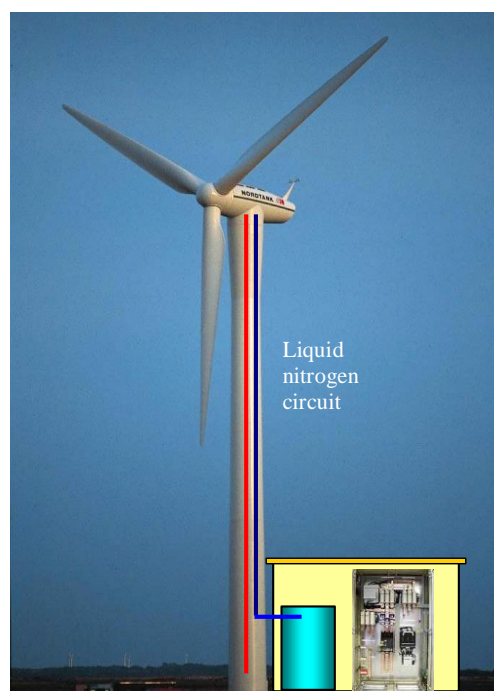


Figure 34 - HTS wind generator

One of the possible applications of these machines is in wind generators [15,16]. To decrease the motor weight in top of the tower, liquid nitrogen for motor cooling is proposed to be installed in the ground, as illustrated in above figures. A final year project has been developed within group [17].

Superconducting synchronous linear motor

The high diamagnetism observed in HTS materials lead to applications involving levitation such as the linear synchronous motor (LSM). An all superconducting motor (without copper or iron elements), as the one represented in figures bellow, with BSCCO tapes in the armature and trapped-flux YBCO in the moving part, is being developed in the group.

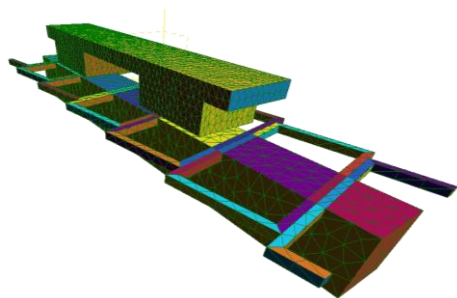


Figure 35 - HTS linear synchronous motor

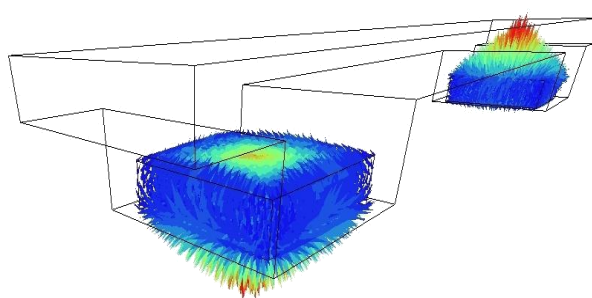


Figure 36 - Trapped-field YBCO in LSM moving part.

Certain features taken into account in conventional LSM design cannot be applied in the HTS case, due to these materials characteristics, such as BSCCO stiffness, when used as armature windings, see figure bellow. The magnetomotive force time and space spectrum for the referred armature is represented in the figure bellow.

[15] M Caserza Magro, M Ventim Neves, A Sfetsos, "Multipole Superconducting Synchronous Generator", Proceedings of the 6th European Conference on Applied Superconductivity EUCAS, Sorrento, Italy, September 2003.

[16] A L Rodrigues, "Aerogerador Eólico Supercondutor", National Conference ENER'04, Figueira da Foz, Portugal, May 2004.

[17] F Cruz, J Santos, N Martins, Dimensionamento de um sistema de conversão eólico com geradores supercondutores, final thesis project, Faculty of Science and Technology, Lisbon, Portugal, 2004.

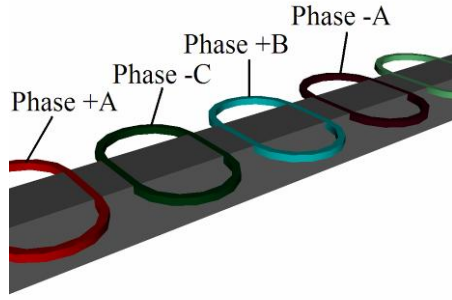


Figure 37 - Armature topologies

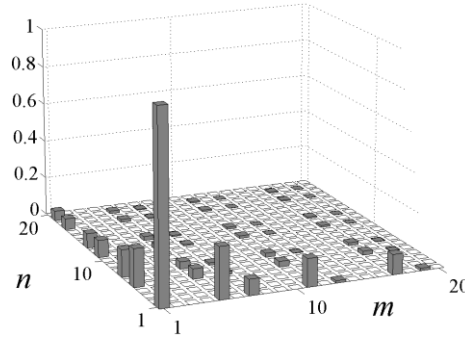


Figure 38 - Magnetomotive force spectrum

These and other aspects such as the field profile in the YBCO pellets (bellow), the thrust and lift forces (plotted in the following figure) or the effect of motor control through an inverter were examined and presented in [18, 19, 20], where the analytical and numerical methodologies involved in the design optimisation of the LSM are described.

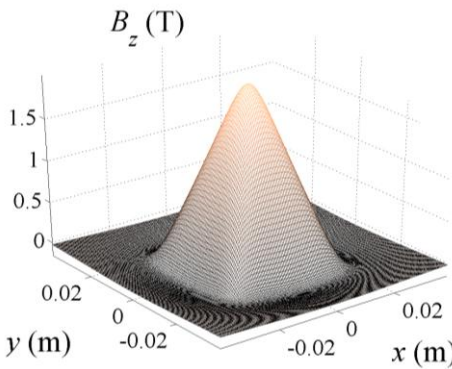
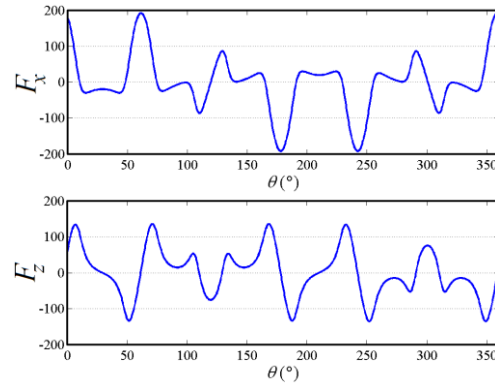
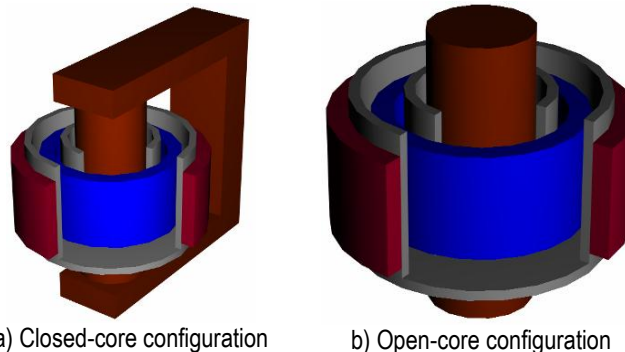


Figure 39 - Trapped field components in YBCO pellet


Figure 40 - Thrust (F_x) and lift (F_z) force in LSM

Superconducting current limiters

Superconducting current limiters are commonly accepted as the most promising applications of HTS in power systems, replacing switch breakers in medium voltage grids. There are several topologies, classified according to the way in which the HTS element is connected to the power line. The main topologies are then resistive (series connected), inductive (magnetically connected) and rectifier (connected through a rectifier bridge). In their inductive form, they can be designed with a closed or open magnetic core, as shown in next figure.



a) Closed-core configuration

b) Open-core configuration

Figure 41 - Inductive HTS fault current limiter (in blue: HTS tube; in red: primary winding)

[18] J M Pina, M V Neves, M D McCulloch, A L Rodrigues, "Design of a linear synchronous motor with high temperature superconductor materials in the armature and in the field excitation system", Journal of Physics: Conference Series, 43, pp. 804-808 2006.

[19] J Pina, M Ventim Neves, A Rodrigues, "Case Study in the Design of HTS Machines: an All Superconducting Linear Synchronous Motor", Proc. of the 1st International Conference on Power Engineering, Energy and Electrical Drives (POWERENG), Setúbal, Portugal, April 2007.

[20] J Pina, P Pereira, S Valtchev, A Gonçalves, M Ventim Neves, A L Rodrigues, "A test rig for thrust force measurements for an all HTS linear synchronous motor", Presented at the 8th European Conference on Applied Superconductivity (EUCAS), Brussels, Belgium, September 2007.

In normal grid operation the HTS ring acts as a short circuit secondary coil, shielding the iron core from the primary flux. The transformer has nearly zero impedance and the current flows freely. When a fault occurs the HTS ring loses superconductivity and the transformer impedance increases, since flux penetrates iron, then limiting the current in the power line. These distinct operation modes are represented in figure. Although the closed-core topology has better limiting performance, the open-core topology allows an easier replacement of the superconducting tube.

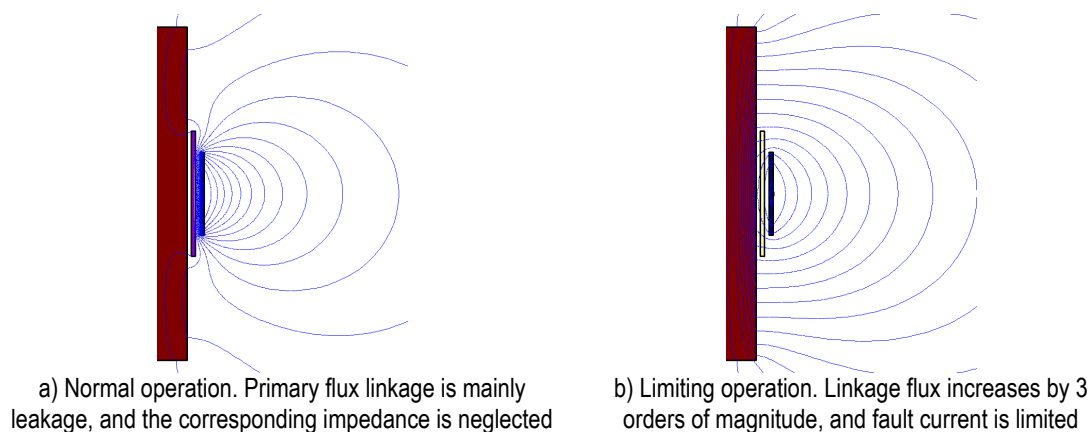


Figure 42 - Operation of an inductive HTS fault current limiter

Single and three phase current limiters of inductive, rectifier and hybrid topologies are being developed within the Group.

Superconducting power transformers

In order to decrease losses and weight in power transformers, HTS windings are proposed to replace the traditional copper windings in power transformers. However, since conventional transformers are already highly efficient, the environmental friendliness of these HTS devices (they are oil free) is usually pointed out as one of the most interesting improvements. Research in the Group has also shown that magnetic core losses increase when temperature decreases, for which the core should be maintained in the “hot” region and the windings in the “cold” one, which increases design complexity. Figure shows the experimental apparatus for measuring hysteresis loop of the ferromagnetic transformer core, at room and cryogenic temperature. The results are displayed showing that at room temperature the hysteresis losses are 40 kW/m³ and at 77 K are 43 kW/m³. Therefore in a crystalline iron core, at 77 K, the hysteresis losses increase approximately 10%. This is a rather original result still under research by the Group [21].

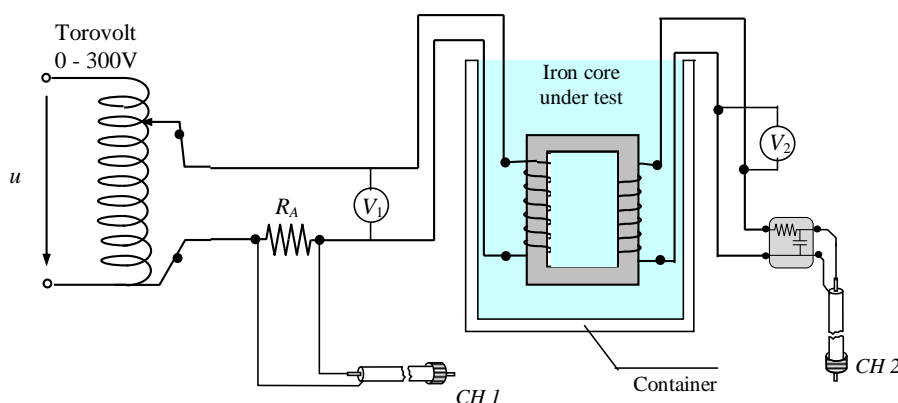


Figure 43 - Experimental apparatus for measuring hysteresis loop

[21] A Gonçalves, M Ventim Neves, A L Rodrigues, “Hysteresis loop measurements at low temperatures”, Internal report of the Supermachines project (www.supermachines.org), 2003.



Figure 44 - Experimental transformer with crystalline iron core

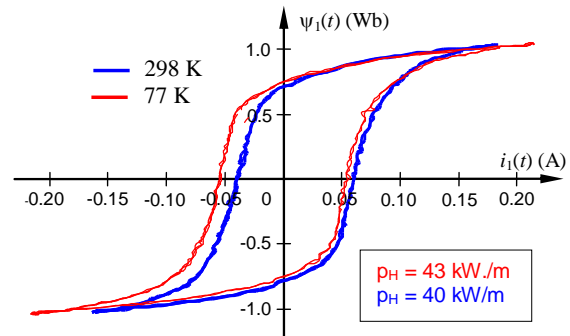


Figure 45 - Comparison of hysteresis loops at room and liquid nitrogen temperature

Therefore, a special transformer design must be implemented. Figure below shows a proposal of a superconducting three-phase transformer design, where only the coils are immersed in liquid nitrogen in order to minimise core losses and winding losses.

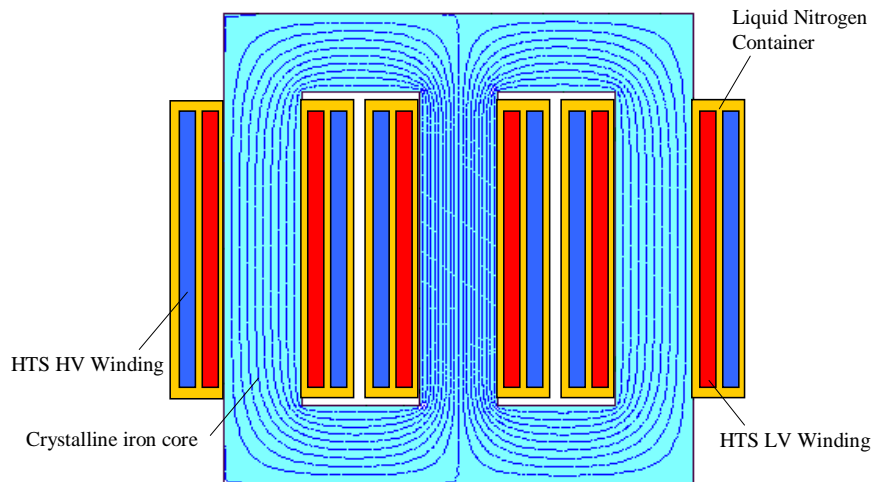


Figure 46 - Design proposal of a superconducting three-phase transformer

Power electronics under cryogenic conditions

Power electronics (PE) plays a major role in conventional and HTS power electrical devices and systems, namely in electromechanical drives, in motor and generator controllers, and in power grids, including high-voltage DC (HVDC) power transmission. PE is also used in devices for the protection against grid disturbances, like voltage sags or power breakdowns.

To cope with these disturbances, back-up energy storage devices are used, like uninterruptible power supplies (UPS) and flywheels. Some of these devices may use superconductivity.

Commercial PE semiconductor devices (power diodes, regular thyristors, gate turn-off thyristors, power MOSFETs, IGBTs, power Darlington transistors, and others) are rarely (or never) experimented for cryogenic temperatures, even when designed for military applications. This means that its integration with HTS power devices is usually done in the hot environment, raising several implementation restrictions. These reasons led to the natural desire of characterising PE under extreme conditions, e. g. at liquid nitrogen temperatures, for use in HTS devices.

Some researchers expect that cryogenic temperatures may increase power electronics' performance when compared with room-temperature operation, namely reducing conduction losses and switching time. Also the overall system efficiency may increase due to improved properties of semiconductor materials at low temperatures, reduced losses, and removal of dissipation elements.

Steady state and dynamic operations of commercial PE semiconductors and devices are currently under investigation at liquid nitrogen and room temperatures. Tests to efficiency and output voltage response to load changes are being carried out at both temperatures and performances in cryogenic and room temperatures are being compared [22]. Results helps to decide which environment should be used for different power HTS applications.

Starting research themes

Microgrids with Integration of Renewable Energies and HTS Technologies

Some research themes which appeared as a natural technical and scientific demand are also being initiated by the Group. This includes the integration of high temperature superconductivity and renewable energies, such as wind or photovoltaic generation, or hydrogen technologies. For that, a DC-AC microgrid, represented in the figure below, is currently under study.

Another subject under research is the use of thin film YBCO (see figure), which is the base for YBCO coated conductors or second generation wires. This technology is agreed to have an enormous potential, as these wires shows higher current densities and less performance degradation under applied magnetic fields than BSCCO tapes.

The microgrid concept and technologies are documented in [23, 24].

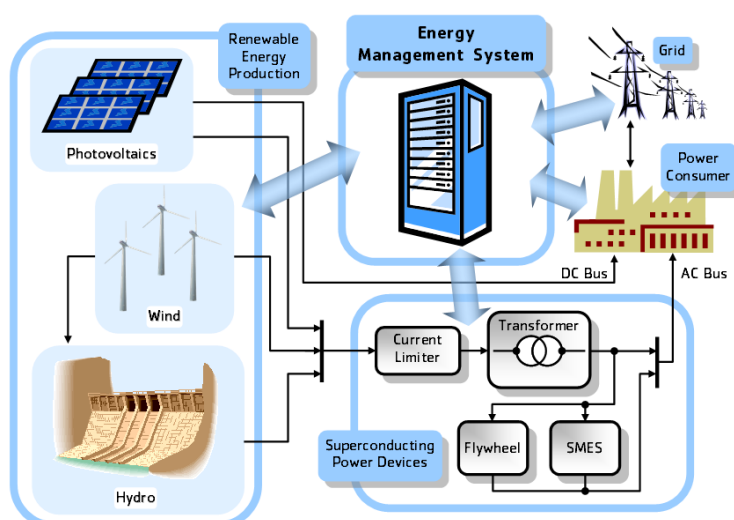


Figure 47 - DC-AC microgrid with integration of HTS and renewable energy sources



a) Bi-spiral thin film YBCO for resistive current limiter



b) YBCO coated conductor

Figure 48 - YBCO deposited conductors

[22] P Pereira, J Pina, A Gonçalves, M Ventim Neves, A L Rodrigues, "Power Electronics Performance in Cryogenic Environment: Evaluation for Use in HTS Power Devices", Presented at the 8th European Conference on Applied Superconductivity (EUCAS), Brussels, Belgium, September 2007.

[23] J M Pina, C Caracaleanu, A Gonçalves, P Pereira, S Valtchev, M Ventim Neves, A L Rodrigues, "New and Renewable Energy Technologies/Hydroelectric Power", Accepted for Presentation at the 12th International Energy Conference and Exhibitio Energex 2007, Singapore, November 2007.

[24] A L Rodrigues, M Ventim Neves, J M Pina, "Pilhas de Combustível como Fonte Limpa de Energia Eléctrica", Proceedings of the 10th Portuguese-Spanish Conference on Electrical Engineering (XCLEEE), Madeira Island, Portugal, July 2007.

Modelling and Control of Electrical Machines and Drives

Electrical machines and drives are widely used in industry and domestic applications. Their development and analysis, including modelling, design and control are issues of great significance, mainly for researchers [25, 26, 27, 28, 29, 30].

In this research theme, the future work (for the next three years) will be divided in two main fields:

1. A field linked with the Switched Reluctance Machine (SRM) eventually employing HTS materials on the stator:
 - One work will be the study and construction of an 8/6 SRM prototype for angular position control without gearbox and position sensor. There are several scientific works evolving the SRM as motor and as generator, however, there are few studies related with the SRM angular position control [31, 32].
 - Another work will focus on the use of the SRM as a generator. Its operation as generator has not been much explored by researchers compared with the motor operation. This work will use the SRM associated to a stand-alone system of renewable electrical energy production with wind turbines [33].
2. A field devoted to the fault diagnosis of electrical drives, particularly using the induction machine and non-invasive techniques. [34, 35, 36, 37, 38, 39].

Collaboration with the Microelectronic, Materials and Processing Group

Microelectronic, Materials and Processing Group joined recently to the centre and has a great expertise in thin films technology. The new generation of superconducting wires is based on this technology, and these devices are named YBCO coated conductors. Supermachines Group is expecting collaboration of the referred Group to cooperate in the characterization of

[25] J F Martins, P J Santos, A J Pires, L E Borges da Silva, R Vilela Mendes, "Entropy Based Choice of Neural Network Drive Model Input Layer", in IEEE Transactions on Industrial Electronics, Vol. 54, nº 1, pp. 110-116, February 2007.

[26] P Lobato, S Rafael, A J Pires, "Obtaining the Flux-Linkage Characteristic of an 8/6 Switched Reluctance Machine: FEM Modelling and Analytical Functions Approach", ISEF 2007 - XIII International Symposium on Electromagnetic Fields in Mechatronics, Electrical and Electronic Engineering, Prague, Czech Republic, September 2007.

[27] P. Lobato, S. Rafael, A. J. Pires, "Magnetic Characteristics Model for an 8/6 Switched Reluctance Machine: Analytical Function Approach from Experimental Tests", in IEEE Region 8 EUROCON 2007 International Conference "Computer as a Tool", pp. 1493-1498 - Warsaw, Poland, September 2007.

[28] B Parreira, S Rafael, A J Pires, P J Costa Branco, "Obtaining the Magnetic Characteristics of an 8/6 Switched Reluctance Machine: from FEM Analysis to the Experimental Tests", IEEE Transactions on Industrial Electronics, Vol. 52, nº 6, pp. 1635-1643, December 2005.

[29] A J Pires, J F Martins, P J Branco, J A Dente, "An Average Values Global Model for the Switched Reluctance Machine", Transactions of IMACS on Mathematics and Computers in Simulation, Special Issue on Modeling and Simulation of Electric Machines, Converters and Systems, Vol. 71, Issues 4-6, pp. 466-475, 2006.

[30] S Rafael, A J Pires, P J Costa Branco, "An On-Line Learning Speed Controller for a Switched Reluctance Machine; Design, Dynamic Problems and Solutions", WSEAS Transactions on Power Systems, Issue 1, Vol. 1, pp. 266-273, January 2006.

[31] Silviano Rafael, P J Costa Branco, A J Pires, "Shaft Position for an 8/6 Switched Reluctance Machine: Theoretical concept, FEM analysis and Experimental results", PEDS'07 - 7th International Conference on Power Electronics and Drive Systems, Bangkok, Thailand, November 2007.

[32] Silviano Rafael, P J Costa Branco, A J Pires, "Study and Analysis of the Switched Reluctance Machine Shaft Position", IEEE-IECON 2007 - 33rd Annual Conference of the IEEE Industrial Electronics Society, Taipei, Taiwan, R.O.C., November 2007.

[33] Pedro Lobato, A Cruz, J Silva, A J Pires, "The Switched Reluctance Generator for Wind Power Conversion", Proceedings da Conferência 9CHLIE - 9th Spanish Portuguese Congress on Electrical Engineering, Marbella, Spain, July 2005.

[34] J F Martins, V F Pires, A J Pires, "On-Line Diagnosis of Three-Phase Closed Loop Induction Motor Drives Using an Eigenvalue $\alpha\beta$ -Vector Approach", PEDS'07 - 7th International Conference on Power Electronics and Drive Systems, Bangkok, Thailand, November 2007.

[35] T G Amaral, V F Pires, J F Martins, A J Pires, M M Crisóstomo, "Image Processing to a Neuro-Fuzzy Classifier for Detection and Diagnosis of Induction Motor Stator Fault", IEEE-IECON 2007 - 33rd Annual Conference of the IEEE Industrial Electronics Society, Taipei, Taiwan, R.O.C., November 2007.

[36] Tito G. Amaral, V F Pires, J F Martins, A J Pires, Manuel M Crisóstomo, "Statistic Moment Based Method for the Detection and Diagnosis of Induction Motor Stator Fault", POWERENG 2007 International Conference on Power Engineering, Energy and Electrical Drives, pp. 106-110, Setúbal, Portugal, April 2007.

[37] J F Martins, V F Pires, A J Pires, "PCA-Based On-Line Diagnosis of Induction Motor Stator Fault Feed by PWM Inverter", Proceedings da Conferência IEEE-ISIE 2006 - International Symposium on Industrial Electronics pp. 2401-2405, Montréal, Québec, Canada, July 2006.

[38] V. F. Pires, J. F. Martins, A. J. Pires, "On-Line Diagnosis Of Three-Phase Induction Motor Using An Eigenvalue $\alpha\beta$ -vector Approach", Proceedings of IEEE-ISIE 2005 - International Symposium on Industrial Electronics, pp. 863-866, Dubrovnik, Croatia, June 2005.

[39] J F Martins, V F Pires, A J Pires, "Unsupervised Neural-Network Based Algorithm for an On-Line Diagnosis of Three-Phase Induction Motor Stator Fault", IEEE Transactions on Industrial Electronics, Vol. 54, nº 1, pp. 259-264, February 2007.

YBCO thin films for fault current limiter applications. Moreover, the presence of a visiting Brazilian PhD student will be of great help in reinforcing the connection and cooperation between the groups.

YBCO thin films are expected to be used in a new type of HTS resistive fault current limiters, called magnetic field assisted quench FCL. In figure a) a typical resistive current limiter is represented. Under a fault the current in line, i_L , increases and the HTS element quenches. This is a very aggressive process, since the high current densities involved associated with the material heterogeneity usually lead to the formation of hot spots that normally degrade or destroy the element. If the HTS element is covered with a coated conductor then quench is more homogeneous due to the generated magnetic induction. These devices are part of a PhD thesis by a Supermachines member.

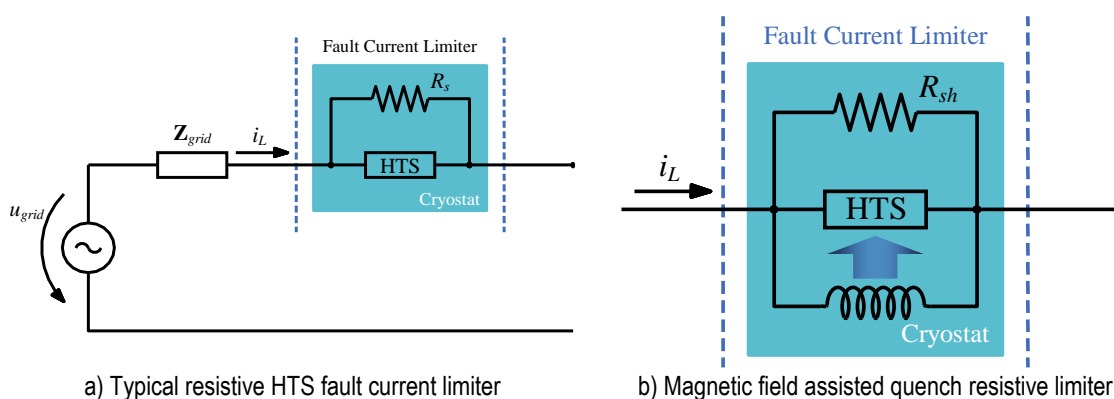


Figure 49 - Resistive HTS fault current limiters

Last Relevant Scientific Projects

Advanced Rotating Electrical Machines Exploiting High Temperature Superconducting Components (1999-2004)

This was an European Commission Project entitled Human Potential Research Training Network - N° RTN1 – 1999 – 00282. It was a joint Project, which partners were:

- Electrical Power Group, Oxford University, United Kingdom:
 - Emeritus Professor David Dew-Hughes.
 - Professor Malcolm McCulloch.
- Interdisciplinary Research Centre in Superconductivity, Cambridge University, UK:
 - Professors Archie Campbell.
 - Professor Tim Boots.
- Institute of Material Science from Barcelona, Spain:
 - Professor Xavier Granados.
 - Professor Xavier Obradors.
- Institute for Physical High Technology, Jena, Germany:
 - Doctor Wolfgang Gawalek
- Research Group on Superconductivity, Liège, Belgium:
 - Professor Marcel Ausloos.
 - Professor Rudy Cloots.

The main task was to design and constructed a four-pole reluctance superconducting motor electronically driven, as shown in figure below.

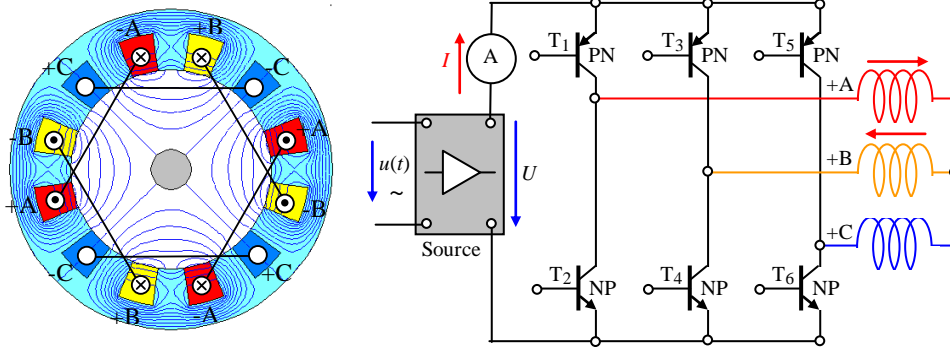


Figure 50 - Stator flux plot and electronic commutator

The HTS coils were produced by Barcelona Institute of Materials and the rotor core shown in figure was constructed in Lisbon.

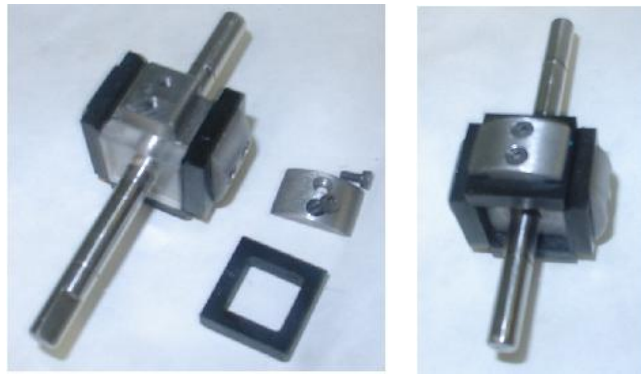


Figure 51 - HTS coils to be assembled in the rotor core

The motor was provided with superconducting magnetic bearings designed by Cambridge University. The all partners final meeting of the project took place in the Group's department, where the superconducting motor was assembled and tested. Some views of the motor under testing in our Laboratory are shown below. Figure shows the measured static torque.

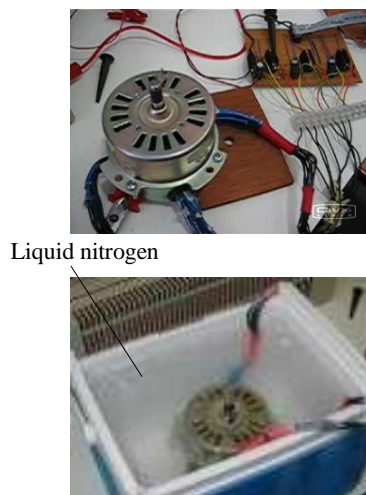


Figure 52 - Motor test in LN2

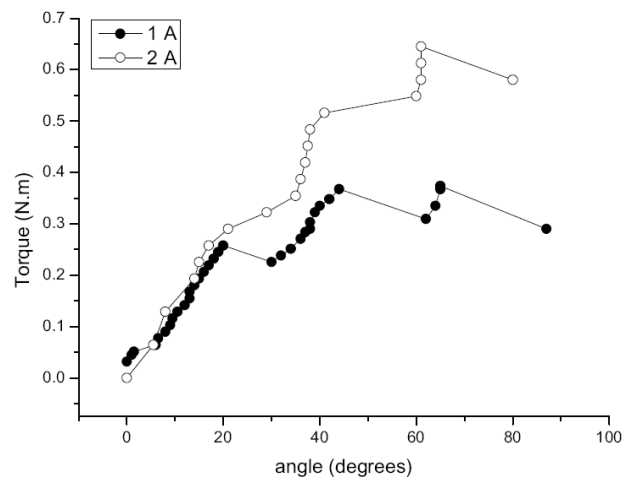


Figure 53 - Static torque of the motor vs. Angle for different interacting currents after field cooling with current of 15A [40]

The project was successful and a final report was written to be presented to the Commission. Several papers within the project were published [41, 42, 43].

[40] S Inácio, D Inácio, J M Pina, S Valtchev, M Ventim Neves, L Rodrigues, "An Electrical Gearbox by means of pole variation for induction and superconducting disc motor", Presented at the 8th European Conference on Applied Superconductivity (EUCAS), Brussels, Belgium, September 2007.

The Development of Brushless Electrical Motors and Generators with Superconducting Rotors (1999-2004)

This was a NATO Project between a NATO Country (UK) (Prof. Dew-Hughes from Oxford University) and a non-NATO Country (Russia) (Prof. Lev Kovalev from Moscow Aviation Institute). Prof Leão Rodrigues was invited by NATO Science Affairs Division to be the Project Consultant. The main task was to develop a superconducting four-pole 10 kW hysteresis motor to drive a liquid hydrogen pump, as shown in figure.

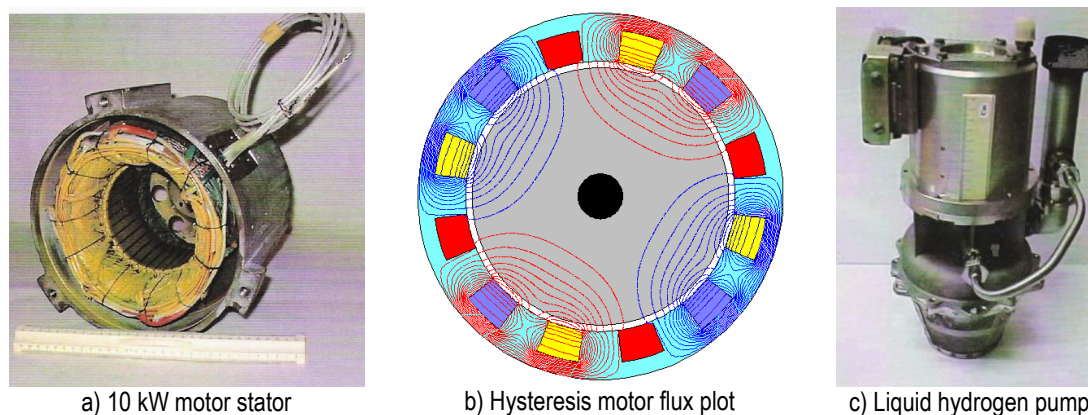


Figure 54 - Hysteresis motor driving a liquid hydrogen pump

The experimental results showed that the power/weight of this prototype is about 5 times greater than the equivalent conventional motor. The liquid nitrogen pump was designed to be installed on board of a Tupolev cryogenic plane prototype (see figure below), where power/weight ratio should be kept as a maximum.

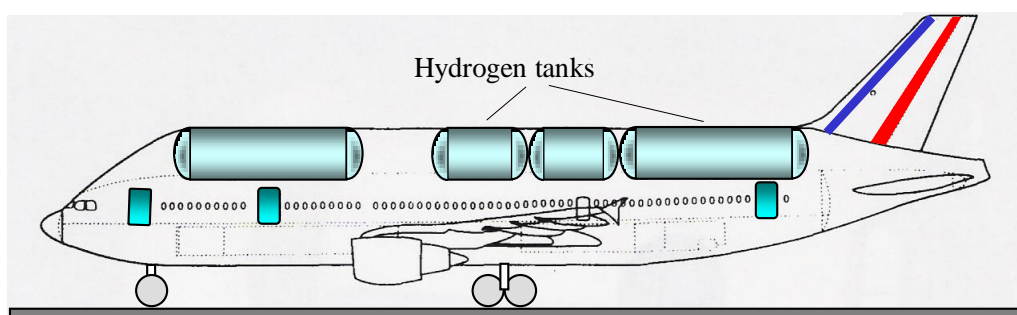


Figure 55 - Tupolev cryogenic plane

Design and construction of a flat linear induction motor to drive a robot for steel ships inspection (2001-2005)

This was a national Project (POSI/33994/SRI/2000, "Climber Robot" Project) and was classified as good. The main task was to design and build a flat linear induction motor to drive a robot for steel ships inspection [44], see figure below. Although not integrating HTS technologies, this is still under the goal of Group research activities, as already mentioned.

[41] J M Pina, M V Neves, M D McCulloch, A L Rodrigues, "Design of a linear synchronous motor with high temperature superconductor materials in the armature and in the field excitation system", Journal of Physics: Conference Series, 43, pp. 804-808 2006.

[42] A L Rodrigues, "Superconducting magnetic levitated bearings for rotary machines", Proceedings of the 5th International Symposium on Advanced Electromechanical Motion Systems, Marrakech, Morocco, November 2003.

[43] X Granados, E Bartolomé, X Obradors, M Tormes, A L Rodrigues, W Gawalek, M D McCulloch, D Dew Hughes, A Campbell, T Coombs, M Ausloos, R Cloots, "Iron-YBCO heterostructures and their application for trapped field Superconducting motor", Journal of Physics: Conference Series, 43, pp. 788-791 2006.

44 A L Rodrigues, "Design and construction of a flat linear induction motor to drive a robot for steel ships inspection", Proceedings of the 4th International Symposium on Linear Drives for Industry Applications LDIA2003, Birmingham, UK, September 2003.

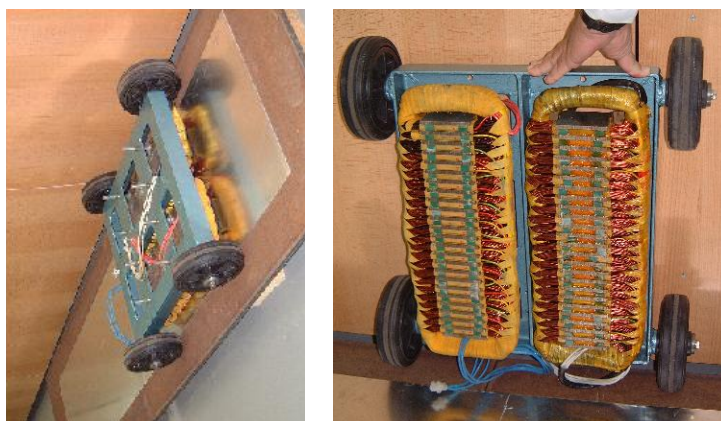


Figure 56 - The vehicle prototype with two stators in parallel

Leonard da Vinci Project (RO/01/BF/PP141024)

This was a pilot Project virtual electro-lab on Education in Electrical Machines in collaboration with the Transylvania University of Brashov, Romania. A didactical e-learning book on Electrical Machines was written [43]. The final product has been evaluated by the Romanian Academy of Science and the verdict has been positive.

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
a) Book - Author			1		1
d) Book Chapter		1		2	3
e) Periodical - International	6	2	4	4	16
g) Conference Paper (Refereed)	14	13	21	4	52
k) Patent				1	1
m) Other (Technical Reports, etc.)	1		2		3
Grand Total	21	16	28	11	76

Table 26 - Publications by Year for Hosted Activity A2.1

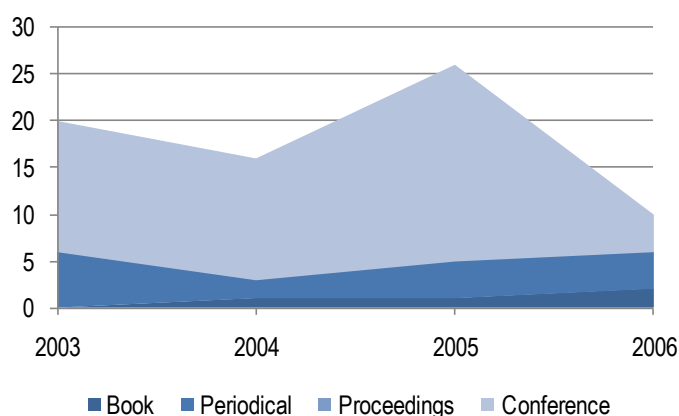


Figure 57 – Evolution of Publications by Year for Hosted Activity A2.1

Count of publication	WoS		
Type Table	No	Yes	Grand Total
e) Periodical - International	7	9	16
g) Conference Paper (Refereed)	41	11	52
Grand Total	48	20	68

Table 27 - Publications of A2.1 at ISI Web of Knowledge Indexing Service

Book – Author

1. Rodrigues, Amadeu and Scutaru, Gheorghe and Gogiou, Aurel. 2005. [*Electric Machines-didactic book "e-learning Virtual-Electro-Lab" Leonard da Vinci Project RO/01/BF/PP141024*](#). Romanian Academy of Sciences..

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2. Martins, João and Pires, Armando and Vilela Mendes, R. and Dente, J. A.. 2006. [*Entropy Analysis for the Language Modeling of Electrical Drives*](#). In: Intelligent Systems at the Service of Mankind, Ubooks, pp. 53-62. ISBN 3-86608-052-2.
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16. Sfetsos, Athanasios and Pina, João and Gonçalves, Anabela and Neves, Mário and Rodrigues, Amadeu. 2003. [Flux Modelling of Reluctance Machines with Bulk Superconducting Materials](#). Electromotion Review.

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34. Pires, Armando and Cordeiro, José and Rodrigues, Vítor T. and Filipe, Joaquim. 2004. [The Polytechnic Institute of Setúbal and the ICT – The Example of an e-Learning Project Based on the Theory of Organized Activity](#). In: EISTA'2004 – International Conference on Education and Information Systems: Technologies and Applications, Jul 2004, Orlando, USA. *Indexed at ISI Web of Science*.

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36. Rodrigues, Amadeu. 2004. [*Torque Production in Superconducting Hysteresis Electrical Motors*](#). In: ?, Capri, Italy.
37. Rodrigues, Amadeu. 2004. [*Aerogerador Supercondutor*](#). In: Simpósio sobre Energias Renováveis em Portugal, Portugal.
38. Rodrigues, Amadeu. 2004. [*Design of Journal and Thrust Levitated Magnetic Bearings*](#). In: ACEMP'2004, 26-28 May 2004, Istambul, Turkey.
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49. Parreira, B. and Rafael, Silviano and Pires, Armando and Costa Branco, P. J.. 2003. [*Obtaining the Magnetic Characteristics of an 8/6 Switched Reluctance Machine: FEM Analysis and Experimental Tests*](#). In: IEEE-ISIE'03 – International Symposium on Industrial Electronics, Jul 2003, Rio de Janeiro, Brasil. *Indexed at ISI Web of Science*.
50. Rafael, Silviano and Pires, Armando and Costa Branco, P. J.. 2003. [*Implementation of an 8/6 Switched Reluctance MOSFET Current Controller: Simulation Study and Experimental Tests*](#). In: IEEE-ISIE'03 – International Symposium on Industrial Electronics, Jul 2003, Rio de Janeiro, Brasil. *Indexed at ISI Web of Science*.
51. Rodrigues, Amadeu. 2003. [*High Temperature Superconductor Disc Motor*](#). In: 8th Portuguese-Spanish Congress on Electrical Engineering, 03-05 July 2003, Vilamoura (PT).
52. Rodrigues, Amadeu. 2003. [*Torque comparison of an eight pole permanent excited and a high temperature superconductor disc motor*](#). In: The 2003 International Conference on Electrical Machines and Systems, ICEMS2003, Beijing, China.

Patents

1. [*Control System based on electronic pole changing*](#). A recently developed control system (whose patent is still pending) is being developed by the Group. The motor is of axial flux type and the control system is based on electronic pole changing. It has 24 windings, two semi-stators and an YBCO plate as rotor, for it behaves as a hysteresis disc motor.

Other (Technical Reports, etc)

1. Santos, P. J. and Martins, A. G. and Pires, Armando. 2005. [Designing the input vector to ANN-based models for short-term load forecast in electricity distribution systems](#). Technical Report. Elsevier Science Ltd..
2. Santos, P. J. and Martins, A. G. and Pires, Armando and Martins, João and Mendes, R. V.. 2005. [Short-term Load Forecast Using Trend Information and Process Reconstruction](#). Technical Report. INESC Coimbra.
3. Gonçalves, Anabela and Neves, Mário and Rodrigues, Amadeu. 2003. [Hysteresis loop measurements at low temperatures](#). Project Report. <http://www.supermachines.org...>

Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
j) Thesis - MSc			1	1	2
Grand Total			1	1	2

Table 28 - Theses by Year for Hosted Activity A2.1

MSc Theses

1. Fernandes, João. 2006. [Máquina Síncrona em Regime Transitório após Brusco Curto Circuito no Estator](#). MSc thesis, (Rodrigues, Amadeu, supervisor), Faculdade Ciências e Tecnologia/UNL.
2. Pereira, Pedro. 2005. [Desenvolvimento de Ambiente para Caracterização Automática de PLLS](#). MSc thesis, (Rodrigues, Amadeu, supervisor), Faculdade Ciências e Tecnologia/UNL.

Prototypes and Products

1. [Flat linear induction motor to drive a robot for steel ships inspection](#). Prototype resulted from a national project (POSI/33994/SRI/2000, "Climber Robot" project) and was classified as good. This prototype was designed and constructed within the Superconducting Machines Group in 2003 and consists of a flat linear induction motor to drive a robot for steel ships inspection. [prototype]
2. [Superconducting flat linear synchronous linear motor](#). The high diamagnetism observed in HTS materials lead to applications involving levitation such as the linear synchronous motor (LSM). An all superconducting motor (without copper or iron elements), with BSCCO tapes in the armature and trapped-flux YBCO in the moving part, is being developed in the Group. [prototype]
3. [Disc electronic pole changing motor](#). This motor is of axial flux type and the control system is based on electronic pole changing. It has 24 windings, two semi-stators and an YBCO plate as rotor, for it behaves as a hysteresis disc motor. The prototype was recently constructed by the group (the patent is still pending). [prototype]

Projects

1. CLIMBER (POSI/SRI/33994/99) - Climber Robot for Ferromagnetic Surfaces - Dates: 01-01-2000/31-12-2003(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POSI/SRI; Funding: 99.759,58€ (99.759,58€)
2. COMPLETE (A2) (RO/04/B/F/PP-175016) - New Strategies of Competence acquisition for Lifelong Learning in Energy-Transport-Environment Engineering - Dates: 01-01-2005/31-12-2007(36 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: Leonardo da Vinci /; Funding: 340.778,67€ (32.046,67€)

3.2. Line B: Computational Intelligence, Decision, Modelling & Control

Research Line Coordinator: Rita Almeida Ribeiro

Advisory Board

- University of Trento – Italy (Ricardo Marques Pereira)
- Azad University – Iran (Javad Jassbi)

The CA3 research group was formed in 1996 and in 2000 it was integrated in the CTS of UNINOVA (www.uninova.pt/ca3/).

Our mission: (a) actively participate in research and development supported by projects; (b) to encourage our researchers to disseminate their research work and to develop international professional contacts in their respective areas of research.

Objectives: Our first goal is to continue the development of our fundamental and applied research. To accomplish this objective we need to write more proposals (time consuming activity) and extend our collaboration with other institutions/companies to ensure the financial means for the group to grow. Our second goal is to provide a realistic transition of knowledge and technology to industry. Our third goal is to help young researchers to mature and to encourage them to publish their research results in conferences and leading journals. Our fourth goal is to promote a higher internationalization of our group so as to broaden the horizons of our research.

In order to improve our capabilities and enlarge our scope of intervention we joined two main areas of expertise that existed at CTS: soft computing and modelling & control. This joining will allow us to apply for more projects addressing decision support systems as well as modelling and control systems. Recently, we also incorporated young PhDs to cover the areas of knowledge discovery/data mining and intelligent image processing. These latter areas are still incipient but we expect them to grow in the near future.

Strategy: In next figure we present a summary of our research development strategy to accomplish our objectives.

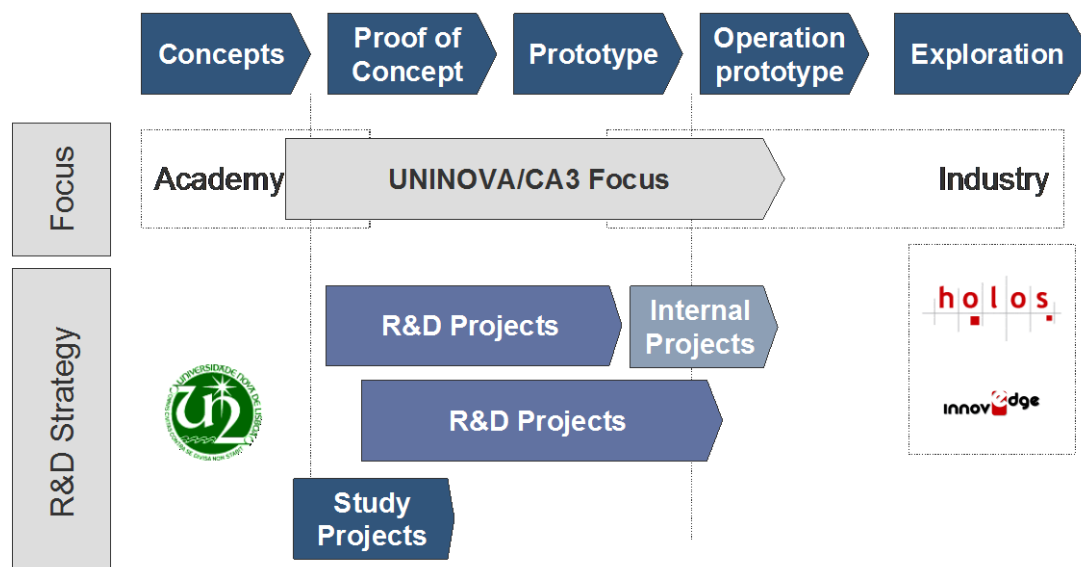


Figure 58 - CA3 Strategy

As can be seen in figure, our research life cycle starts with defining the concepts to be used in a specific project. Afterwards, we try to provide a proof-of-concept (usually with case studies or examples) so that client understands and appreciates our conceptual/technological approach.

Next, we develop a prototype. Finally, we often team-up with companies to provide potential commercial technology (HOLOS being a spin-off from the CA3 group, is a good example).

Publishing policy: First, we promote the publication in leading journals of the area; second, we promote the attendance/publication in international conferences as the means to familiarize young researchers with research as well as to establish contacts with peers in their area of research. We believe that conferences are a good opportunity to meet colleagues, to disseminate work-in-progress and to establish networks for obtaining financing for future projects.

In summary, our main research groups are:

1. **B1 - Decision Support Systems (DSS):** This research group deals mainly with computational intelligent decision support systems in uncertain environments. The focus of research is on: fuzzy knowledge-based systems, fuzzy multicriteria and fuzzy optimization. The major application areas are: aerospace and ergonomics.
2. **B2 - Modelling and Control of Distributed Parameter Systems (MC-DP):** This research group deals with the development of advanced control algorithms for distributed parameter systems, that is, systems modelled by partial differential equations. A special emphasis has been made in systems with transport phenomena.
3. **Other (recent members):** There are recent members that joined CA3 but they will not be considered for evaluation because they just started their research activities. The collaboration already developed is:
 - Data Mining and Knowledge Discovery - 2 projects (CERTAIN, MODI) and 3 papers (papers co-authored by P. Sousa and J. Pimentão);
 - Intelligent Image Processing – 1 project (COSIS) and 1 paper (co-authored by J.M. Fonseca).

Publications – Line B

This section focuses on the Publications performance of Research Line B.

Count of publication		Hosted		
Type Table	Year	B1	B2	Grand Total
d) Book Chapter	2003	3		3
	2004	1		1
	2005	2		2
	2006	6	1	7
d) Book Chapter Total		12	1	13
e) Periodical - International	2003	4	3	7
	2005		3	3
	2006	1	2	3
e) Periodical - International Total		5	8	13
g) Conference Paper (Refereed)	2003	8	9	17
	2004	15	17	32
	2005	9	15	24
	2006	14	4	18
g) Conference Paper (Refereed) Total		46	45	91
h) Special Issue				
h) Special Issue Total		1		1
Grand Total		64	54	118

Table 29 – Publications by research group of research line B

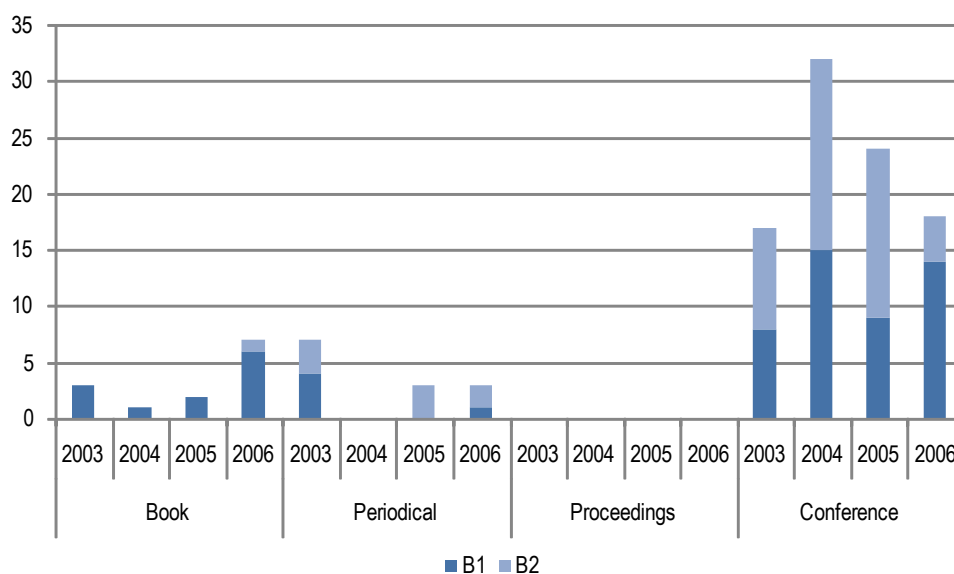


Figure 59 – Publication performance by period year and research group of research line B

Count of publication		Hosted		
Type Table	WoS	B1	B2	Grand Total
e) Periodical - International	No	2		2
	Yes	3	8	11
e) Periodical - International Total		5	8	13
g) Conference Paper (Refereed)	No	32		32
	Yes	14	45	59
g) Conference Paper (Refereed) Total		46	45	91
Grand Total		51	53	104

Table 30 – Publications of research line B at ISI Web of Knowledge Indexing Service

Theses – Line B

This section presents the theses production figures of Research Line B.

Count of publication		Hosted		
Year	Type Chart	B1	B2	Grand Total
2003	PhD	1	0	1
2005	MSc	1	1	2
2006	PhD	2	0	2
	MSc	4	0	4
Grand Total		8	1	9

Table 31 - Theses Production by Group of Line B

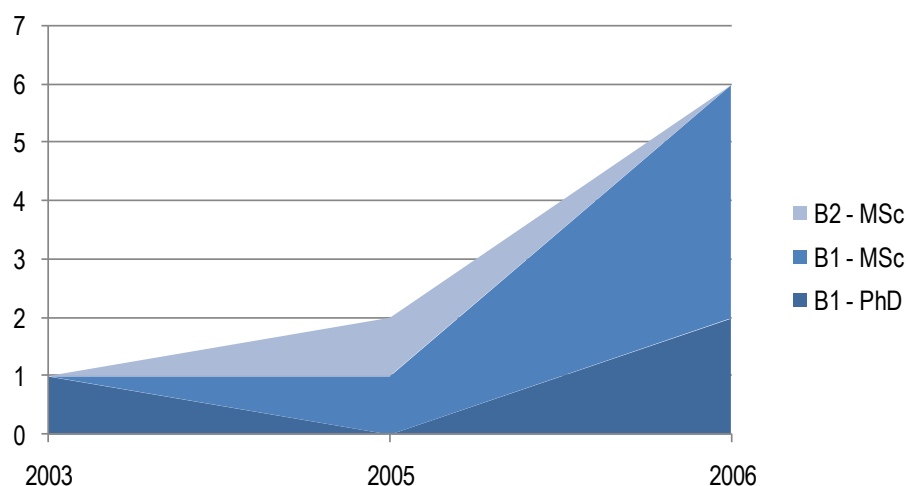


Figure 60 - Evolution of Theses Production of Line B

Funding – Line B

This section focuses analysis on the projects allocated to Research Line B.

Acronym	Hosted	Type	Total Funding	Own Funding	Period Funding
ACODUASIS	B2	RTD	1.720.317,00 €	189.900,00 €	189.900,00 €
AMBIDISC	B2	RTD	49.879,79 €	0,00 €	0,00 €
AMPLE	B1	RTD	3.790.000,00 €	166.000,00 €	13.833,33 €
ASSD	B1	RTD	150.000,00 €	60.000,00 €	46.153,85 €
BIOPATTERN (B1)	B1	Network	2.666.666,67 €	133.289,58 €	99.967,19 €
CERTAIN	B1	RTD	176.424,00 €	48.500,00 €	42.437,50 €
CESADS	B1	RTD	299.982,00 €	106.419,00 €	72.212,89 €
COSIS	B1	RTD	12.000,00 €	5.000,00 €	3.333,33 €
Dialugares	B1	RTD			0,00 €
DRUSAS	B1	RTD	62.772,00 €	38.000,00 €	19.612,90 €
ECOPADEV	B1	RTD	2.196.880,00 €	99.897,00 €	61.227,19 €
EE-II	B1	RTD	602.561,00 €	188.000,00 €	20.888,89 €
EO-KES	B1	RTD	299.982,00 €	124.996,00 €	109.996,48 €
FAST-ERGO X	B1	RTD	57.000,00 €	57.000,00 €	21.000,00 €
FLOW	B2	RTD	65.256,00 €	15.720,00 €	9.347,03 €
FRF	B1	RTD			0,00 €
InAml	B2	RTD	1.449.029,00 €	149.469,00 €	62.278,75 €
InLife	B2	RTD	1.698.012,00 €	215.840,00 €	83.937,78 €
MODI	B1	RTD	250.000,00 €	155.218,00 €	155.218,00 €
NOMDIS	B1	RTD	50.000,00 €	22.500,00 €	22.500,00 €
RIAT-AIP	B1	RTD			0,00 €
SARP	B1	RTD	266.507,20 €	266.507,20 €	266.507,20 €
SEIS	B1	RTD	200.000,00 €	160.000,00 €	160.000,00 €
SESS	B1	RTD	400.000,00 €	123.000,00 €	72.103,45 €
Singrar	B1	RTD			0,00 €
SPRAYNET	B2	RTD	967.788,00 €	37.680,00 €	26.166,67 €
VET-TREND (B2)	B2	RTD	289.742,00 €	12.795,50 €	533,15 €
Grand Total			17.720.798,66 €	2.375.731,28 €	1.559.155,57 €

Table 32 – Projects list for Research Line B

Hosted	Funding 2003	Funding 2004	Funding 2005	Funding 2006	Total Funding
B1	256.113,19 €	309.493,16 €	301.292,60 €	320.093,25 €	1.186.992,21 €
B2	70.585,00 €	75.860,00 €	93.042,18 €	132.676,19 €	372.163,37 €
Grand Total	326.698,19 €	385.353,16 €	394.334,77 €	452.769,44 €	1.559.155,57 €

Table 33 - Project funding by period year and research group of Research Line B

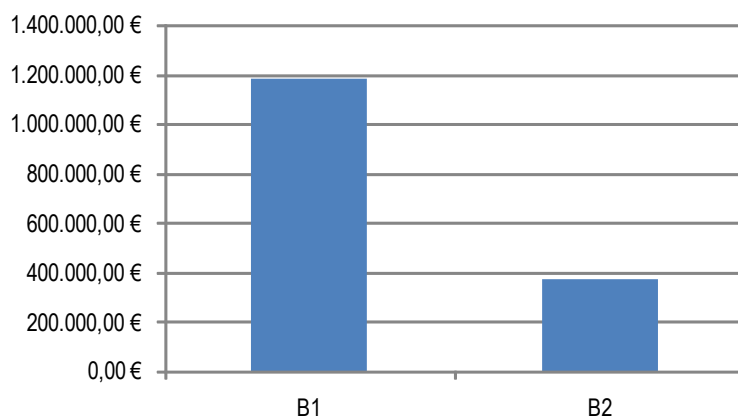


Figure 61 - Project funding by research group of Research Line B

Cooperation – Line B

This section presents the composite analysis of cooperation level for Research Line B.

Count of publication	Year				
ns1:cooperation	2003	2004	2005	2006	Grand Total
worldwide	2		2	3	7
regional	6	8	1	5	20
national	10	12	12	7	41
organisation	2	3	3	6	14
group	8	9	9	4	30
none		1	2	3	6
Grand Total	28	33	29	28	118

Table 34 – Cooperation levels by year for research line B

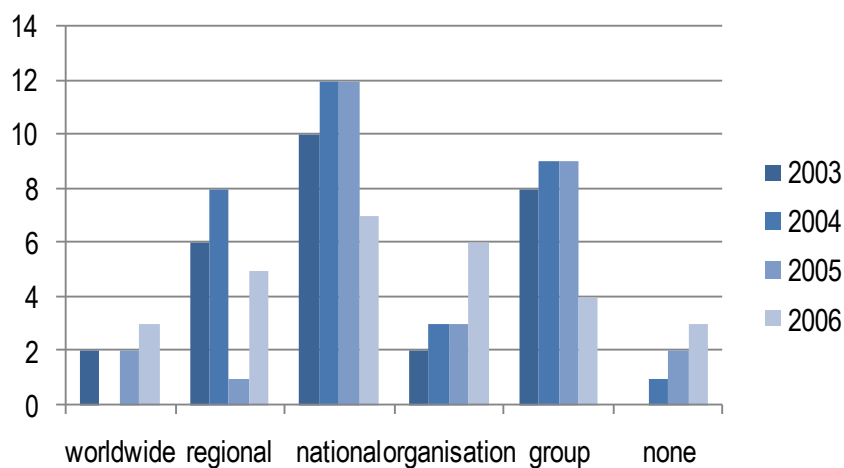


Figure 62 - Cooperation levels by year for research line B

3.2.2. Group B1: Computational Intelligence in Decision Support Systems

Important achievements are related to our contribution for theoretical and methodological advances in the computational intelligence and decision support areas, particularly in fuzzy multi-criteria systems, fuzzy knowledge-base systems, fuzzy optimisation and intelligent query systems. We have also developed novel fuzzy methodologies for both Space monitoring problems and Ergonomics.

In the Space area, solid evidence of our expertise and technological achievements relates to the quantity of projects (10) with the European Space Agency (ESA) that have been awarded since 2001.

We highlight an on-going project of a fuzzy monitoring system and terrain-hardness detection for the Mars rover drill (MODI), where, due to its success, we were asked to propose an extension for building a small real-setup drill to enable us to perform real-time tests. Another interesting achievement was the project COSIS that was subject of a special program for the EuroNews television channel about the Sun and related activities in Portugal. Furthermore, recently we got involved in the European Space Agency's GAIA mission, whose objective is to make a precise mapping of our Galaxy's population of 100 billion stars.

In addition, we are proud to have two patents under submission: a Portuguese patent on a new model and methodology (pending) in the area of ergonomics; and a preliminary registration for claiming another patent in the area of automation and security.

Membership

Senior researchers

- Rita Ribeiro
- Isabel Nunes

Young researchers

- José Manuel Fonseca
- Pedro Sousa
- João Pimentão

PhD students

- Bruno Santos, Tiago Simas, André Mora, Ana Fachada

Master students

- Bruno Miranda, Margarida Gomes, Tiago Pais, Pedro Barroso, David Beja, Carlos Moreira

Engineers

- A.Falcão, Gonçalo Barata, F. Moitinho, Inês Guerra, Sérgio Agostinho, Carlos Figueira

Theoretical research in DSS

- *Multi-Criteria Decision Making*: a) development of new weighting functions for aggregation with generalized mixture operators in multi-criteria problems (3 papers); b) definition of a fuzzy model for disaster contingency management (2 papers).
- *Fuzzy Optimization*: New flexible formulation of fuzzy linear and non-linear problems (soft constraints, uncertain parameters) solved using genetic algorithms (2 papers)
- *Fuzzy Inference Systems (FIS)*: a) definition of fuzzy measures transformation of the Mamdani FIS type to Sugeno-Takagi FIS type to improve efficiency (3 papers); b)

integration of the Choquet integral with correlation matrices for a new fuzzy inference scheme of the Takagi-Sugeno type (2 papers)

- *Monitoring & Diagnostic Systems*: New methodologies for construction of inference systems targeted to space applications (2 papers)
- *Intelligent Queries in Databases*: Extension of classical databases query systems to handle semantic (quasi natural language) queries (4 papers).
- *New Modelling Techniques in Ergonomics*: Development of a new fuzzy expert toolkit for evaluation of workstations (3 papers and 1 national patent –pending)

Applied Research in DSS

- Application of novel methodologies and concepts for space fuzzy monitoring systems (14 papers)
- Applications of new modelling techniques in Ergonomics (3 papers)
- Other: applications of fuzzy multicriteria models, multiagent systems, data warehousing, software engineering (10 papers).

Outputs (period 2003-2006) for CA3-DSS

Publications

In summary, our publications during the period 2003-2006 are:

- International Journal Papers: 8 (1 in print)
- Books and Series Chapters: 14 (3 in print)
- International Conference Papers: 35
- Thesis: 5

In terms of international collaboration we published several papers with researchers from Belgium, France, Germany, Italy, Iran, Poland, Spain and United Kingdom.

Seminars, workshops organization and participation in international networks

We organized 12 seminars with external researchers in the last 3 years (see <http://www2.uninova.pt/ca3/en/events.htm>). We also have monthly internal seminars for discussing on-going projects in terms of novel methodologies and concepts applied, particularly in the topics of our theoretical research.

Regarding editorial activities one member is in the editorial advisory board of the Journal of Intelligent & Fuzzy Systems (JIFS) and also participated as guest editor in a special number of the European Journal of Operational Research (EJOR).

Regarding organization of events (conferences and workshops) we do not consider it a priority for the group because our objective is to increase publications in journals. However, we should highlight that in the last 3 years one of the young researchers organized 3 workshops as chair and co-chair and another organized a special session in a conference.

Projects and Prototypes

All our projects final deliverables are prototypes; some are just research tools while others are real operational prototypes. Most of our projects are international and financed both by ESA (European Space Agency) – 7 projects, and by the European Commission – 5 projects.

We highlight two operational prototypes (www.uninova.pt/ca3) that are being used by ESA one a space weather information system and another a reporting tool for the satellite GOCE.

Our policy regarding projects, particularly the ESA projects, is to assign a team with:

- Project manager (PhD)- responsible for the scientific and technical success of the project, completeness of requirements, timely deliveries and general management issues;
- Scientific advisor (PhD) – external specialist in the area responsible for the scientific content of all tasks and guidance of project tasks;
- Researchers/engineers – responsible for the development and implementation of specific tasks.

Patents

Although it is quite uncommon in our research area to have patents, because our outputs are mainly software prototypes, we have applied for two patents in the Portuguese patent registration office:

- patent on a new model and methodology in the area of ergonomics (pending);
- preliminary registration for claiming another patent in the area of automation and security.

Resources and Training at CA3-DSS

Since 2003 we have been trying to improve the expertise of our research team and we already produced 2 finished PhDs, and 4 are on-going; 3 finished Master thesis and 6 are on-going. We have also been trying to internationalize our group and we were successful in attracting two visiting post-docs, a Solar physicist (Ivan Dorotevic- Slovak) and a Fuzzy knowledge-based specialist (Javad Jassbi- Iranian), as well as a foreign PhD student (Jasna Kovacevic- Serbian).

At the moment (end 2006) this group of research includes: 2 Senior researchers (Rita Ribeiro, Isabel Nunes); 3 young researchers (Pedro Sousa, JM Fonseca, João Pimentão); 4 PhD students (Bruno Santos, Tiago Simas, André Mora, Ana Fachada); 6 Master students (Bruno Miranda, Margarida Gomes, Tiago Cardal Pais, Pedro Barroso, David Beja, Carlos Moreira); 6 Engineers (A.Falcão, Gonçalo Barata, F. Moitinho, Inês Guerra, Sergio Agostinho, Carlos Figueira).

Regarding facilities for this group we have 2 laboratories equipped with around 10 computers, 1 acting as server, where most researchers/engineers work and 4 offices also equipped with computers. All researchers have access to the general University library. The researchers do the technical support since most are computer science specialists.

DSS Future plans

We are now in the process of ensuring a smooth integration with our recent young PhDs specialized in knowledge discovery/data mining and image processing through new projects and joint publications.

We also plan to improve our publication record in leading journals and continue our efforts to establish our group as a leading reference in the Space sector for knowledge-enabled systems, particularly for monitoring systems for decision support.

Regarding fundamental research our main objective is to devise an automatic process to build monitoring systems for decision support, directly from physical phenomenon. To this aim our planned research is:

- Automatic construction of linguistic variables from telemetry, using knowledge discovery/data mining algorithms (partial research done -1 paper);
- Optimization of the number of terms in the linguistic variables (1 paper being written);
- Devise a new method to automatically construct the optimized set of rules for monitoring systems (1 paper in print);

- Devise a new method to evaluate/classify the results obtained from monitoring systems (1 paper in print);
- Define a method/algorithm that takes into account the relationships between the variables in the same rule;
- Define a method/algorithm for aggregating rules that takes into account synergies between rules (partially done -3 papers).
- Define an adaptable and dynamic multicriteria decision model (research under way).

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
d) Book Chapter	3	1	2	6	12
e) Periodical - International	4			1	5
g) Conference Paper (Refereed)	8	15	9	14	46
h) Special Issue	1				1
k) Patent				2	2
Grand Total	16	16	11	23	66

Table 35 – Publications by Year of Group B1

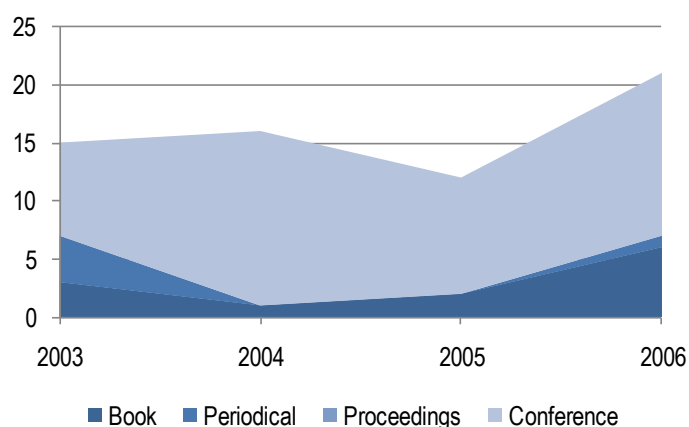


Figure 63 – Evolution of Publications by Year of Group B1

Count of publication	WoS		
Type Table	No	Yes	Grand Total
e) Periodical - International	2	3	5
g) Conference Paper (Refereed)	32	14	46
Grand Total	34	17	51

Table 36 – Publications of B1 at ISI Web of Knowledge Indexing Service

Book Chapter

1. Fonseca, José and Mora, André and Barroso, Pedro. 2006. [The Web and the new generation of medical information systems](#). In: Perspectives in Outcome Prediction in Cancer, Studies in Multidisciplinary series. Elsevier..
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7. Nunes, Isabel. 2006. [ERGO_X - The Model of a Fuzzy Expert System for Workstation Ergonomic Analysis](#). In: International Encyclopedia of Ergonomics and Human Factors (Karwowski, W., ed.), CRC Press, pp. 3114-3121..
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Papers in International Scientific Periodicals with Referees

1. Ribeiro, Rita. 2006. [Fuzzy Space Monitoring and Fault Detection Applications](#). Journal of Decision Systems, Vol. 15 (2-3). pp. 267-286. ISSN 1246-0125.
2. Milagres, Francisco and Moreira, Edson and Pimentão, João and Sousa, Pedro and Steiger-Garção, Adolfo. 2003. [Dealing with Security within the DEEPSIA Project](#). WSEAS Transactions on Systems, Vol. 2 (2). pp. 444-453. ISSN 1109-2777.
3. Ribeiro, Rita and Marques-Pereira, R.. 2003. [Generalized mixture operators using weighting functions: a comparative study with WA and OWA](#). European Journal of Operational Research, Vol. 145 (2). pp. 329-342. ISSN 0377-2217. *Indexed at ISI Web of Science*.
4. Marques-Pereira, R. and Ribeiro, Rita. 2003. [Aggregation with generalized mixture operators using weighting functions](#). Fuzzy Sets and Systems, Vol. 137 (1). pp. 43-58. ISSN 0165-0114. *Indexed at ISI Web of Science*.
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Papers in Conference Proceedings

1. Grillo, M. and Lopes, David and Mora, André and Ferreira, Ana and Fonseca, José and Vieira, Pedro. 2006. [Software for the semi-automatic determination of the retinal vessel diameter](#). In: EVER-2006, 4-7 Oct 2006, Vilamoura (PT). *Indexed at ISI Web of Science*.
2. Jameaux, D. and Vitulli, R. and Ribeiro, Rita and Fonseca, T. and Santos, B. and Barata, Manuel. 2006. [Monitoring & Diagnosis on-board software module for Mars driller](#). In: 5th Workshop on Planning and Scheduling for Space (IWPSS06), October, Baltimore, USA.
3. Moitinho, F. and Mora, André and Vieira, Pedro and Fonseca, José. 2006. [AD3RI a Tool for Computer – Automatic Drusen Detection](#). In: CompIMAGE - Computational Modelling of Objects Represented in Images: Fundamentals, Methods and Applications, 20-21 Oct 2006, Coimbra (PT). *Indexed at ISI Web of Science*.
4. Mora, André and Fonseca, José and Vieira, Pedro. 2006. [Quantification of Drusen Deposits using Image Processing Techniques](#). In: EVER-2006, 4-7 Oct 2006, Vilamoura (PT).
5. Marques-Pereira, R. and Serra, P. and Ribeiro, Rita. 2006. [Choquet integration and correlation matrices in fuzzy inference systems](#). In: Proceedings of the International conference 9th Fuzzy Days, Dortmund (DE). *Indexed at ISI Web of Science*.

6. Jassbi, J. and Serra, P. J. and Ribeiro, Rita and Donati, A.. 2006. [Comparison of Mamdani and Sugeno fuzzy inference systems for a space fault detection application](#). In: Proceedings of the World Automation Congress (WAC2006), Hungary.
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16. Fonseca, José and Mora, André and Marques, Ana. 2005. [MAMIS – A Multi-Agent Medical Information System](#). In: Proc. Biomed-2005, 16-18 Feb 2005, Innsbruck (AUS).
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1. Ribeiro, Rita and Rodrigues, A. J. and Zaraté, P., eds. 2003. [Special issue on Decision support systems](#). European Journal of Operations Research , Vol. 145 (2).

Patents

1. [Patent on a new model and methodology in the area of ergonomics](#).
2. [Preliminary registration for claiming another patent in the area of automation and security](#).

Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
i) Thesis - PhD	1			2	3
j) Thesis - MSc			1	4	5
Grand Total	1		1	6	8

Table 37 – Theses by Year of Group B1

PhD Theses

1. Pimentão, João. 2006. [Comunicação Segura sem Recurso a Cifra](#). PhD thesis, (Steiger-Garção, Adolfo, supervisor), Faculdade Ciências e Tecnologia/UNL.
2. Rosado, António. 2006. [Fuzzy Conceptual Queries Based on Object-role Modeling](#). PhD thesis, Faculdade Ciências e Tecnologia/UNL.
3. Nunes, Isabel. 2003. [Modelo de Sistema Pericial Difuso para apoio à Análise Ergonómica de Posto de Trabalho \(fuzzy Expert System Model to Support Workstation Ergonomic Analysis\)](#). PhD thesis, Faculdade de Ciências e Tecnologia/UNL.

MSc Theses

1. Santos, Bruno R.. 2006. [Sistema Inteligente Baseado em Agentes para Catalogação de Informação Existente na Internet](#). MSc thesis, (Steiger-Garção, Adolfo, supervisor), Faculdade Ciências e Tecnologia/UNL.
2. Morganho, Hugo. 2006. [Uma proposta de técnicas de aprendizagem em texto para agentes inteligentes](#). MSc thesis, (Steiger-Garção, Adolfo, supervisor), Faculdade Ciências e Tecnologia/UNL.
3. Monteiro, Telma. 2006. [Análise de riscos na Construção Civil. Construção e validação da base de conhecimentos de um sistema pericial](#). MSc thesis, (Nunes, Isabel, supervisor), Faculdade de Ciências e Tecnologia/UNL.
4. Pantoquilha, Marta. 2006. [A Space Environment Information System For Mission Control Purposes: System Analysis and Data Integration Design](#). MSc thesis, (Ribeiro, Rita A., supervisor), Faculdade Ciências e Tecnologia/UNL.
5. Viana, Nuno. 2005. [Analysis, Design and Development of an Extraction, Transformation and Loading Software Architecture for Space-Oriented Business Intelligence Activities with Real-time Constraints](#). MSc thesis, (Ribeiro, Rita A., supervisor), Faculdade Ciências e Tecnologia/UNL.

Prototypes and Products

1. [NOMDIS - New Operators for Monitoring and Diagnostic of Intelligent Systems](#). Integration of Choquet integral as a new aggregation method in fuzzy inference systems. Case study: Rosetta thermal alarm system [proof-of-concept]
2. [EOKES - Earth Observation Domain Specific Knowledge Enabled Service](#). Information system with an ontology to provide EO Knowledge Enabled Services through powerful, customized, and adaptive search capabilities [demonstrator]
3. [CESADS - Centralised ESTRACK Status And Diagnostic System](#). Monitoring and diagnostic of health status of components involved in linking a satellite and the control centre (space link). [demonstrator]
4. [SEIS - Space Environment Information System](#). Integration of Space Weather information, S/C orbital positions and Telemetry data. The system includes a monitoring module, a reporting analysis tool and a meta-data repository [prototype]

5. [MODI - Simulation of Knowledge Enabled Monitoring and Diagnosis Tool for Mars Lander Payloads](#) . Prototype for intelligent monitoring of the drill device for the ExoMars Rover also capable of recognizing Mars terrain hardness [demonstrator]
6. [EE-II Evolution and Ecology of Interacting Infohabitants](#). This project will implement in software the ERGO_X ergonomic analysis tool [proof-of-concept]

Projects

1. AMPLE (033710) - Aspect Oriented, Model Driven Product Line Engineering - Dates: 01-10-2006/30-09-2009(36 months) ; Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/?; Funding: 3.790.000,00€ (166.000,00€)
2. ASSD () - Aspects Specification for the Space Domain - Dates: 01-03-2006/30-03-2007(12 months) ; Type: RTD; Role: Prime Contractor; Sponsor: ESA; Programme: ESTEC; Funding: 150.000,00€ (60.000,00€)
3. BIOPATTERN (B1) (508803) - Computational Intelligence for Biopattern Analysis to Support eHealth - Dates: 01-01-2004/31-12-2007(48 months) ; Type: Network; Role: Partner; Sponsor: EC; Programme: FP6/IST; Funding: 2.666.666,67€ (133.289,58€)
4. CERTAIN () - CryoSat Event Reporting Tool for Analysis and Investigation - Dates: 01-11-2005/01-02-2007(15 months); Type: RTD; Role: Partner; Sponsor: ESA; Programme: ESOC; Funding: 176.424,00€ (48.500,00€)
5. CESADS (CESADS_PROP_001_1-0) - INTELMOD Test-bed for Failure Anomaly and Diagnostic Support - Dates: 01-04-2002/30-07-2004(); Type: RTD; Role: Partner; Sponsor: ESA; Programme: ESOC; Funding: 299.982,00€ (106.419,00€)
6. COSIS (POCTI-CTEAST/58333/2004) - Coimbra Observatory Solar Information System - Dates: 01-01-2005/31-12-2007(24 months); Type: RTD; Role: Partner; Sponsor: FCT; Programme: POCTI/CTEAST; Funding: 12.000,00€ (5.000,00€)
7. Dialogares () - Educação Arte e Cultura - Dates: 01-01-2006/31-12-2006(); Type: RTD; Role: Prime Contractor; Sponsor: ICCTI/CNPq; Programme: ?/?; Funding: 0,00€ (0,00€)
8. DRUSAS (POCI/SAU-ESP/57592/2004) - Automatic detection of Drusens in fundus images - Dates: 01-09-2005/30-03-2008(36 months) ; Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POCI/Health Sciences - Epidemiology and Public Health; Funding: 62.772,00€ (38.000,00€)
9. ECOPADEV (EVK4-2001-00089) - Developing new decision-making tools to promote the sustainable development in European cities based on eco-industrial park strategy - Dates: 01-01-2002/31-07-2004(31 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP5/?; Funding: 2.196.880,00€ (99.897,00€)
10. EE-II (IST-1999-10304) - Evolution and Ecology of Interacting Infohabitants - Dates: 01-05-2000/30-04-2003(36 months) ; Type: RTD; Role: Partner; Sponsor: EC; Programme: FP5/FET; Funding: 602.561,00€ (188.000,00€)
11. EO-KES (EOKES_PROP_01_1-0OF02/4456) - Earth Observation domain-specific Knowledge Enabled Services - Dates: 01-10-2002/01-10-2004(12 months); Type: RTD; Role: Partner; Sponsor: ESA; Programme: ESRIN; Funding: 299.982,00€ (124.996,00€)
12. FAST-ERGO X () - Method to support workstation ergonomic analysis - Dates: 01-06-2006/31-12-2007(); Type: RTD; Role: Prime Contractor; Sponsor: EC; Programme: FP5/?; Funding: 57.000,00€ (57.000,00€)
13. FRF () - Fabrico Rápido de Ferramentas - Dates: 01-01-2003/31-12-2005(); Type: RTD; Role: ; Sponsor: EU/PRIME; Programme: ?/?; Funding: 0,00€ (0,00€)
14. MODI (19143/05/NL/GM) - Simulation of Knowledge Enabled Monitoring and Diagnosis Tool for Mars Lanfer Payloads (monitoring and Diagnosis for Mars Driller) - Dates: 01-05-2005/01-11-2006(18 months); Type: RTD; Role: Prime Contractor; Sponsor: ESA; Programme: ?/; Funding: 250.000,00€ (155.218,00€)
15. NOMDIS () - New Operators for Monitoring and Diagnostic of Intelligent Systems - Dates: 01-08-2005/01-06-2006(9 months); Type: RTD; Role: Prime Contractor; Sponsor: ESA; Programme: ESOC; Funding: 50.000,00€ (22.500,00€)
16. RIAT-AIP () - Network of information and technical support - Dates: 01-01-2004/30-06-2005(); Type: RTD; Role: ; Sponsor: ESA; Programme: ?/; Funding: 0,00€ (0,00€)
17. SARP () - Sistema de Apoio à Realização de Projectos - Dates: 01-06-2003/31-12-2005(); Type: RTD; Role: ;

Sponsor: FCT; Programme: ?/?; Funding: 266.507,20€ (266.507,20€)

18. SEIS () - Space Environment Information System - Dates: 01-08-2003/01-09-2005(); Type: RTD; Role: Prime Contractor; Sponsor: ESA; Programme: ESTEC/; Funding: 200.000,00€ (160.000,00€)

19. SESS () - Space Environment Support System for Telecom and Navigation Missions - Dates: 01-08-2005/01-12-2007(); Type: RTD; Role: Partner; Sponsor: ESA; Programme: ESTEC/; Funding: 400.000,00€ (123.000,00€)

20. Singrar () - Sistema integrado para a gestão de prioridades de reparação e afectação de recursos - Dates: 01-01-2004/31-12-2007(); Type: RTD; Role: ; Sponsor: ?; Programme: ?/?; Funding: 0,00€ (0,00€)

21. Transatlântico () - Organização virtual Luso-Brasileira para PME - Dates: 00-01-1900/00-01-1900(); Type: RTD; Role: Prime Contractor; Sponsor: ?; Programme: ?/?; Funding: 0,00€ (0,00€)

3.2.3. Group B2: Modelling and Control of Distributed Parameter Systems

This research group deals with the development of advanced control algorithms for distributed parameter systems, that is, systems where both time and space are involved in the plant dynamics, modeled by partial differential equations. In particular, the group has been putting a special emphasis in systems with transport phenomena (e.g. heat-exchangers).

This type of systems present additional challenges when compared with the finite order lumped systems, due to the non-linear characteristics, variable delay, anti-resonance and infinite dimension. The generic approach to these problems has been, first, to identify particularities of the problem to find appropriate transformations, in space and/or in time, that simplify the initial problem (e.g. feedback linearization). Secondly, to apply predictive and adaptive control methods, that has been proving to deal, with success, with this type of systems.

Finally, the lessons learned from one particular system, where the intuition could be stronger, have been tried in others more close to intuition, but with the same mathematical structure.

Membership

PhD Members

- Rui Neves da Silva

PhD Students

- Maria Marques
- Ana Rita Campos
- José Manuel Igreja (co-supervision UNL-FCT / UTL-IST)

Other

- Various Students

Theoretical and applied research in MC-DP

The following list presents specific theoretical and applied research developed during the evaluation period with extensions to the present day:

- New control algorithm based on variable-sampling methods applied to the ACUREX solar field. By means of time distortion (discrete time and continuous time do not run in parallel) it is possible to obtain a discrete equivalent of the plant, which is almost-linear. The application of a predictive and adaptive control algorithm has resulted in a level of performance unseen before in this particular plant. From the practical point of view, this has allowed set-point changes three times larger than any of the tested alternative techniques by several European control research groups. This work resulted in two papers at IEEE Transactions on Control Systems Technology - Special issue on control of industrial spatially distributed processes and at IFAC - Control Engineering Practice - Special issue on IFAC-B'02 prize winning applications, both in 2003. More recently (2006), extension of this work has been published as a book chapter in the Springer's "Assessment and Future Directions of Nonlinear Model Predictive Control" volume.



Figure 64 - Acurex solar field in Almería, Spain

- New dual adaptive predictive controller applied to the ACUREX solar field. The major impact of this result is automatically solving the abrupt start-up of the adaptive controller starting from zero knowledge about the plant. This is made by finding the best balance between probing (so the controller can learn) and cautious action (specially at the initial stage). The novelty of this result is the application of this dual approach to the multipredictive and adaptive MUSMAR algorithm, known by its robustness to unmodelled plant dynamics and variable delay. The conjunction of these characteristics with the dual mechanism makes this control algorithm, in practice, almost flawless for a wide range of applications, in particular, the ones covered by this research group (MC-DSP). This work has resulted in a paper published at IEEE Transactions on Control Systems Technology in 2005.
- A proposed new cellular automata model for the car-driver set and its derivation for the distributed parameter system characteristic. The novelty of this model is the model of the human driver based on the control theory. A breakthrough result is the This model was used to build a computer simulator of the traffic behaviour and test some control methodologies (e.g. Fuzzy logic). Additionally, it has been showed that it is possible to get the fundamental diagram of traffic flow from the statistical superposition of these models. This work has been presented at IEEE Conference on Intelligent Transportation Systems (2005), and more recently, at the 2007 American Control Conference, and it is under revision at IEEE Transactions on Intelligent Transportation Systems.

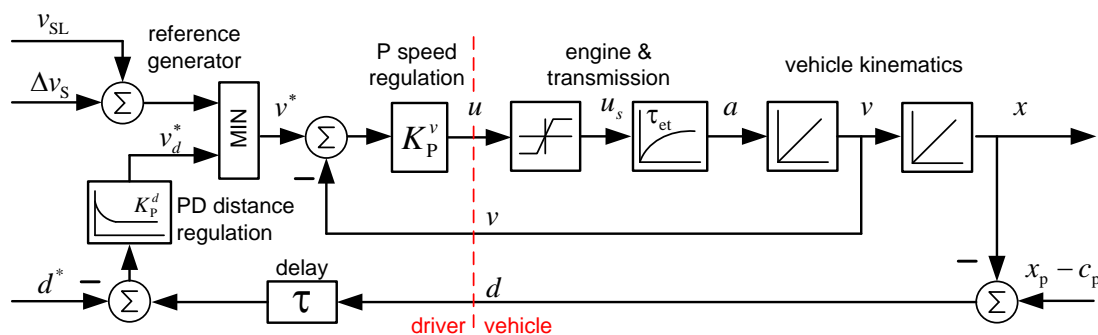


Figure 65 - New proposed driver-vehicle model

- Development of model and simulator for an experimental open canal based on the Saint-Venant equations. This model was used to prepare the application, with success, of the predictive and adaptive MUSMAR controller to the control of the experimental plant in Évora.



Figure 66 - Évora canal

- The work reported above has resulted in one PhD thesis (now ending) with the title: Adaptive control of processes with transport phenomena (in Portuguese) and one MSc thesis with the title: Methods for simulation and control for road traffic distributed systems.
- Several incremental advances in the use of predictive adaptive controllers for distributed parameter systems have been disseminated in major conferences such as: IFAC's World Congress (2005 and previously in 2002), European Control Conference (2005 and previously in 2003).

MC-DP Future plans

This path of research will continue active by, at least three more years, with the exploitation of the theoretical results obtained so far in other different application fields. These are the control of open canals and the traffic control in multilane roads.

In the first case, the access to the experimental canal in Évora will allow to continuing to verify, in practice, the results obtained in simulation. This will provide an intuitive perspective on how the control algorithms can be refined to cope with the engineering part of the problem. Open issues are the accessibility to the disturbance signals (consumer requests), the best way to use these signals and the multirate sampling based on each individual pool delay.

In the second case, the recent preliminary contact with BRISA, the biggest highways concessionaire in Portugal (a formerly state-owned company), where the group is preparing a proof of concept study, will eventually open an opportunity to have, also, an engineering insight on the general problem. Open issues are the demonstration of the "capacity drop" phenomena and the development of the best way to avoid it.

Currently, two masters thesis are being developed in these two topics with possible extensions to PhDs.

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
d) Book Chapter				1	1
e) Periodical - International	3		3	2	8
g) Conference Paper (Refereed)	9	17	15	4	45
Grand Total	12	17	18	7	54

Table 38 – Publications by Year for Group B2

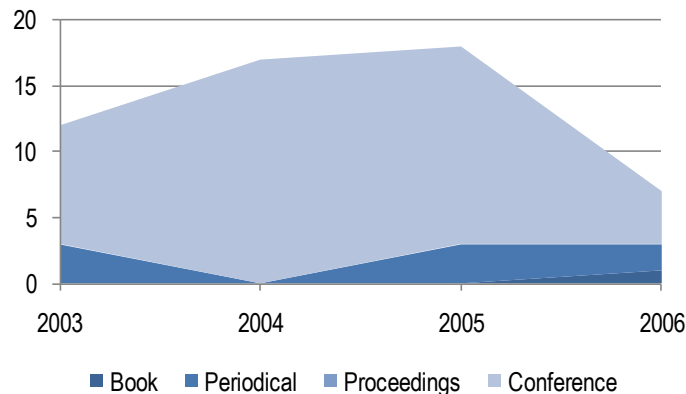


Figure 67 – Evolution of Publications by Year for Group B2

Count of publication	WoS		
Type Table	Yes	Grand Total	
e) Periodical - International	8	8	
g) Conference Paper (Refereed)	45	45	
Grand Total	53	53	

Table 39 – Publications of B2 at ISI Web of Knowledge Indexing Service

Book Chapter

1. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2006. [Controlling distributed hyperbolic plants with adaptive nonlinear model predictive control](#). In: Assessment and Future Directions of Nonlinear Model Predictive Control, Springer..

Papers in International Scientific Periodicals with Referees

1. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2006. [Adaptive Nonlinear Predictive Control of a Distributed Collector Solar Field](#). International Journal on Adaptive Control and Signal Processing. Indexed at ISI Web of Science.
2. Marques, Maria C. and Neves-Silva, Rui. 2006. [Development of traffic flow-density relations from cellular driver-vehicle modelling](#). IEEE Transactions on Intelligent Transportation Systems. Indexed at ISI Web of Science.
3. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2005. [Robust Fault Diagnosis Approach using Analytical and Knowledge-Based Techniques Applied to a Water Tank System](#). International Journal of Engineering Intelligent Systems for Electrical Engineering and Communications, Vol. 13 (4). pp. 237-244. Indexed at ISI Web of Science.
4. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2005. [Robust fault diagnosis approach using analytical and knowledge based techniques applied to a water tank system](#). Journal of Engineering Intelligent Systems, Vol. 13 (4). Indexed at ISI Web of Science.

5. Neves-Silva, Rui and Filatov, N. and Lemos, J. M. and Unbehauen, H.. 2005. [A Dual Approach to Start-up of an Adaptive Predictive Controller](#). IEEE Transactions on Control Systems Technology, Vol. 13 (6). pp. 877-883. *Indexed at ISI Web of Science.*
6. Neves-Silva, Rui and Rato, L. M. and Lemos, J. M.. 2003. [Time scaling internal state predictive control of a solar plant](#). Control Engineering Practice, Vol. 11 (12). pp. 1459-1467. *Indexed at ISI Web of Science.*
7. Neves-Silva, Rui and Lemos, J. M. and Rato, L. M.. 2003. [Variable sampling adaptive control of a distributed collector solar field](#). IEEE Transactions on Control Systems Technology, Vol. 11 (5). pp. 765-772. *Indexed at ISI Web of Science.*
8. Neves-Silva, Rui and Rato, L. M. and Lemos, J. M.. 2003. [Scaling internal state predictive control of a solar plant](#). Control Engineering Practice, Vol. 11 (12). pp. 1459-1467. *Indexed at ISI Web of Science.*

Papers in Conference Proceedings

1. Palma, Luís and Coito, Fernando and Neves-Silva, Rui and Almeida, Filipe. 2006. [A Neural PCA Approach To Fault Detection and Diagnosis in Nonlinear Dynamical Systems](#). In: International Conference on Knowledge Engineering and Decision Support (ICKEDS'06), 0 9-12 May 2006, Lisboa (PT). *Indexed at ISI Web of Science.*
2. Campos, A. R. and Pina, P. and Neves-Silva, Rui. 2006. [Supporting distributed collaborative work in manufacturing industry](#). In: II IEEE International Conference on Collaborative Computing, 17-20 Nov 2006, Atlanta. *Indexed at ISI Web of Science.*
3. Coito, Fernando and Gomes, Luís. 2006. [Remotos e Virtuais: situação e perspectivas no DEE da FCT da UNL](#). In: Laboratórios Remotos e Virtuais 2006, Aveiro (PT). *Indexed at ISI Web of Science.*
4. Marques, Maria C. and Neves-Silva, Rui. 2006. [A systems theory approach to the development of traffic flow-density models](#). In: XI IFAC Symposium on Control in Transportation Systems, Delft (NL). *Indexed at ISI Web of Science.*
5. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2005. [Diagnosis of Parametric Faults Based on Identification and Statistical Methods](#). In: 44th IEEE Conference on Decision and Control, and European Control Conference, Joint CDC - ECC 2005, 12-15 December, Seville, (ES). *Indexed at ISI Web of Science.*
6. Coito, Fernando and Almeida, P. and Palma, Luís. 2005. [SMCRVI-A Labview1/Matlab2 Based Tool for Remote Monitoring and Control](#). In: ETFA 2005 - 10th IEEE International Conference on Emerging Technologies and Factory Automation, 19-22 Sept, Catania (IT). *Indexed at ISI Web of Science.*
7. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2005. [A Combined Approach to Fault Diagnosis based on Principal Components and Influence Matrix](#). In: IEEE International Symposium on Intelligent Signal Processing, WISP'05, 01-03 Sept 2005, Faro (PT). *Indexed at ISI Web of Science.*
8. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2005. [Process Fault Diagnosis Approach based on Neural Observers](#). In: 10th IEEE International Conference on Emerging Technologies and Factory Automation, 19-22 Sept 2005, Catania (IT). *Indexed at ISI Web of Science.*
9. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2005. [Adaptive Receding Horizon Control of a Distributed Collector Solar Field](#). In: 44th IEEE Conference on Decision and Control & European Control Conference ECC 2005, Sevilha (ES). *Indexed at ISI Web of Science.*
10. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2005. [Adaptive Receding Horizon Control of Tubular Bioreactors](#). In: 44th IEEE Conference on Decision and Control & European Control Conference ECC 2005, Sevilha (ES). *Indexed at ISI Web of Science.*
11. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2005. [Controlling Distributed Hyperbolic Plants with Adaptive Nonlinear Model Predictive Control](#). In: Int. Workshop on Nonlinear Model Predictive Control NMPC'05, Freudenstadt-Lauterbad (DE). *Indexed at ISI Web of Science.*
12. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2005. [Nonlinear predictive control of a solar plant based on reduced complexity models](#). In: XVI IFAC World Congress, Praga (CZ). *Indexed at ISI Web of Science.*
13. Marques, Maria C. and Neves-Silva, Rui. 2005. [Traffic simulation for intelligent transportation systems development](#). In: IEEE Conf. on Intelligent Transportation Syst. - ITSC '05. Viena, Viena (AT). *Indexed at ISI Web of Science.*
14. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2005. [A combined approach to fault diagnosis based on principal components and influence matrix](#). In: IEEE International Workshop on Intelligent Signal Processing, Faro (PT). *Indexed at ISI Web of Science.*
15. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2005. [Diagnosis of Parametric Faults Based on Identification and Statistical Methods](#). In: 44th IEEE Conference on Decision and Control & European Control Conference ECC 2005, Sevilha (ES). *Indexed at ISI Web of Science.*

16. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2005. [Process fault diagnosis approach based on neural observers](#). In: X IEEE International Conference on Emerging Technologies and Factory Automation, Catania (IT). *Indexed at ISI Web of Science*.
17. Neves-Silva, Rui and Lemos, J. M.. 2005. [Predictive Adaptive feedforward control of a time scaled solar plant](#). In: XVI IFAC World Congress, Praga (CZ). *Indexed at ISI Web of Science*.
18. Coito, Fernando and Palma, Luís. 2004. [An Environment for Remote Control – The ERC System](#). In: - 1st International Workshop on E-Learning and Virtual and Remote Laboratories (VIRTUAL-LAB'2004), 25-28 August 2004, Setúbal (PT). *Indexed at ISI Web of Science*.
19. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2004. [A Combined Approach to Fault Diagnosis in Dynamic Systems – Application to the Three-Tank Benchmark](#). In: 1st International Conference on Informatics in Control, Automation, and Robotics (ICINCO 2004), 25-28 Sept 2004, Setúbal (PT). *Indexed at ISI Web of Science*.
20. Palma, Luís B. and Coito, Fernando and Neves-Silva, Rui. 2004. [Robust Fault Diagnosis Approach using Analytical and Knowledge-Based Techniques Applied to a Water Tank System](#). In: International Conference on Knowledge Engineering and Decision Support (ICKEDS'04), 21-23 July 2004, Porto (PT). *Indexed at ISI Web of Science*.
21. Palma, Luís B. and Coito, Fernando and Neves-Silva, Rui. 2004. [Sensor Fault Diagnosis based on Neural Observers and Parameter Estimation – Application to the Three-Tank Benchmark](#). In: 6th Portuguese Conference on Automatic Control, Controlo 2004, 07-09 June 2004, Univ. of Algarve (PT). *Indexed at ISI Web of Science*.
22. Campos, A. R. and Neves-Silva, Rui. 2004. [Multimodel Knowledge Base Fault Detection and Isolation System](#). In: IASTED Conf. on Modelling, Ident. and Control, Grindelwald (CH). *Indexed at ISI Web of Science*.
23. Campos, A. R. and Stokic, D. and Neves-Silva, Rui. 2004. [Integrated approach for innovation and problem solving dynamic virtual enterprises](#). In: II IEEE Int. Conf. on Industrial Informatics, Berlin (DE). *Indexed at ISI Web of Science*.
24. Caporaletti, G. and Marques, Maria C. and Neves-Silva, Rui. 2004. [Advanced automated algorithm generation software in the control of a solar power plant](#). In: IASTED Conf. on Modelling, Ident. and Control, Grindelwald (CH). *Indexed at ISI Web of Science*.
25. Igreja, J. M. and Lemos, J. M. and Rouchon, P. and Neves-Silva, Rui. 2004. [Dynamic motion planning of a distributed collector solar field](#). In: VI IFAC Symposium on Nonlinear Control Systems, Stuttgart (DE). *Indexed at ISI Web of Science*.
26. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2004. [Dynamic motion planning for a spray dryer plant](#). In: VI Portuguese Conference on Automatic Control, Faro. *Indexed at ISI Web of Science*.
27. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2004. [Flatness based adaptive tracking control for a distributed collector solar field](#). In: XVI Int. Symp. on Mathematical Theory of Networks and Systems, Leuven (BE). *Indexed at ISI Web of Science*.
28. Igreja, J. M. and Lemos, J. M. and Neves-Silva, Rui. 2004. [Variable sampling rate observers for state estimation in distributed collector solar fields](#). In: VI IFAC Symposium on Nonlinear Control Systems, Stuttgart (DE). *Indexed at ISI Web of Science*.
29. Lemos, J. M. and Neves-Silva, Rui. 2004. [Time sampling of dynamic systems using semigroup decomposition methods](#). In: VI Portuguese Conf. on Automatic Control, Faro. *Indexed at ISI Web of Science*.
30. Marques, Maria C. and Neves-Silva, Rui. 2004. [Road traffic simulation for control methods development](#). In: VI Portuguese Conference on Automatic Control, Faro, Portugal. *Indexed at ISI Web of Science*.
31. Palma, Luís B. and Coito, Fernando and Neves-Silva, Rui. 2004. [A combined approach to fault diagnosis in dynamic systems](#). In: I International Conference on Informatics in Control, Automation and Robotics, 25-28 Aug 2004, Setúbal (PT). *Indexed at ISI Web of Science*.
32. Palma, Luís B. and Coito, Fernando and Neves-Silva, Rui. 2004. [Robust fault diagnosis approach using analytical and knowledge based techniques applied to a water tank system](#). In: I Int. Conf. on Knowledge Engineering and Decision Support, Porto (PT). *Indexed at ISI Web of Science*.
33. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2004. [Sensor fault diagnosis based on neural observers and parameter estimation – application to the three-tank benchmark](#). In: VI Portuguese Conf. on Automatic Control, Faro. *Indexed at ISI Web of Science*.
34. Neves-Silva, Rui and Lemos, J. M.. 2004. [Industrial applications of predictive adaptive control: the MUSMAR algorithm](#). In: 2nd International Symposium on Spraydrying, Cork (IE). *Indexed at ISI Web of Science*.
35. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2003. [Fault Diagnosis based on Black-Box Models with Application to a Liquid-Level System](#). In: IEEE International Conference on Emerging Technologies and Factory Automation (ETFA'03), 16-19 Sept 2003, Lisboa (PT). *Indexed at ISI Web of Science*.

36. Palma, Luís and Neves-Silva, Rui and Coito, Fernando. 2003. [Fault Tolerant Control Approach applied to the Three-Tank System](#). In: 8th Portuguese-Spanish Congress in Electrical Engineering (8CLEEE), 03-05 July 2003, Vilamoura, (PT). *Indexed at ISI Web of Science*.
37. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2003. [Neural Observer-Based Approach to Fault Diagnosis applied to a Liquid Level System](#). In: IFAC International Conference on Intelligent Control Systems and Signal Processing, ICONS 2003, 08-11 April 2003, Univ. of Algarve (PT). *Indexed at ISI Web of Science*.
38. Igreja, J. M. and Lemos, J. M. and Barão, M. and Neves-Silva, Rui. 2003. [Adaptive nonlinear control of a distributed collector solar field](#). In: VII European Control Conference, Cambridge (UK). *Indexed at ISI Web of Science*.
39. Lemos, J. M. and Neves-Silva, Rui. 2003. [Controller design for plants involving transport phenomena using the Wei-Norman technique](#). In: XVI International Conference on Systems Engineering, Coventry (UK). *Indexed at ISI Web of Science*.
40. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2003. [Failure Analysis on a Process Plant Model Based on Adaptive Filter Techniques](#). In: ICEFA-I 2004: First International Conference on Engineering Failure Analysis, Lisbon (PT). *Indexed at ISI Web of Science*.
41. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2003. [Fault Diagnosis based on Black-Box Models with Application to a Liquid-Level System](#). In: IX IEEE International Conference on Emerging Technologies and Factory Automation, Coventry (UK). *Indexed at ISI Web of Science*.
42. Palma, Luís and Coito, Fernando and Neves-Silva, Rui. 2003. [Neural observer-based approach to fault diagnosis applied to a liquid level system](#). In: IFAC Inter. Conf. on Intelligent Control Syst. and Signal Processing, Faro (PT). *Indexed at ISI Web of Science*.
43. Palma, Luís and Neves-Silva, Rui and Coito, Fernando. 2003. [Fault tolerant control approach applied to the three-tank system](#). In: VII Cong. Luso-Espanhol de Eng. Electr, Vilamoura (PT). *Indexed at ISI Web of Science*.
44. Coito, Fernando and Lemos, J. M.. 2005. [Adaptive Optimization with Constraints: Convergence and oscillatory behaviour](#). In: IbPRIA 2005 - 2nd Iberian Conference on Pattern Recognition and Image Analysis, Estoril (PT). *Indexed at ISI Web of Science*.
45. Coito, Fernando and Lemos, J. M. and Alves, S. S.. 2005. [Stochastic Extremum Seeking in the Presence of Constraints](#). In: 16th IFAC World Congress, Prague, Czech Republic. *Indexed at ISI Web of Science*.

Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
j) Thesis - MSc			1		1
Grand Total			1		1

Table 40 – Theses by Year for Group B2

MSc Theses

1. Marques, Maria C.. 2005. [Metodologia de Simulação e Controlo em Sistemas Avançados de Gestão de Tráfego Rodoviário](#). MSc thesis, (Neves-Silva, Rui, supervisor), Faculdade de Ciências e Tecnologia/UNL.

Prototypes and Products

1. [EICASLAB](#). EICASLAB is a professional software suite for automatic control design and forecasting – represents an innovative approach to the design of automatic controls. (<http://www.eicaslab.com>) The prototype of this tool has been developed in the scope of ACODUASIS project. <http://www.eicaslab.com> [product]

Projects

1. ACODUASIS (IPS-2001-42068) - Automatic control design using advanced simulation software - Dates: 01-02-2003/31-01-2006(36 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP5/IST; Funding: 1.720.317,00€

(189.900,00€)

2. AMBIDISC (POSI/SRI/36328/99) - Adaptive and nonlinear control of distributed parameter systems with environmental impact - Dates: 01-11-2001/30-10-2004(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: POSI/SRI; Funding: 49.879,79€ (0,00€)

3. FLOW (POSC/EEA-SRI/61188/2004) - Advanced Control of Processes with Transport Phenomena - Dates: 01-03-2005/30-03-2008(); Type: RTD; Role: Prime Contractor; Sponsor: FCT; Programme: POSC/EEA-SRI; Funding: 65.256,00€ (15.720,00€)

4. InAml (FP6-2004-IST-NMP-2-16788) - Innovative Ambient Intelligence Based Services to Support Collaborative Work in Flexible Assembly and Manufacturing Systems - Dates: 01-10-2005/30-09-2008(36 months); Type: RTD; Role: Prime Contractor; Sponsor: EC; Programme: FP6/IST; Funding: 1.449.029,00€ (149.469,00€)

5. InLife (517018) - Integrated Ambient Intelligence and Knowledge-Based Services for Optimal Life-Cycle Impact of Complex Manufacturing and Assembly Lines - Dates: 01-11-2005/31-10-2008(36 months); Type: RTD; Role: Prime Contractor; Sponsor: EC; Programme: FP6/NMP; Funding: 1.698.012,00€ (215.840,00€)

6. SPRAYNET (G1RT-CT-2001-05037) - Technology transfer of application protocols, standards and health/safety criteria for the use of spray drying technology - Dates: 01-02-2002/31-01-2005(36 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP5/GROWTH; Funding: 967.788,00€ (37.680,00€)

7. VET-TREND (B2) (RO/06/B/F/NT175014) - Valorisation of an Experiment-based Training System through a Transnational Educational Network Development - Dates: 01-12-2006/30-11-2008(24 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: Leonardo da Vinci/?; Funding: 289.742,00€ (12.795,50€)

3.3. Line C: Collaborative Networks, Distributed Industrial Systems and Interoperability

Advisory Board

- Guy Doumeingts – Emeritus Professor, University Bordeaux 1, France
- Steve Ray – Chief Manufacturing Systems Integration Division, NIST, USA

Organisation

- Group C1: Collaborative Networks and Distributed Industrial Systems
- Group C2: Interoperability

Publication – Line C

This section focuses on the Publications performance of Research Line C.

Count of publication		Hosted		
Type Table	Year	C1	C2	Grand Total
a) Book - Author	2003	1		1
	2005	1		1
a) Book - Author Total		2		2
b) Book - Editor	2003	1		1
	2004	1		1
	2005	1		1
b) Book - Editor Total		3		3
c) Book - Proceedings	2003		2	2
	2004	3		3
	2005	1		1
	2006	1		1
c) Book - Proceedings Total		5	2	7
d) Book Chapter	2003	1		1
	2004	9		9
	2005	6	1	7
	2006	1	1	2
d) Book Chapter Total		17	2	19
e) Periodical - International	2003	4	2	6
	2004	3		3
	2005	2	2	4
	2006		3	3
e) Periodical - International Total		9	7	16
f) Periodical - National	2004	1		1
f) Periodical - National Total		1		1
g) Conference Paper (Refereed)	2003	8	11	19
	2004	11	19	30
	2005	14	11	25
	2006	16	13	29
g) Conference Paper (Refereed) Total		49	54	103
h) Special Issue	2003	1	4	5
	2004	1		1
	2005		2	2
	2006		3	3
h) Special Issue Total		2	9	11
Grand Total		88	74	162

Table 41 – Publications by research group of research line C

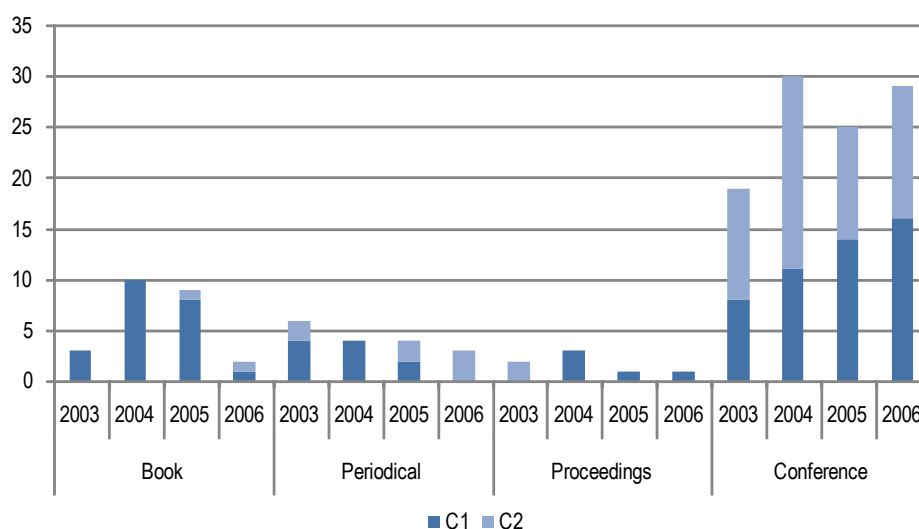


Figure 68 – Publication performance by period year and research group of research line C

Count of publication		Hosted		
Type Table	WoS	C1	C2	Grand Total
e) Periodical - International	No	5	5	10
	Yes	4	2	6
e) Periodical - International Total		9	7	16
g) Conference Paper (Refereed)	No	15	33	48
	Yes	34	21	55
g) Conference Paper (Refereed) Total		49	54	103
Grand Total		58	61	119

Table 42 – Publications of research line C at ISI Web of Knowledge Indexing Service

Theses – Line C

This section presents the theses production figures of Research Line C.

Count of publication		Hosted		
Year	Type Chart	C1	C2	Grand Total
2004	PhD	0	2	2
	MSc	0	1	1
2005	PhD	1	0	1
2006	MSc	2	3	5
Grand Total		3	6	9

Table 43 - Theses Production by Group of Line C

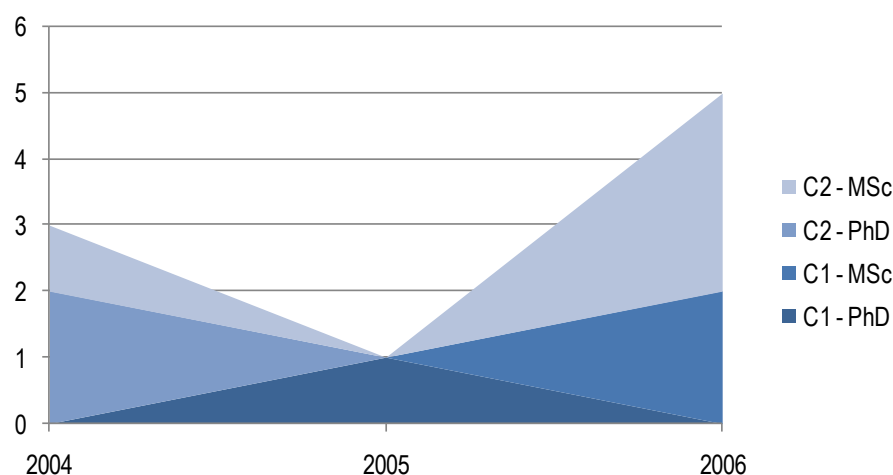


Figure 69 - Evolution of Theses Production of Line C

Funding – Line C

This section focuses analysis on the projects allocated to Research Line C.

Acronym	Hosted	Type	Total Funding	Own Funding	Period Funding
ASSEMBLY-NET	C1	Network	750.500,00 €		0,00 €
ATHENA	C2	RTD	14.399.999,00 €	564.400,00 €	519.842,11 €
AVOEC	C2	RTD	19.951,92 €	4.987,98 €	1.246,99 €
BIOPATTERN (C2)	C2	Network	2.666.666,67 €	133.289,58 €	99.967,19 €
CE-NET II	C1	Network	732.000,00 €	15.888,00 €	6.809,14 €
CIT-EU	C2	RTD			0,00 €
CoSpaces	C2	RTD	8.000.000,00 €	365.080,00 €	69.539,05 €
ECOLEAD	C1	Network	9.747.001,00 €	1.079.920,00 €	742.445,00 €
EUPASS	C1	RTD	10.709.183,00 €	278.520,00 €	148.148,94 €
FUNSIEC	C2	RTD	307.008,00 €	48.289,00 €	48.289,00 €
IDEAS	C2	RTD	399.993,00 €	30.242,00 €	12.600,83 €
INNOVAFUN	C2	RTD	799.996,00 €	250.439,00 €	20.869,92 €
INTEROP	C2	Network	6.500.000,00 €	226.160,00 €	226.160,00 €
prodAEC	C2	RTD	381.584,00 €	147.241,00 €	87.253,93 €
SEEMSEED	C2	RTD	1.499.393,00 €	176.968,00 €	176.968,00 €
SMART-FM	C2	RTD	1.770.854,00 €	295.201,00 €	237.800,81 €
STAND-INN	C2	RTD	987.405,00 €	28.503,00 €	4.560,48 €
TeleCARE	C1	RTD	2.857.896,00 €	529.598,00 €	243.328,81 €
THINKcreative	C1	RTD	495.000,00 €	187.470,00 €	74.988,00 €
VIVACE	C2	RTD	43.299.803,00 €	266.746,60 €	200.059,95 €
VOMAP	C1	RTD	449.536,00 €	148.154,00 €	74.077,00 €
VOSTER	C1	Network	1.350.000,00 €	112.161,00 €	63.557,90 €
Grand Total			108.123.769,58 €	4.889.258,16 €	3.058.513,04 €

Table 70 – Projects list for Research Line C

Hosted	Funding 2003	Funding 2004	Funding 2005	Funding 2006	Total Funding
C1	370.230,34 €	300.941,47 €	341.091,49 €	341.091,49 €	1.353.354,79 €
C2	195.961,70 €	567.733,05 €	471.179,34 €	470.284,16 €	1.705.158,25 €
Grand Total	566.192,04 €	868.674,52 €	812.270,83 €	811.375,65 €	3.058.513,04 €

Table 44 - Project funding by period year and research group of Research Line C

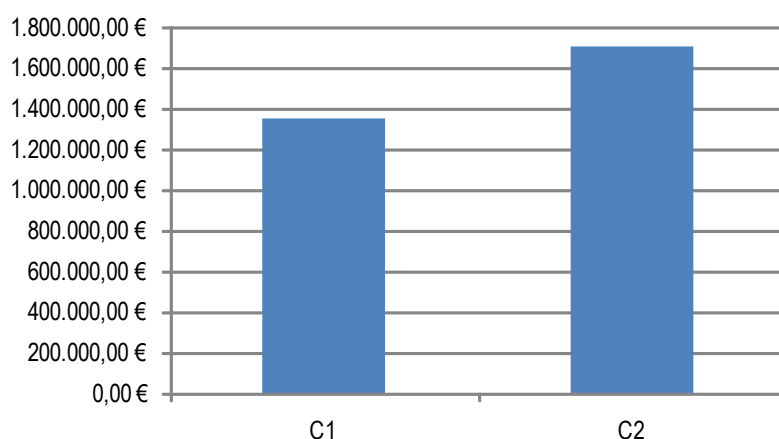


Figure 71 - Project funding by research group of Research Line C

Cooperation – Line C

This section presents the composite analysis of cooperation level for Research Line C.

Count of publication	Year				
ns1:cooperation	2003	2004	2005	2006	Grand Total
worldwide	4	1	1	2	8
regional	12	22	16	14	64
national	3	6	11	9	29
organisation	14	15	9	11	49
group	2	4	4	2	12
none	2	4	4	2	12
Grand Total	35	48	41	38	162

Table 45 – Cooperation levels by year for research line C

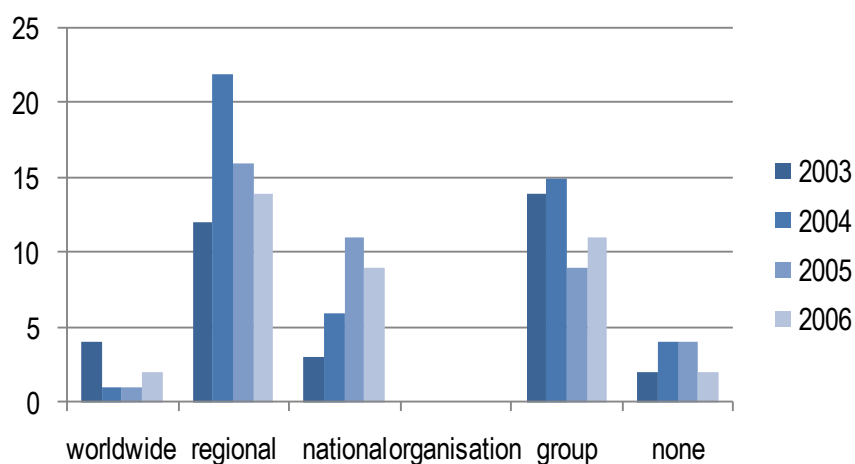


Figure 72 - Cooperation levels by year for research line C

3.3.2. Group C1: Collaborative Networks and Distributed Industrial Systems

Membership

PhD Members

- Luís Camarinha-Matos (Senior Research Coordinator)
- José Barata (Post-doc Researcher, since February 2004)

PhD Students

- A. Abreu (PhD finished in 2007)
- O. Castolo
- J. Rosas
- P. Macedo
- T. Cardoso
- R. Frei

MSc Students

- F. Ferrada (finished in 2006)
- I. Oliveira (finished in 2006)
- Few other students for short periods

Characterization of the research area

CoDIS focus its research activities on the understanding (principles and models) and support (methods, tools, and technologies) for collaborative networks and distributed architectures and systems applied to industry and services.

A large number of new organizational forms have emerged during the last years as a result of the challenges faced by industry, services and the society in general, and are enabled and even boosted by the advances in the ICT. Dynamic and highly integrated supply chains, extended enterprise, virtual enterprises, virtual organizations, virtual organizations breeding environments, professional virtual communities, value constellations, and collaborative virtual laboratories, represent examples of such trend. As such enterprises as well as other organizations and professionals seek complementarities and join their activities in order to participate in a wide variety of competitive business opportunities, for example in new markets or to reach scientific excellence for innovative developments. Similar trends can be identified within the non-profit/social-oriented contexts, e.g., in incident/crisis management, time banks, elderly care networks, etc.). Simultaneously at the shop-floor level a convergent phenomenon is observed.

More and more manufacturing systems are composed of autonomous (progressively more intelligent) components / resources, interconnected by computer networks (a truly ubiquitous computing and sensing environment) forming “coalitions” that need to be easily re-configured as driven by the needs of flexibility and agility. The traditional paradigm of control systems is giving pace to other mechanisms (e.g. coordination, negotiation, fuzzy reasoning, contracting) that are characteristic of collaborative networks, as seen in the most innovative recent proposals for advanced manufacturing systems architectures.

Therefore, the new discipline of Collaborative Networks (CN) provides a uniform paradigm to address such complex and highly dynamic systems.

CoDIS aims at contributing to important research questions in this area, for which novel approaches, models, and mechanisms are being designed and developed, namely:

- Questions related to the theoretical foundation for CN:
 - TQ1: What are the base principles and mechanisms of collaboration? And some further questions related to the CNs:
 - What is a suitable holistic reference model for CN?
 - What is a suitable taxonomic characterization of the variety of CN forms?
 - Can we elaborate more formal models for an area that although promising, since in its infancy, has a quite ad-hoc nature?
 - TQ2: What is a proper value system and benefits model for CN?
 - TQ3: Which approach to CN can improve the agility and ease the re-configurability in manufacturing systems?
- Questions related to the applied research in CN:
 - AQ1: Which system architecture for tool-independent technological ICT infrastructures for CN?
 - AQ2: Which pilot demonstrations provide good representatives for creating scientific and industrial impact in this area?

Research strategy

In pursuing its objectives, CoDIS adopts the following approach:

- Combine the identified and acquired real-world requirements (from the applied and experimental perspective) with the theoretical conceptualization. This is reflected in:
 - Development / experimentation of CN in advanced application scenarios for diverse domains;
 - Seeking contributions from “adjacent” disciplines to systematize and formalize the base knowledge on CN.
- Active engagement with the international community of researchers in this area in order to:
 - Jointly achieve the necessary critical mass (not available in any single institution given the wide scope and highly multidisciplinary nature of CN) to address such complex domain;
 - Pursue a unification of approaches towards common reference models and wider recognition of CN as a new scientific discipline.

Achievements

Achievements. Addressing the open research questions stated above, since 2003 CoDIS has achieved the following novel contributions in scientific research and practice in industry:

Conceptual and base scientific innovations:

3. Major contribution to establishing Collaborative Networks as a new scientific discipline (related to TQ1). Through the characterization of the CN as a new paradigm and defining its multiple manifestations (according to Kuhn’s principles for a new paradigm), the six pillars characterizing this discipline including: the focus of study, paradigm, reference disciplines, principles and practices, research agenda, and education and professionalism are elaborated, in line with the principles of Liles’ et al. Publication of a research “manifesto” defining the discipline is achieved within 2 chapters in Springer books and an article in the Int. J. Intelligent Manufacturing, which was announced by the publisher as the “most downloaded” during 4 months in 2005.

4. Substantial progress towards a reference model for CN (related to TQ1). As a fundamental requirement, the novel ARCON Reference Modeling framework was developed, offering a 3-dimensional approach for model collaborative networks, including: 1) the CN life cycle dimension (with creation, operation, evolution/metamorphosis, and dissolution), 2) the CN In & About perspectives dimension, including the In-CNO perspective (with structural, componential, functional, and behavioral sub-dimensions), and the About-CNO perspective (with market, support, societal, and constituency sub-dimensions), and 3) the CN modeling intent dimension (with general-concepts, specific-modeling, and implementation modeling). The ARCON framework, though benefits from previous modeling approaches, greatly extends the previous frameworks (e.g. CIM-OSA, GERAM, SCOR, Zachman, etc.) that were developed mostly for modeling single enterprises. A clarification of the concept of collaboration in comparison to other concepts (cooperation, coordination, and networking) and the elaboration of a taxonomy of collaborative networks were part of these contributions. A comprehensive map linking the modeling dimensions of the framework with existing theories and approaches (e.g. graph theory, social network analysis, workflow, Petri nets, transaction costs theory, game theory, federated systems, deontic logic, temporal logic, soft computing, self-organization, ...) is included. These results have been adopted by the ECOLEAD European project and are published in several recent IFIP international conferences (PROLAMAT'06 invited keynote, BASYS'06, PRO-VE'06).
5. Benefits model for collaborative networks (related to TQ2). Considering elements from social network analysis, transaction costs theory, game theory, Shapley value, and graph theory a detailed analysis of the value formation processes in CN was made and a novel formal model to represent the network of benefits was established. An extensive set of network-centric indicators was proposed as a conceptual step towards the so-much needed performance indicators for collaborative networks. Based on this model, a contribution to a reciprocity-based theory for sustainable collaboration was made. Axiomatic set theory is used for a characterization of collaborative forms. In addition to publications in relevant conferences (e.g. BASYS'04, PRO-VE'05, PRO-VE'06) this work has led to a PhD thesis (2006). The work also offers the bases for the ongoing research on value systems for CN.
6. Contract-based approach for agile manufacturing (related to TQ3). Departing from the requirements for agility in manufacturing systems, a novel approach for the configuration and synthesis of the control system for agile manufacturing systems was developed. The approach applies the base concepts of collaborative networks to manufacturing systems seen as composed of autonomous ("agentified") mechatronic modules. A contract-based approach is defined for consortium formation and composition of complex skills (combining contracts theory, agency theory, and ontology engineering). Various classes of contracts were defined as the basis for regulating the behavior of the manufacturing agents. In addition to several publications (e.g. IJNVO, JIRS, BASYS'04, IMS Forum 2004) his work has led to a PhD thesis (2004). This conceptual approach is now adopted by the ongoing European EUPASS project.

Applied research achievements

1. System architecture for the ICT infrastructure for CN (related to AQ1). System architectures for generic platforms for collaboration and implementation prototypes were developed for three main technological approaches (various publications, e.g. J Computers in Industry, IJ CIM, 2 book chapters, ETFA'03, BASYS'04, SAINT'05):
 - Transaction-oriented / component-based infrastructure, focusing on the integration of components for flexible security infrastructure, federated information management, EDI, PDM, and workflow-based coordination.

- Multi-agent based infrastructure, extending the mobile agent paradigm (Aglets system) with new passport-based and biometry-based security, agents' persistency, and flexible communication mechanisms.
 - Service-oriented infrastructure, providing new mechanisms for value-added services composition in the tourism industry.
2. Integrated service-oriented collaborative networks applied to elderly care (related to AQ1 & AQ2). The collaborative networks paradigm combined with adequate tools to support the cooperation of social care assistants, health care professionals, elderly people, and their relatives, was proposed as an approach to reduce the overwhelming care provision costs and to increase their quality. A system's architecture for a flexible platform based on adaptive mobile agents and information federation mechanisms over Internet was proposed and implemented, as well as a number of vertical services for telecare. The developed prototypes were evaluated in extensive field tests in the regions of Andalucia and Navarra (Spain) (4 papers in journals, 5 papers in conferences, 1 book chapter; 1 MSc thesis and 1 ongoing PhD thesis).
 3. Support infrastructure for time bank collaborative network (related to AQ1). The concepts of virtual community and time bank were integrated and adapted as a vertical service for elderly care, supported by a mobile-agent based distributed service implementation over Internet (1 MSc thesis, 1 journal paper, 1 chapter in an Encyclopedia, IDEA Group).
 4. Comprehensive synthesis of the state-of-the-art study on Virtual Organizations (related to AQ1&AQ2). As an effort to systematize and consolidate the disperse empiric knowledge on virtual organizations, results from 38 international research projects and several existing collaborative networks in industry were analyzed and synthesized under an European action coordinated by CoDIS (a multi-author book by Springer, 1 paper at ETFA'03).
 5. Achieving COBASA prototype for assembly systems (related to AQ1). A multi-agent based and contract-driven control system was developed for the NovaFlex assembly cell. Legacy controllers were agentified and controlled using agents in order to create an agile complex assembly system. Based on these results, another test case was developed using the MOFA cell (Fisherteknik) to show FESTO company how multi-agent systems can be used to solve problems faced by agile assembly systems. In the sequence of these implementations links with various organizations were established in order to pursue the work towards Evolvable Production Systems, namely:
 - With University of Nottingham (UK) and KTH (SE) for the development of an ontology for the assembly domain;
 - With Electrolux, FESTO, and Masmec companies for the exploitation of research experiences in the development of agile control architectures based on the concept of emergence. In this context one researcher from FESTO stayed at Uninova for a training period;
 - With Schneider Electric (DE) for research on agile control systems based on web services.
 6. Definition of models for VO creation and VO Negotiation wizard (related to AQ1). A detailed process for creation of virtual organizations in the context of VO breeding environments was developed and the functionalities for a negotiation wizard (extending the concept of virtual negotiation room) were developed (papers at PRO-VE'05 and DET'06).
 7. Achieving strategic research roadmaps for CN (related to AQ2), including:
 - A research agenda for collaborative networked organizations (a multi-author book by Springer, international action coordinated by CoDIS);
 - A systematic 10-step roadmapping methodology (1 chapter in a book by Springer);

- A roadmap for research in advanced virtual organizations (1 chapter in book by Springer; 1 paper at PRO-VE'03);
 - A roadmap for future European precision assembly systems (booklet by Royal Institute of Technology, Stockholm, Sweden; 1 paper at ISATP'03);
 - Roadmap for Mine Action Robotic Technology Development (1 paper in Journal of Mine Action).
8. Reference curriculum for education in CN (related to AQ2). Considering that education plays a vital role in the development of any scientific discipline as well as in facilitating the dissemination and broad acceptance of its results, an effort was put in the development of a reference curriculum for education on collaborative networks. In collaboration with the University of Amsterdam (NL) and Federal University of Santa Catarina (BR), and extensive world-wide survey was conducted on the current offer and needs in the area and a first draft curriculum was proposed for discussion (papers at PRO-VE'04, CIRP ISMS'05, short article in IFIP Newsletter). This curriculum is already being tested at the New University of Lisbon and the other involved universities and the feedback and additional contributions being collected from other colleagues will be used for the preparation of the final proposal.

Newly pursued challenges

Current research of CoDIS focuses on:

- Pursuing the development of a reference model for collaborative networks and contributions to define a sounder theoretical foundation for the area.
- Development of a theoretical and formal basis for value systems in collaborative networks, leading to a better understanding of the mechanisms of value creation in collaborative networks (combining axiomatic set theory and soft computing methods).
- Develop soft computing methods for risk analysis and management in collaborative networks.
- Creation of a theoretical framework to exploit emergence, artificial life (swarm algorithms), self-organization, complexity/non-linear dynamics, and chaos theory in Evolvable Production Systems.
- Pursuing a unified collaborative networks based approach for manufacturing system, both at (agile) shop-floor and inter-organizational levels, following a balanced automation systems approach (combining agile self-organizing systems with anthropocentric systems).
- Developing advanced pilot cases of collaborative networks in collaboration with other academic partners and industry SME networks (e.g. Swiss-Chinese Microtech network, Spanish Helice network, German CeBeNetwork, Mexican IECOS network).
- Applying the collaborative networks paradigm to the management of energy production and distribution networks.

Training of new researchers

CoDIS plays an active role in the education of young researchers in the focused area of research in an effort to increase the critical mass in the area. In the period under analysis (since 2003), the following main actions were performed:

- Post-doc: 1 post-doc (José Barata) is involved in the group (since Feb 2004 when he finished his PhD). Progressive autonomy and guidance to establish his line of research were given, namely through the allocation of a leading role in two international projects (AssemblyNet and EUPASS), support for the creation of his working group (various students), and progressive involvement in international program committees of conferences and other organizations. He was also encouraged to, and supported in

creating his own sub-group and is already supervising a PhD student. A new post-doc (António Abreu) started in 2007, after the defense of his PhD thesis (defended in Mar 07).

- **PhD studies:** 6 PhD students were involved as key members of the group during this period, namely António Abreu, from Mechanical and Industrial Engineering Department, UNL (thesis submitted in 2006 and defended in 2007), Octavio Castolo, from Mexico (thesis to be defended), João Rosas, from Electrical Engineering Department, UNL (started in 2005), Patrícia Macedo, from Polytechnic Institute of Setubal (started in 2005), Tiago Cardoso, from Electrical Engineering Department, UNL (started in 2006), and Regina Frei, from Switzerland (started in 2006). These students are involved in the international projects of the group and, as such participate in the international meetings and other project activities, which from the very beginning expose them to an international collaborative research environment. They are also encouraged to publish and present papers at international conferences (from the early results stage) and to publish in international journals towards the end of their dissertation work. Participation of PhD students in international conferences and workshops since 2003: A. Abreu – 8; O. Castolo – 2; J. Rosas – 1; P. Macedo – 2; T. Cardoso – 1; R. Frei – 1.
- **MSc studies:** 2 MSc students developed their thesis in the group in this period (Filipa Ferrada and Inês Oliveira) (concluded in 2006). Similarly to the PhD students, they are involved in the international research projects, participating in meetings where they give presentations, and already have international publications and presentations in conferences. Participation of MSc students in international conferences and workshops since 2003: I. Oliveira – 3, F. Ferrada – 1. After the defense of their MSc dissertations the plan is to continue for the PhD. Please note that this master program followed a pre-Bologna model, therefore it represents a 2-year program after the conclusion of a 5-year engineering program.
- **Other actions:** During this period the group contributed to the training of other young researchers that stayed with us for short periods, namely: Edmilson Klen, from Federal University of Santa Catarina, Brazil (4 months in 2005), Dario Franco, from University of Valencia, Spain (3 months in 2005), Johannes Hoos, Researcher from FESTO (1 week). Various undergraduate students from the New University of Lisbon have also been involved in the activities of the group, namely for the realization of their final course project.

Elements of national and international recognition

During the period under analysis CoDIS members had an active involvement in the national and international scientific community, namely:

- **Involvement in Scientific & technical organizations:** Chairman of IFIP WG5.5 (Cooperation infrastructure for Virtual Enterprises and electronic business); Chairman of IEEE Subcommittee on Collaborative Networks (under TC on Industrial Agents); Chairman of SOCOLNET (International Society of Collaborative Networks), founding members; Chairman of the European Commission projects' cluster on Business Networking – Reference models and technologies; Portuguese representative on IFIP TC5 (Computer Applications in Technology); Membership to various national and international organizations (IEEE, IFAC TC4.4, IFIP WG6.11, IFIP WG5.7, INSTICC, ACM, AAI, ASME, APSIOT, Portuguese Association of Engineers, Portuguese Association of Artificial Intelligence, APSDI- Portuguese Association for the Development of the Information Society, Centre for Business Information, Organisation and Process Management (BIOPoM) of the University of Westminster, UK).
- **Scientific Conferences:** Chairmanship of international conferences (IFIP PRO-VE'03, IEEE ETFA'03 – track chair & Registration chair, IFIP PRO-VE'04, IFIP BASYS'04, TELECare'04, IFIP PRO-VE'05, IFIP BASYS'06–co-chair, IFIP PRO-VE'05, IFIP PRO-VE'07), Membership of the Program Committees (CESA 2003, IEPM 2003, EXCELLENCE

2003, ICE 2003, ROBÓTICA 2003, IPAS 2003, I3E 2003, COLLECTeR'03, VRAP 2003, ISATP 2003, INDIN 2003, DEXA'03, HOLOMAS 2003, ETFA'03, ODAM7, HAPM'03, PDT 2003, IPAS 2004, ICEIS 2004, ABS 2004, CSCWD 2004, ICE 2004, World Computer Congress 2004, ICINCO 2004, DEXA'04, INES'04, AIS'04, ICEIMT'04, DISM'04, ICMA 2004, BASYS'04, PRO-VE'04, PDT 2004, SAINT 2005, ABS 2005, ROBOTICA 2005, CTS 2005, IESM'05, CSCWD 2005, ICEIS 2005, ISC 2005, ICE 2005, ACIT 2005, PLM'05, DEXA'05, HOLOMAS 2005, ICINCO 2005, INES 2005, ESM 2005, CAI 2005, BAOSW'05, SOAS 2005, PDT 2005, PRO-VE'05, INDIN'05, ISC 2005, ETFA 2005, JETC 2005, SAINT 2006, CSCWD 2006, CTS 2006, INCOM 2006, ICEIS 2006, ICS 2006, PROLAMAT'06, ICE 2006, INES 2006, DET 2006, SOAS 2006, KES 2006, EAR 2006, PRO-VE'06, BASYS'06, PDM 2006, SAINT'07, COA 2007, CSCWD 2007, ICINCO 2007, IRMA 2007, CTS 2007, IESM'07, ICE 2007, TEAR 2007, ISC 2007, ICEIS 2007, INES 2007, ICABS'2007, DEXA 2007, HOLOMAS 2007, APMS 2007, DET 2007, SOAS 2007, CEA'07, ICEGOV2007, ICDCIT2007).

- Editorial boards of journals: Robótica e Automação, Porto; Studies in Informatics and Control, Bucharest; Computación y Sistemas – Revista Iberoamericana de Computación (Associated Editor), Mexico; Journal of Intelligent and Robotics Systems; International Journal of Networking and Virtual Organisations (Associated Editor, till Jun 2006), Inderscience, UK; International Journal of Information Technology and Management (Inderscience); Revista Produção on Line, Brazil; Revista Produção, Brazil; International Journal of Logistics Systems and Management; International Journal of Agile Systems and Management; Multiagent and Grid Systems – An International Journal” (IOS Press); International Journal of Mobile Learning and Organisation (Inderscience); IEEE Transactions on Industrial Informatics (Associated Editor); European Journal of Industrial Engineering (EJIE) (Associated Editor).
- Membership on evaluation panels (for research projects and proposals): CRUP (Conselho de Reitores das Universidades Portuguesas), Programa de Acções Integradas (Jun 2003); Agência de Inovação, Programa IDEA – Investigação e Desenvolvimento Empresarial Aplicado (Jun-Jul 2003); The Research Council of Norway (Aug 2003); Research Grants Council of Hong Kong, University Grants Committee (Jan/Mar 2004); Agência de Inovação, Program IDEA (Jun-Jul 2004); CRUP (Conselho de Reitores das Universidades Portuguesas), Programa de Acções Integradas (29 Jul 2004); IMAGINE CUP, Microsoft Portugal (17 May 2005); Sixth EU Framework Programme for Research and Technological Development (2006).
- Award: The group leader was awarded in 2005 with the IFIP Outstanding Service Award in the IFIP General Assembly (Sep 2005).
- Invited talks: Keynotes at international conferences: 5; other invited talks / seminars (without paper): 18.
- Membership of PhD examination boards: University of Minho (Jan 2003), FEUP (Jun 2003), University of Minho (Jul 2003), UNL (Feb 2004), Royal Institute of Technology, Stockholm (May 2004), University of Minho (Jul 2004), FEUP (Jul 2004), University of Trás-os-Montes e Alto Douro (Jul 2004), UNL (Nov 2004), ISCTE (Jul 2006), Royal Institute of Technology, Stockholm (Mar 2006), University of Nottingham (May 2006), UNL (Mar 2007), Univ. Coimbra (Sep 2007), Univ. Amsterdam (Oct 2007).
- Membership of other academic examination boards: “Habilitation” exam (Agregação), University of Coimbra (2004); “Habilitation” exam (“Agregação”), University of Porto (2005); MSc exam, University of Porto (Mar 2003); Associate professorship application, University of Coimbra (2003); Associate professorship application, University of Coimbra (2005); Associate professorship application, University of Coimbra (2006), “Habilitation” exam (“Agregação”), UNL (2007); “Habilitation” exam (“Agregação”), UNL (2007).

Publication strategy

Scholarly practice in the area. As it is typical in many new research areas, there is not yet a set of well established journals that are clearly focused on collaborative networks. A large number of new journals focused on this and related areas have appeared recently as a reflection of the rapid growth of the area, but they are not consolidated yet and therefore do not appear in the major citation indexes. Therefore, and also due to the wide scope and multi-disciplinary nature of CN, the research community has been publishing in a disperse way on a large number of journals.

The most common scholar practice is, so far, to publish mainly in highly focused conferences with strict refereeing process, sponsored by recognized professional organizations (e.g. IFIP, IFAC, IEEE) and with proceedings published by major international publishers.

CoDIS members have followed this common practice, although progressively investing more on journals. In 2006, and as a consequence of the new evaluation criteria defined by the national research funding agency as well as other national academic entities, it was decided to change the publication practice and invest more on journal publications.

In an attempt to identify the most relevant journals for publication of CN research results, a survey was conducted with a panel [45] of active international experts in the area. The results are synthesized in the following table.

A large number of recent journals also cover CN topics but their impact has still to be established. Examples: IJ of Agile Systems and Management, Multiagent and Grid Systems – an IJ, IJ of Mobile Learning and Organisation, European J of Industrial Engineering, IJ of Business Data Communications and Networking , J of Electronic Commerce in Organizations, J of Global Information Management, IJ of Cases on Electronic Commerce, IJ of Electronic Commerce, etc.

[45] Panel participants: Ling Liu (Georgia Inst. Tech), Goran Putnik (Univ Minho), Weiming Shen (Nat Research Council Canada), Elsa Estevez (United Nations Univ), Norman Sadeh (Carnegie Mellon University), George Kovacs (Hungarian Academy of Sciences), Paul Grefen (Tech Univ Eindhoven), Jean-Pierre Lorré (EBM), Shahram Dustdar (Tech Univ Vienna), Kazi Abdul Samad (VTT), Rolando Vargas Vallejo (Univ Caxias do Sul), Jim Browne (NUI Galway), Hamideh Afsarmanesh (Univ Amsterdam), José Barata (New Univ Lisbon), Toshiya Kaihara (Kobe Univ), François Vernadat (European Commission), Adamantios Koumpis (ALTEC), Rosanna Fomasiero (ITIA-CNR), Nathalie Galeano (ITESM), Arturo Molina (ITESM), Chima Adiele (Univ Lethbridge), Laszlo Nemes (CSIRO), Arash Aloosh (Mazandaran Univ Science & Tech), Peter Rayson (Tech Innovation Centre), Kim Jansson (VTT), Samuil Angelov (Tech Univ Eindhoven), Luis Camarinha-Matos (New Univ Lisbon), Toni Jarimo (VTT), Fernando Guerrero (Univ Seville), Xavier Boucher (Ecole Nationale Supérieure des Mines de St Etienne).

Journal	Publisher	SCI impact in 2006	Nº of CN articles since 2000	Leading / Well known	Related journal	I am not familiar with
Computers in industry	Elsevier	1.141	43	73,33%	6,67%	20,00%
J. Intelligent Manufacturing	Springer	0.598	31	65,52%	10,34%	24,14%
I. J. Networking & Virtual Organizations	Inderscience	-	48	57,14%	32,14%	10,71%
J. Production Research	Taylor & Francis	0.799	40	57,14%	14,29%	28,57%
I. J. Computer Integrated Manufacturing	Taylor & Francis	0.383	30	57,14%	14,29%	28,57%
J. Production Planning & Control	Taylor & Francis	0.438	18	50,00%	21,43%	28,57%
Data & Knowledge Engineering	Elsevier	1.367	4	46,15%	26,92%	26,92%
IEEE T. Systems, Man & Cybernetics C	IEEE	0.885	3	46,15%	26,92%	26,92%
IEEE Internet Computing	IEEE	1.935	2	44,44%	40,74%	14,81%
J. Robotics & Computer Integrated Manufacturing	Pergamon-Elsevier	0.810	16	40,00%	36,00%	24,00%
CSCW Journal	Springer	-	7	37,04%	37,04%	25,93%
Technovation	Elsevier	0.582		33,33%	33,33%	33,33%
Annual Reviews in Control	Elsevier	0.822		25,00%	55,00%	20,00%
J. Computers & Industrial Engineering	Elsevier	0.650	5	25,00%	50,00%	25,00%
IEEE Trans. Professional Communication	IEEE	-	5	18,52%	14,81%	66,67%
J. Systems and Software	Elsevier	0.592	2	17,39%	26,09%	56,52%
I. J. E-Business Research	Idea Group			16,00%	24,00%	60,00%
I. J. of Integrated Supply Management	Inderscience			16,00%	24,00%	60,00%
J. Information Systems Frontiers	Springer	0.347	29	14,29%	32,14%	53,57%
I. J. of Collaborative Engineering	Inderscience			11,54%	26,92%	61,54%
J. Future Generation Computer Systems	Elsevier	0.722		8,33%	29,17%	62,50%
I. J. Logistics Systems & Management	Inderscience			8,00%	20,00%	72,00%
IEEE T. on Industrial Informatics	IEEE	0.923		4,17%	33,33%	62,50%
I. J. of e-Collaboration	Idea Group			3,85%	42,31%	53,85%
IJ Cooperative Information Systems	World Scientific	0.971		0,00%	66,67%	33,33%

Note: this table also includes some magazines

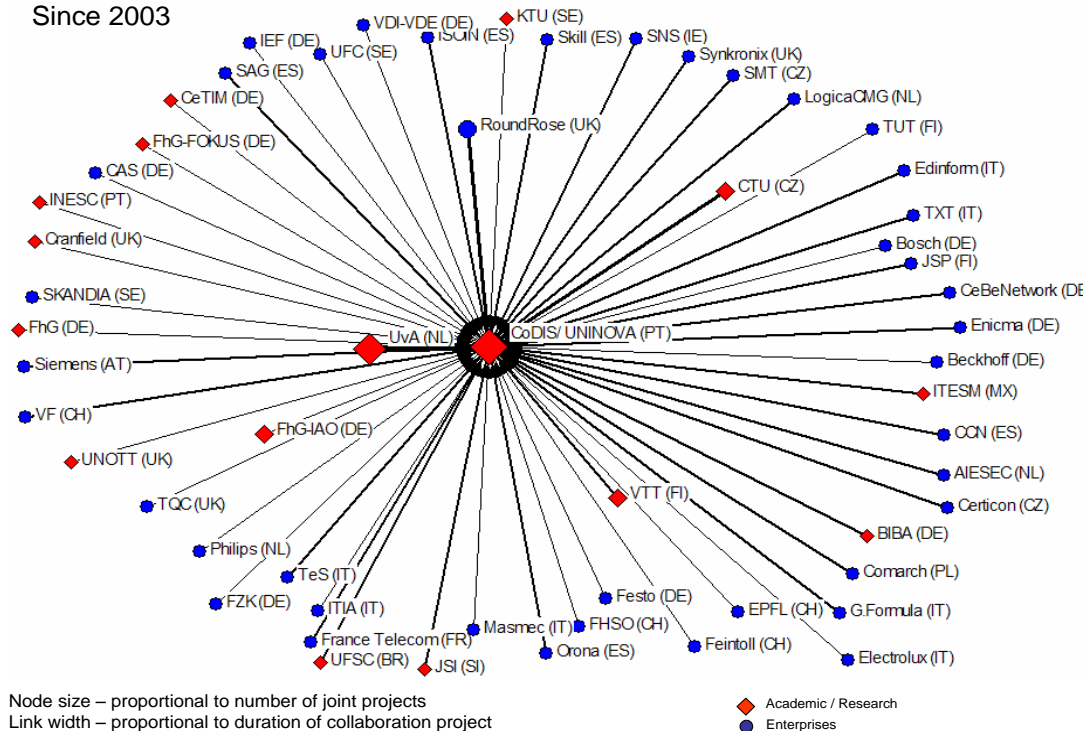
In terms of conferences, the most focused scientific event in the area is the IFIP PRO-VE Working Conference on Virtual Enterprises. Other relevant related conferences where the topic of CN is progressively more represented include: SAINT, DEXA, ICE, BASYS, ETFA, PROLAMAT, CTS, SOAS, etc.

Interactions with other national and international entities

Considering the multidisciplinary nature of Collaborative Networks and thus the need to consider a large diversity of experiences provided by adequate critical mass, CODIS has pursued its activities in an international collaboration framework, namely through EC funded projects. Complementarily, CODIS members have also been active in the context of international organizations such as IFIP, IFAC, IEEE, and SOCOLNET, namely on Technical Committees and Working Groups related to Collaborative Networks.

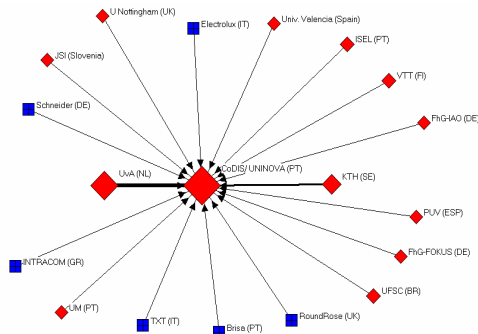
The following diagram shows the main institutions that CODIS has worked with, in joint projects, since 2003.

PROJECTS Since 2003

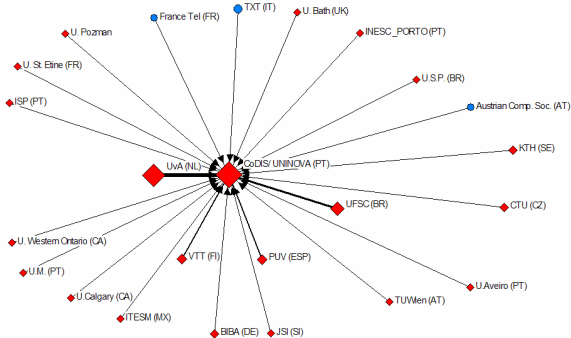


Besides joint projects, other relevant collaboration initiatives are joint publications and organization of scientific events. Next diagrams summary the main indicators in this area.

Joint Publications Since 2003



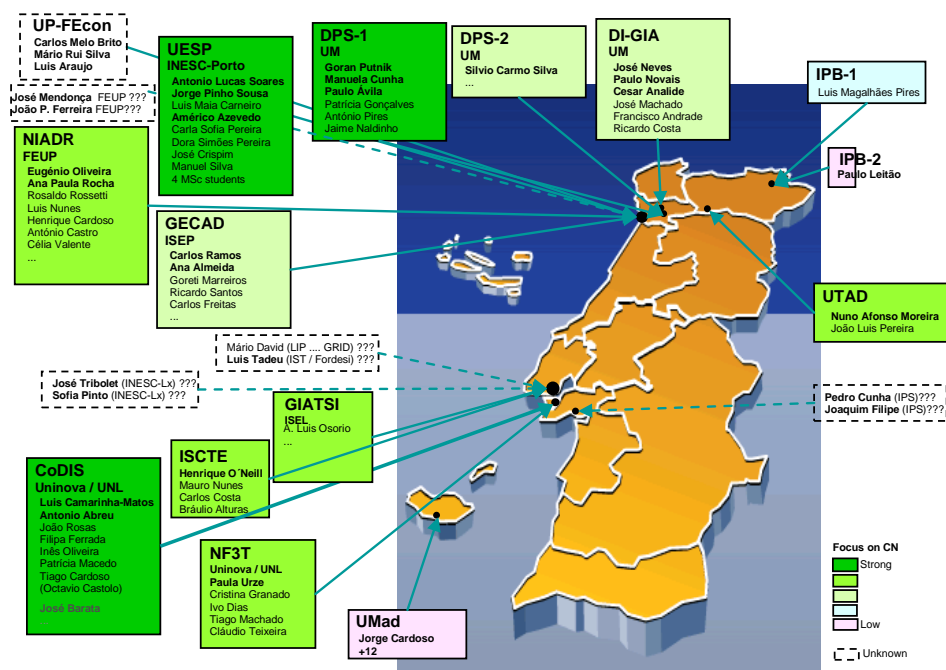
CO-ORGANIZED EVENTS Since 2003



A strategy for national collaboration

At national level, and considering that Collaborative Networks research is done by small groups disperse around the country, CODIS, with some initial support from Microsoft, started an initiative trying to “organize” the various groups around a common goal. The purpose is to elaborate a strategic research roadmap to give more cohesion and consistency to this national community of researchers.

As initial steps, the baseline was characterized, a common vision was defined, and the elaboration of a plan of actions is ongoing. The following diagrams illustrate the situation.



Current characterization of national community:

<p>Strengths</p> <ul style="list-style-type: none"> Theoretical foundation Reference models e-Contracting and negotiation Workflow and business processes Manufacturing networks Some training programs in place Good international visibility Strong involvement in relevant conferences Strong involvement in some organizations (leadership) Reasonable level of conference publications Good international network of contacts 	<p>Weaknesses</p> <ul style="list-style-type: none"> Dispersion, lack of critical mass (too small groups) Lack of collaboration at national level Some overlap of areas, while others are not covered High heterogeneity among groups (very different levels) Only a few groups have strong "international presence" Limited number of journal publications (below international standards) Some groups still suffer from fragmented knowledge Low organizational competence / culture Still low impact on local enterprises Mainly engineering focus; lacking more representation of other areas Limited culture of collaboration among local enterprises
<p>Opportunities</p> <ul style="list-style-type: none"> Creation of a strong world-class "region of excellence" Joint initiatives to access resources Raise visibility of the area at national level Increase international presence in relevant channels (mutual support) Participation in transportation networks policies Exportation of know-how Exploitation of trans-border opportunities (with Spain) 	<p>Threats</p> <ul style="list-style-type: none"> Increased fragmentation due to competition for scarce resources Deviations of research focus due to opportunistic fund seeking Area not yet recognized by "national institutions" Getting distracted with proliferation of new technologies (loosing focus) Required multi-disciplinarity may face difficulties with traditional department barriers Evaluators of project proposals might not be aware of the area

Roadmap for national coordination

Vision. In 5 years the national community of research in collaborative networks will be organized around common strategic objectives, will be driven by a common action plan and coordinated actions, forming a consolidated critical mass towards the recognition of Portugal as a "region of excellence" in this scientific area and a stronger involvement in the socio-economic system.

- Organization of the community as dynamic virtual organizations breeding environment.
- Creation of synergies and complementary of competences.
- Leverage (joint) access to funding sources.
- Increase human resources training.
- Support researchers' careers.
- Create impact in the academy and society.

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
a) Book - Author	1		1		2
b) Book - Editor	1	1	1		3
c) Book - Proceedings		3	1	1	5
d) Book Chapter	1	9	6	1	17
e) Periodical - International	4	3	2		9
f) Periodical - National		1			1
g) Conference Paper (Refereed)	8	11	14	16	49
h) Special Issue	1	1			2
Grand Total	16	29	25	18	88

Table 46 – Publications by Year for Group C1

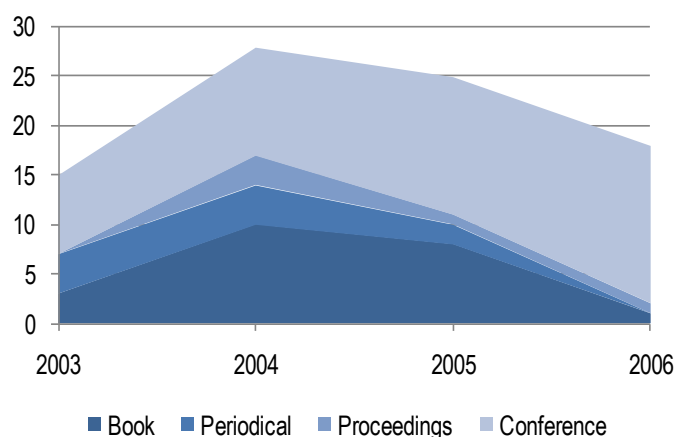


Figure 73 – Evolution of Publications by Year for Group C1

Known citations (SCI, Scholar Google, Google, etc)

1999	2000	2001	2002	2003	2004	2005	2006
72	119	148	152	218	327	247	156

Table 47 – Citations Per year, for **all** past publications [46]

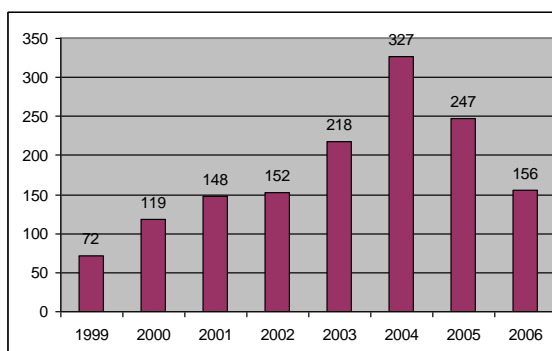


Figure 74 – Citations Per year, for **all** past publications

	2003	2004	2005	2006
Total citations	4	46	108	100
of journal papers	2	14	27	25
of confer. Papers	2	17	32	41
of book chapters		6	19	11
of edited books		9	30	23

Table 48 – Citations for publications from 2003-2006

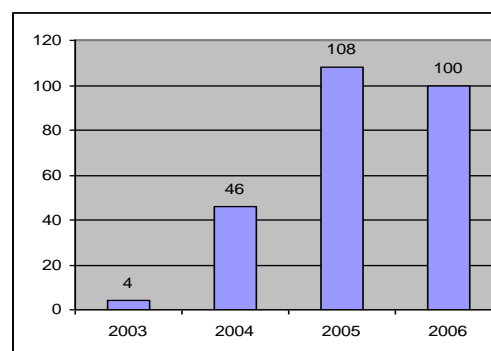


Figure 75 – Citations for publications from 2003-2006

[46] It shall be noted that papers published in 2003 are likely to start having citations only in the following years. That is the reason for the small number of citations in 2003. The higher number (218) in the diagram above includes not only these 4, but also the citations received in 2003 for papers published in previous years.

Count of publication	WoS		
Type Table	No	Yes	Grand Total
e) Periodical - International	5	4	9
g) Conference Paper (Refereed)	15	34	49
Grand Total	20	38	58

Table 49 – Publications of C1 at ISI Web of Knowledge Indexing Service

Book – Author

1. Barata, José. 2005. [Coalition Based Approach For ShopFloor Agility](#). ORION, Lisboa..
2. Onori, M. and Barata, José and Lastra, J. and Tichem, M.. 2003. [European Precision Assembly - Roadmap 2010](#). European Commission. ISBN 91-7283-637-7.

Book – Editor

1. Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds. 2005. [Virtual Organizations: Systems and Practices](#). Springer. ISBN 0387237550.
2. Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds. 2004. [Collaborative networked organizations – A research agenda for emerging business models](#). 1st Print: Kluwer Academic Publishers (sold-out); 2nd Print: Springer. ISBN 978-1-4020-7823-1.
3. Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds. 2003. [Processes and foundations for virtual organizations](#). IFIP International Federation for Information Processing, 134. Kluwer Academic Publishers. ISBN 978-1-4020-7638-1.

Book – Proceedings

1. Camarinha-Matos, Luís and Afsarmanesh, Hamideh and Ollus, M., eds. 2006. [Network-centric collaboration and Supporting Frameworks](#). In: IFIP TC5/WG5.5 - Seventh IFIP Working Conference on Virtual Enterprises, 25-27 Sep 2006, Helsinki, Finland.
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1. Barata, José. 2006. [The CoBASA Architecture as an Answer to Shop Floor Agility](#). In: Manufacturing The Future - Concepts, Technologies, Visions (Kordic, V. and Lazinec, A. and Merdan, M., eds.), pro literatur Verlag, pp. 31-76..
2. Camarinha-Matos, Luís and Ferrada, Filipa. 2005. [Supporting a Virtual Community for the Elderly](#). In: Encyclopedia of Virtual Communities, Idea Group. ISBN 1591405637.
3. Camarinha-Matos, Luís. 2005. [ICT Infrastructures for VO](#). In: Virtual Organizations: Systems and Practices, Springer. ISBN 0387237550.
4. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2005. [Brief historical perspective for virtual organizations](#). In: Virtual Organizations: Systems and Practices, Springer. ISBN 0387237550.
5. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2005. [Collaborative networks: A new scientific discipline](#). In: Virtual Organizations: Systems and Practices, Springer. ISBN 0387237550.
6. Kaletas, E. and Afsarmanesh, Hamideh and Anastasiou, M. and Camarinha-Matos, Luís. 2005. [Emerging technologies and standards](#). In: Virtual Organizations: Systems and Practices, Springer. ISBN 0387237550.

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8. Afsarmanesh, Hamideh and Marik, V. and Camarinha-Matos, Luís. 2004. [Challenges of collaborative networks in Europe](#). In: collaborative networked organizations – a research agenda for emerging business models, Kluwer Academic Publishers. ISBN 1402078234.
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10. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2004. [Emerging behaviour in complex collaborative networks](#). In: Collaborative Networked Organizations – A research agenda for emerging business models, Kluwer Academic Publishers. ISBN 1402078234.
11. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2004. [Formal modelling methods for collaborative networks](#). In: Collaborative Networked organizations – A research agenda for emerging business models, Kluwer Academic Publishers. ISBN 1402078234.
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13. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2004. [Targeting major new trends](#). In: Collaborative Networked Organizations – A research for emerging business models, Kluwer Academic Publishers. ISBN 1402078234.
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15. Camarinha-Matos, Luís and Banahan, E. and Sousa, J. and Sturm, F. and Afsarmanesh, Hamideh and Barata, José and Playfoot, J. and Tschammer, V.. 2004. [Emerging collforms](#). In: Collaborative Networked Organizations – A research agenda for emerging business models, Kluwer Academic Publishers. ISBN 1402078234.
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1. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2005. [Collaborative networks: a new scientific discipline](#). Journal of Intelligent Manufacturing, Vol. 16 (4-5). pp. 439-452. ISSN 09565515. Indexed at ISI Web of Science.
2. Santana, Pedro and Mestre, A. and Barata, José and Flores, L.. 2005. [Roadmap for Mine Action Robotic Technology Development](#). Journal of Mine Action, Vol. 9 (1). pp. 89-91. ISSN 1533-9440.
3. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2004. [TeleCare: collaborative virtual elderly support communities](#). The Journal on In Technology in Healthcare, Vol. 2 (2). pp. 73-86. ISSN 1479-649X.
4. Castolo, Octávio and Ferrada, Filipa and Camarinha-Matos, Luís. 2004. [TeleCARE Time Bank: A Virtual Community supported by mobile agents](#). The Journal on Information Technology in Healthcare, Vol. 2 (2). pp. 119-133. ISSN 1479-649X.
5. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2004. [A multi-agent based infrastructure to support virtual communities in elderly care](#). International Journal of Networking and Virtual Organisations (IJNVO), Vol. 2 (3). pp. 246-266. ISSN 1470-9503.
6. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2003. [Elements of a base VE infrastructure](#). Journal Computers in Industry, Vol. 51 Issue 2. pp. 139-163. Indexed at ISI Web of Science.
7. Camarinha-Matos, Luís and Afsarmanesh, Hamideh and Rabelo, R.. 2003. [Infrastructure developments for agile virtual enterprises](#). Int. Journal of Computer Integrated Manufacturing, Vol. 16 (4-5). pp. 235-254. ISSN 0951192X. Indexed at ISI Web of Science.
8. Barata, José and Camarinha-Matos, Luís. 2003. [Coalitions of manufacturing components for shopfloor agility](#). International Journal of Networking and Virtual Organisations (IJNVO), Vol. 2 (1). pp. 50-77. ISSN 1470-9503.
9. Onori, M. and Camarinha-Matos, Luís and Barata, José. 2003. [European assembly – status report](#). Journal of Assembly Automation, Vol. 23 (1). pp. 8-12. ISSN 0144-5154. Indexed at ISI Web of Science.

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1. Camarinha-Matos, Luís. 2004. [Tecnologia na assistência à terceira idade](#). Revista ROBÓTICA (55). pp. 4-5.

Papers in Conference Proceedings

1. Abreu, António and Camarinha-Matos, Luís. 2006. [On the role of value systems and reciprocity in collaborative environments](#). In: PRO-VE'06, Network-centric collaboration and Supporting Frameworks, 25-27 Sep 2006, Helsinki, Finland. *Indexed at ISI Web of Science*.
2. Barata, José and Cândido, G. and Feijão, F.. 2006. [A Multiagent Based Control System Applied To An Educational Shop Floor](#). In: BASYS'06, Information Technology for Balanced Manufacturing Systems, 04-06 Sep 2006, Ontario, Canada. *Indexed at ISI Web of Science*.
3. Camarinha-Matos, Luís. 2006. [Collaborative networks in industry – Trends and foundations](#). In: DET'06 - 3rd International CIRP Conference in Digital Enterprise Technology, 18-20 Sept 2006. *Indexed at ISI Web of Science*.
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8. Osório, Luís and Camarinha-Matos, Luís. 2006. [Towards a distributed process execution platform for collaborative networks](#). In: BASYS'06, Information Technology for Balanced Manufacturing Systems, 4-6 Sept 2006, Ontario, Canada. *Indexed at ISI Web of Science*.
9. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2006. [Collaborative networks: Value creation in a knowledge society](#). In: PROLAMAT 2006, IFIP Int. Conf. On Knowledge Enterprise – New Challenges, Shanghai (CH). *Indexed at ISI Web of Science*.
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11. Barata, José and Onori, M.. 2006. [Evolvable Assembly and Exploiting Emergent Behaviour](#). In: ISIE'06 - IEEE International Symposium on Industrial Electronics, Montreal, Canada. *Indexed at ISI Web of Science*.
12. Barata, José and Santana, Pedro and Onori, M.. 2006. [Evolvable Assembly Systems: A Development Roadmap](#). In: 12th IFAC Symposium on Information Control Problems in Manufacturing, St Etienne, France.
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14. Maraldo, T. and Onori, M. and Barata, José and Semere, D.. 2006. [Evolvable Assembly Systems: Clarifications and Developments to Date](#). In: CIRP / IWES 6th International Workshop on Emergent Synthesis, Kashiwa, Japan.
15. Santana, Pedro and Cândido, C. and Santos, V. and Barata, José. 2006. [A Motion Controller for Compliant Four-Wheel-Steering Robots](#). In: ROBIO - 2006 IEEE International Conference on Robotics and Biomimetics, Kunming, China. *Indexed at ISI Web of Science*.
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19. Camarinha-Matos, Luís and Afsarmanesh, Hamideh and Ollus, M.. 2005. [ECOLEAD: A holistic approach to creation and management of dynamic virtual organizations](#). In: PRO-VE'05 – Collaborative Networks and their Breeding Environments, 26-28 Sept 2005, Valencia, (ES). *Indexed at ISI Web of Science*.
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Special Issues

1. Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds. 2003. [Special issue on Brokerage and contract negotiation](#). International Journal of Networking and Virtual Organizations, Vol. 2 (1).
2. Afsarmanesh, Hamideh and Camarinha-Matos, Luís, eds. 2004. [Special issue on Infrastructures for New Virtual Organisations](#). International Journal of Networking and Virtual Organizations, Vol. 2 (3).

Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
i) Thesis - PhD			1		1
j) Thesis - MSc				2	2
Grand Total			1	2	3

Table 50 – Theses by Year for Group C1

PhD Theses

1. Barata, José. 2005. [Uma Aproximação Baseada em Coligações para a Agilidade da Planta Fabril Usando Multiagentes](#). PhD thesis, (Camarinha-Matos, Luís, supervisor), FCT/UNL.

MSc Theses

1. Oliveira, Ana Inês. 2006. [Multi-agent Infrastructure for Elderly Care Support](#). MSc thesis, (Camarinha-Matos, Luís, supervisor), Faculdade Ciências e Tecnologia/UNL.
2. Ferrada, Filipa. 2006. [Telecare time bank: a virtual community in the elderly care domain](#). MSc thesis, (Camarinha-Matos, Luís, supervisor), Faculdade Ciências e Tecnologia/UNL.

Projects

1. ASSEMBLY-NET (GTC2-2000-33070) - Precision Assembly Technologies for Mini and Micro Products - Dates: 01-10-2001/31-08-2004(); Type: Network; Role: Partner; Sponsor: EC; Programme: FP5/GROWTH; Funding: 750.500,00€

(0,00€)

2. CE-NET II (IST-1999-29107) - Concurrent Enterprise Network of Excellence - Dates: 01-01-2001/30-06-2004(42 months); Type: Network; Role: Partner; Sponsor: EC; Programme: FP5/IST; Funding: 732.000,00€ (15.888,00€)
3. ECOLEAD (IST 506958) - European Collaborative Networked Organizations Leadership Initiative - Dates: 01-04-2004/31-03-2008(48 months); Type: Network; Role: Scientific Coordination; Sponsor: EC; Programme: FP6/IST; Funding: 9.747.001,00€ (1.079.920,00€)
4. EUPASS (507978) - Evolvable Ultra-Precision assembly Systems - Dates: 10-12-2004/31-10-2008(); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/?; Funding: 10.709.183,00€ (278.520,00€)
5. TeleCARE (IST-2000-27607) - A Multi-Agent Tele-Supervision System for Elderly Care - Dates: 01-05-2001/31-05-2004(37 months); Type: RTD; Role: Prime Contractor; Sponsor: EC; Programme: FP5/IST; Funding: 2.857.896,00€ (529.598,00€)
6. THINKcreative (IST-2000-29478) - Thinking network of experts on emerging smart organizations - Dates: 01-07-2001/31-12-2003(30 months); Type: RTD; Role: Prime Contractor; Sponsor: EC; Programme: FP5/IST; Funding: 495.000,00€ (187.470,00€)
7. VOMAP (IST-2001-38379) - Roadmap design for collaborative virtual organizations in dynamic business ecosystems - Dates: 01-07-2002/30-06-2003(12 months); Type: RTD; Role: Prime Contractor; Sponsor: EC; Programme: FP5/IST; Funding: 449.536,00€ (148.154,00€)
8. VOSTER (IST-2001-32031) - Network of Excellence on Virtual Organizations - Dates: 01-12-2001/31-05-2004(30 months); Type: Network; Role: Partner; Sponsor: EC; Programme: FP5/IST; Funding: 1.350.000,00€ (112.161,00€)

3.3.3. Group C2: Interoperability

Membership

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Introduction

A research domain [47]

Research is by its nature speculative and open-ended. It is carried out for the purpose of addressing how to solve class or domain oriented problems. Therefore, research areas should not be prescriptive, in terms of methods, techniques, solutions, variety of implementation of solutions, regardless the way those solutions are provided, or who provided those solutions. Research must take into account the state-of-the-art, and the state-of-practice, as contributions for defining a baseline of the research work. Research work must not be decoupled from considerations of the application of the research results and specifically from the impact of the research (those are essential and complementary measures embracing the research effort). But research as a whole must not be pre-determined by, solutions required by specific problems (reversely, solutions must be the outcome of the research). It is not the purpose of research to pick up business, technology or other winners.

Concerning interoperability

The potential value of interoperability goes beyond the scientific and technical domain to reach much broader application in business, economy, and society. Therefore, interoperability must leverage those developments in order to maximise the value and importance of research. Interoperability critically needs to be established on a more solid and rigorous base of science.

[47] Enterprise Interoperability research roadmap, V4.0 - Annex II – Disposition of Comments V0.2, http://cordis.europa.eu/ist/ict-ent-net/ei-roadmap_en.htm

Interoperability is by nature a multi-disciplinary, crosscutting, engineering activity. Validation, simulation, demonstration and testing in an organizational context, as well as effective dissemination and education, must be an integral part of the research activity. The mentioned science base is expected to comprise a consistent set of concepts, theories, and principles combining and extending the findings from other established and emerging sciences or domains allowing a characterisation of interoperability research field as a whole.

Scientific, industrial, societal and political motivation

Interoperability is an important issue for European Union policy and economy as well as for China, USA and all other industrialized and in development countries. Interoperability affects all enterprises and governmental organizations at national and international level and embraces research domain from all aspects – scientific, industrial, societal and political. The lack of interoperability appears as one of the long lasting and challenging problem for enterprises and governmental organizations. It emerged from proprietary development or extensions, unavailability of standards, and heterogeneous hardware and software platforms as well as continuous dynamic evolution of models and structures. For instance, EU member states have identified the need for interoperability standardization in their e-Government Interoperability Frameworks (eGIFs) that are being under development at national level by all the 27 governments. Interoperability has grown into an important issue in university programs, research events and projects attracting scientists from information and communication technologies (ICT) but also from management science, operational research, business and public administration – becoming a true multi-disciplinary research domain.

SME's represent over 97% of all enterprises in the EU, generate over 40% of the overall economic activity and contribute to over 60% of industrial employment. Although most firms in the EU-25 are connected to the Internet (91.1% in 2005), only a minority use e-business solutions for linking internal processes (33.5% in 2005). Even a smaller minority use e-business solutions for linking with business partners (15.1% in 2005). The use of enterprise integration systems among all EU-15 firms is tiny, which 10.2% use such systems to integrate with suppliers and 9.3% use such systems to integrate with customers. Thus, SMEs face a lack of interoperability in order to reap the biggest possible benefits. Interoperability constitutes the single most important hurdle for SME's trying to use ICT on their activities.

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EU characterization effort

The group participates in the main research projects that tailored the EU view on characterizing the interoperability research area and targeting technology transfer from research results focused on SME needs, e.g., IDEAS, ATHENA and INTEROP.

Research subjects

The following research subjects are part of our focal research domains:

Systems/Complexity

Organizations, systems and tools, have many structures and relationships. Understanding their interactions is considered a major factor in contributing to the success of interoperability solutions and the overall performance.

Complexity, generally considered as a branch of systems, has been developed to address the emergence, adaptation, evolution, and self-organization of systems. In particular, it concerns the coupling and interactions of the parts within these systems in a non-linear fashion.

Networking and modelling

A key premise is that interoperability is an enabler for “networked systems”. The concept of networks as a representation/modelling of objects that are connected by some underlying structure has been applied to numerous problems in applied mathematics, engineering, and computer science. Specifically, networking has been concerned with the impact of structure on behaviour. In recent years, new advances in the domain have been used to relate performance problems to communications structures including the Internet, the Web, and Grids. Impact of standards development due to its acceptance is of paramount importance.

Web-based services

The Web needs to be structured, studied and understood as an analytic discipline as other physical ones; the Web needs to be engineered as a synthetic discipline, as in computer science; and the Web is simultaneously an infrastructure of languages and protocols at the micro scale and a system of human and organizational interactions at the macro scale, governed by conventions and laws. Services rely on a “co-production relationship” between providers and clients as in a transaction, with both simultaneously creating and capturing value in the transaction process. Under this viewpoint, service availability needs to be regarded as a collection of interacting and interoperating systems.

PhDs motivation, objectives and research topics

Objectives

1. Intelligent reconfiguration of components, for interoperability maintenance of evolving networked systems.
2. Harmonization of ontological structures, supported by statistical methods (e.g., stochastic methods) to support the application dynamics and enable adaptability of users’ semantic specifications.
3. Conformance testing and Interoperability checking for complex systems interoperability assessment.

The research to be developed by this PhD will establish the scientific and technological ground to allow different “systems node” to be integrated in a collaborative network, advancing at its own needs, keeping interoperable in the network where it wants to be integrated. Thus, it will permit advanced adaptation and optimization of systems, supporting their maintenance processes by the use of technologies suitable for knowledge representation applied to the Model Management (MoM) domain, namely dynamic models morphisms (DynamicMoMo).

With the foreseen research results, the adoption of advanced techniques for meta-modelling and automatism for model and data transformations, will enable to have the engine for interoperability not embedded directly in the systems coding, but through proper adaptive techniques get a suitable characterization of the actual status of the system’s morphism, supporting predictive system evolution, and analysis of its complexity in the dynamics of the network, including the respective transients and systems responsive behaviour.

At knowledge level, it is foreseen the need for the harmonization of ontological structures within and between the different network nodes, supported by statistical methods (e.g., stochastic methods) to permit semantic adaptability for the users specificities and to support the application dynamics. Then, enrichment of the semantic mapping will be possible, as a process to gather, classify, describe and then analyse the semantically features in the domain of the system models, and take better decisions in the advent of uncertainty.

The main research topics include:

- **Systems complexity**

- Learning and adaptability: After identified the need to solve an interoperability problem, the related systems typically know very few about the necessities required to have the global system completely interoperable. A learning process should be designed to support the adaption of the several system network nodes involved, and thus keep the global network interoperable.
- Transient analysis: The global interoperable network, as a complex integrated system, will face transients whenever an internal or external “interference” occurs, e.g., update in one of its nodes. Thus, there will be a period of time which the systems nodes need to react and readapt to before the system becomes again stable and interoperable. The evolution and progressive adaptation of each network system node should be done supported by a systematic study and analysis of the network transients, as single node, clusters, and global network.
- Interoperability checking: The global network needs to be checked and assessed to assure the maintenance of the networked interoperable system. A proper methodology for monitoring, diagnosis and prognosis, should be in place to assure the interoperability of the complex system in the advent of dynamics in the network.

- **Networking and modelling**

- Discovery and Notification: When a new system node is integrated in the network, or it is updated, how such updates can be automatically identified and completely recognized by the network, and how the network should react to become interoperable, or keep its interoperability, with the new node, or update, through the automatic understanding of the intrinsic knowledge and behaviour of the node. Then, what such information can be processed and what are the needed adaptations of the systems node, to have the global network again globally interoperable.
- Automated categorisation of ontological structures: Automated development of ontologies from descriptive specifications in non-specialized language, e.g., queries described in natural language, supported by an engine with feedback for the user, with learning and reconfiguration capacities.
- Conformance checking: The evolution of the network, by the integration of a new node or updates in the existing ones, will required checking for the conformance of data, models, knowledge and behaviours of the systems and applications. A proper methodology should be in place to assure such conformity in the advent of such dynamics.

- **Web-based services (for knowledge and semantics)**

- Mutation of ontologies supported by stochastic methods: Mutation of ontologies using stochastic method to support the updates in the representation of concepts and its instances.
- Harmonization of ontologies and semantic adaptability: Semantic harmonization, and adaptive mapping in dynamic environments, with mediation of semantic conflicts according to the interactions and evolution with the systems which it interacts.
- **Adaptive services for knowledge management**: Knowledge is the basis for seamless interoperability of the integrated global network. Adaptive services for knowledge management will assure the accuracy of the information and behaviour

of the complex system in each node and in the integrated network, support the dynamics and evolutionary characteristics of the complex system.

What are our current interests and contributions?

As major guidelines, research on Model Driven Architectures taking as reference specified layers on computation independent models, platform independent models and platform specific models is pursued. Also service oriented architectures and normalized Service Oriented Environments, based on Web based architectures, on morphisms and ontology design, have been addressed. Those items contribute to the design of integration platforms.

Hierarchical design for modelling complex and distributed systems requires a consistent supporting framework. Re-using previous developments on standards and meta-standard architectures supported by modular design is an effective and systematic approach to deal with complexity. Embedded in the design, semantic interoperability based on the ability to deal with ontologies and taxonomies has to be considered. The two following questions, how conformance compatibility can be assured through the design process of modular meta-standards based architectures (?) and how can model based interfaces supported by morphisms be validated to guaranty conformance compatibility (?), should be answered. Evolutive systems able to endure in time will require an embedded set of 'self properties' able to re-organize, optimize, configure, diagnosis and maintain. Design rules and methodologies intervening at earlier conceptual phases, are expected to help implementing 'self properties' embedded engines.

This research has been mainly achieved through the realization of PhD and MSc thesis and architecture prototypes, supported by R&D international projects, and are seldom documented in scientific publications. A strong effort was also developed concerning scientific assessment of dissemination and training materials. A set of available e-learning training actions is fully documented and can be found at the [eLearning Training Platform](#). Last but not the least, a sound investment on standards definition, submission and acceptance, was made together with specific industrial segments (wood manufacturing and building and construction) and normalization bodies (ISO).

As it was stated, 'interoperability critically needs to be established on a more solid and rigorous base of science'. Our research effort is bounded by our availability of human resources and by the extension, interdisciplinary and complexity of the area.

For the near future we consider also extending the AP reference model and using funStep as a focus implement advanced pilot cases in cooperation with academic and industrial partners.

The results achieved up to now by GRIS are initial contributions for the grounding steps of the scientific interoperability area, compared with the complexity of the global interoperability problem. These results need to be extended and consolidated by multi-disciplinary complementary researchers, to globally assess the outcomes and relevance of these achievements. Also, improvement of research prototypes developed is needed to allow its transfer to the industry, with assessment and validation of the results obtained in industrial environments, using other technologies and standards.

As an integrated result, GRIS has the ISO10303 AP236 framework, developed and implemented with provable results. The framework includes the multilevel modular Application Protocol with twenty seven reference modules, its reference dynamic architecture, and methodology for implementation, model components and software tools.

The impact of the results is both on the academic and scientific community, with papers published in chapters of books, international scientific journals and conferences. These results are also in use by international research projects addressing interoperability topics, and have

been source for further scientific and technical innovations towards seamless interoperable environments. These include standardisation communities, e.g., ISO and CEN/ISSS, industry, e.g. construction, furniture, aerospace, where the AP236 and research results have been implemented and assessed.

Recognition of the work developed resulted in the ISO SC4 (www.tc184-sc4.org) award, for the innovative architecture of AP236, and on the IMS (www.ims.org) award, for scientific contribution of delivered results in the scope of intelligent manufacturing systems.

The group ongoing strategy includes:

- Contribution for the establishment of the Interoperability scientific area;
- Look for new international research projects, to keep continuing the existing research results;
- Keep focus on the internationalization of young researchers, now with 4 PhD ongoing, 6 MSc concluded/in-conclusion, 4 new PhDs in preparation;
- Consolidate the cooperative research with international organizations, taking as a basis the 4 ongoing international research projects, and the 2 new international research projects just approved, starting January 2008.

Plans for the Future

Based on that, our main goals for next period are the following:

- To consolidate the graduation effort, supervising new PhD students. Due to Bologna paradigm many more MSc students will be engaged every year. The already mentioned areas of scientific interest will continue attracting our main research effort. However, domains as context-awareness, service oriented architectures and collaborative environments will be object of additional research effort.
- Tuning of the publication policy towards better journals, and major conferences. Keep cooperating with emergent journals addressing the interoperability field. The same stands to standardization bodies.
- Keep the ongoing rates of international projects thus competing for adequate international projects, and internationalisation of young researchers.
- Scholarship to young researchers supported by international projects. Training of young researchers.
- Incrementing the internationalization effort involving young researchers will be continued too, within the previous mentioned pattern (PhD and MSc programmes), encouraging them to write and present papers, contribute for project proposals, participate in project meetings and getting involved in major conference organization).
- Dissemination of research through training materials and graduate courses will continue.
- Keep serving major research events, organizing workshops, colloquia and periodic seminars
- Interdisciplinary activities and Interactions with other national and international research units, and companies
- Better planning of PhD theses, and consolidate existing research activity relationships
- Be selective in the mechanisms and targets, for effective outreach activities, and knowledge and technology transfer
- Consolidate the group scientific critical mass.

Publications

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
c) Book - Proceedings	2				2
d) Book Chapter			1	1	2
e) Periodical - International	2		2	3	7
g) Conference Paper (Refereed)	11	19	11	13	54
h) Special Issue	4		2	3	9
Grand Total	19	19	16	20	74

Table 51 – Publications by year for group C2

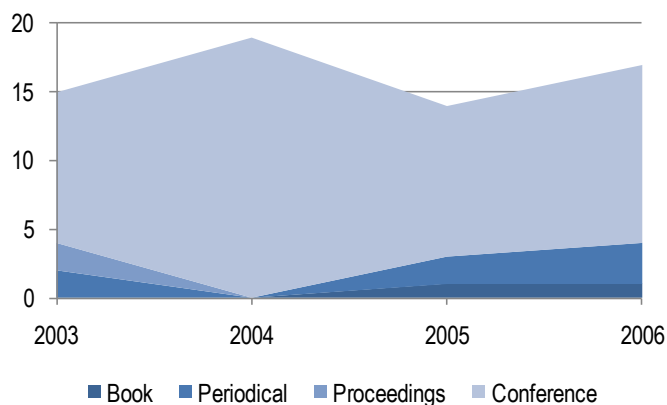


Figure 76 – Evolution of publications by year for group C2

Count of publication	WoS		
Type Table	No	Yes	Grand Total
e) Periodical - International	5	2	7
g) Conference Paper (Refereed)	33	21	54
Grand Total	38	23	61

Table 52 – Publications of C2 at ISI Web of Knowledge Indexing Service

Book - Proceedings

1. Cha, Jianzhong and Jardim-Gonçalves, Ricardo and Steiger-Garção, Adolfo, eds. 2003. [Advanced Design, Production and Management Systems](#). In: 10th ISPE International Conference on Concurrent Engineering, Research and Applications, 26-30 Jul 2003, Madeira, Portugal.
2. Jardim-Gonçalves, Ricardo and Cha, Jianzhong and Steiger-Garção, Adolfo, eds. 2003. [Enhanced Interoperable Systems](#). In: 10th ISPE International Conference on Concurrent Engineering, Research and Applications, 26-30 Jul 2003, Madeira, Portugal.

Book Chapter

1. Jardim-Gonçalves, Ricardo and Silva, João P. and Monteiro, António and Steiger-Garção, Adolfo. 2006. [Framework for enhanced interoperability through ontological harmonization of enterprise models](#). In: Ontologies in the Context of Information Systems (Sharman, Raj and Kishore, Rajiv and Ramesh, Ram, eds.), Springer, pp. 727-750. ISBN 978-0-387-37019-4.
2. Moraru, Sorin-Aures and Perniu, Liviu and Maló, Pedro. 2005. [Integration with web/intranet](#). In: Web-oriented applications of databases used in Electrical Domain, Lux Libris. ISBN 973-9458-20-3.

Papers in International Scientific Periodicals with Referees

1. Jardim-Gonçalves, Ricardo and Grilo, António and Steiger-Garção, Adolfo. 2006. [Challenging the Interoperability in the Construction Industry with MDA and SoA](#). Computers in Industry, Vol. 57 (8-9). pp. 679-689. ISSN 0166-3615. *Indexed at ISI Web of Science*.
2. Jardim-Gonçalves, Ricardo and Figay, Nicolas and Steiger-Garção, Adolfo. 2006. [Enabling interoperability of STEP Application Protocols at meta-data and knowledge level](#). International Journal of Technology Management (IJTM), Vol. 36 (4). pp. 402-421. ISSN 0267-5730. *Indexed at ISI Web of Science*.
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7. Jardim-Gonçalves, Ricardo and Steiger-Garção, Adolfo. 2003. [Integration and adoptability of APs: the role of ISO TC184/SC4 standards](#). International Journal of Computer Applications in Technology (IJCAT) and International Journal of Technology Management (IJTM), Vol. 18 (1/2/3/4). pp. 105-116. ISSN 0952-8091.

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1. Delgado, Marco and Agostinho, Carlos and Jardim-Gonçalves, Ricardo. 2006. [Taking the most of MDA and SOA to challenge SMEs in the advent of a Single European Information Space](#). In: eChallenges e2006 Conference & Exhibition, 25-27 Oct 2006, Barcelona, Spain.
2. Farinha, Fátima and Jardim-Gonçalves, Ricardo and Rebolj, D.. 2006. [Virtual Classroom: Innovation in education for construction IT in the advent of globalization](#). In: CATE2006: 9th IASTED International Conference on Computers and Advanced Technology in Education, 4-6 Oct 2006, Lima, Peru.
3. Farinha, Fátima and Jardim-Gonçalves, Ricardo and Rebolj, Danijel. 2006. [Innovation in Education for Construction IT in the Advent of Globalization](#). In: CATE2006: 9th IASTED International Conference on Computers and Advanced Technology in Education, 4-6 Oct 2006, Lima, Peru.
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13. Jardim-Gonçalves, Ricardo and Agostinho, Carlos and Maló, Pedro and Steiger-Garção, Adolfo. 2005. [*AP236-XML: A framework for integration and harmonization of STEP Application Protocols*](#). In: ASME-CIE2005: International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, 24-28 Sep 2005, Long Beach, California, USA. *Indexed at ISI Web of Science*.
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2. Jardim-Gonçalves, Ricardo, ed. 2005. [Special Issue on E-Business Standards](#). International Journal of IT Standards and Standardization Research (IJITSR), Vol. 3 (2). i-ii. ISSN 1539-3062.
3. Jardim-Gonçalves, Ricardo and Steiger-Garção, Adolfo, eds. 2003. [Special Issue on Applications in Industry of Product and Process Modelling Using Standards](#). International Journal of Computer Applications in Technology (IJCAT) and International Journal of Technology Management (IJTM), Vol. 18 (1/2/3/4). ISSN 0952-8091.
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Theses

Publication type by Year	Year				
Publication Type	2003	2004	2005	2006	Grand Total
i) Thesis - PhD		2			2
j) Thesis - MSc		1		3	4
Grand Total		3		3	6

Table 53 – Theses by year for group C2

PhD Theses

1. Sousa, Pedro. 2004. [Um enquadramento para a catalogação automática de dados. Uma abordagem Multiagentes](#). PhD thesis, FCT/UNL.
2. Jardim-Gonçalves, Ricardo. 2004. [A Framework for Multilevel Standard Protocols and Interoperability](#). PhD thesis, FCT/UNL.

MSc Theses

1. Sarraipa, João. 2006. [Uma Solução para a Interoperabilidade Semântica em Ambientes Globais de Negócios](#). MSc thesis, (Jardim-Gonçalves, Ricardo, supervisor), Faculdade Ciências e Tecnologia/UNL.
2. Vieira, Hugo. 2006. [Arquitectura para Execução de Processos de Negócio Baseados em Planos Parametrizáveis de Serviços](#). MSc thesis, (Jardim-Gonçalves, Ricardo, supervisor), Faculdade Ciências e Tecnologia/UNL.
3. Agostinho, Carlos. 2006. [Plataforma para a adopção e implementação de modelos conceptuais normalizados ISO 10303](#). MSc thesis, (Jardim-Gonçalves, Ricardo, supervisor), Faculdade de Ciências e Tecnologia/UNL.
4. Cabrita, Ricardo. 2004. [Plataforma Facilitadora de Integração de Aplicações ao Nível do Modelo \(Baseada na Norma ISO 10303\)](#). MSc thesis, (Steiger-Garçon, Adolfo, supervisor), Faculdade Ciências e Tecnologia/UNL.

Prototypes and Products

1. [ISO 10303-236 "Application protocol: Furniture catalog and interior design"](#). The International Organization for Standardization (ISO) has been pushing forward the development of standards and models. Efforts like STEP, "Standard for the Exchange of Product model data", have tried to deal with integration and interoperability issues. The ISO 10303-236 standard defines a formalized structure for catalogue and product data under industrial domains of the furniture sector. The catalogue part of AP236 standard embraces: Product Decomposition: The management of each part of any product. Product Composition: The management of a set of pieces of furniture that makes a Composition, as a pre-defined offer in their catalogues. Documentation assignment: Allows the assignment of all kind of documentation, both digital and non-digital to any product in the catalogue. Properties and independent properties definition: Enabling to define all kind of properties such as material, dimensions, prices, etc. Technical and non-technical information relationship: the relationship between all kind of technical and non-technical information, e.g. commercial information or the period of time in which this information is valid. Multilanguage: the feature of the internalization of the product data information in such a way that the product data information could be retrieved in the selected language. AP236 also has the capability of managing CAD files and representations including the aspectual model characteristics without information loss. All the information related to the geometry could be defined in base of variable properties of associated parts. As an example: It is possible to define a relationship between the height, length and width in such way that when one value is modified, others will be modified proportionally as a result of the defined relationship rule. And finally, AP236 also comprises the capability of placing the CAD modelled pieces of furniture in a room space, thus enabling interior design projects. [product]
2. [ISO10303 Part 28 Transformation Tool from EXPRESS to XML Schema](#). EXP2XSD is a tool that converts an EXPRESS schema into XML Schema language. The EXP2XSD morphism, despite

implementing the default ISO 10303-28 transformation of EXPRESS models (input) to XSD (output), also enables the configuration of the morphism according to a pre-defined structure. Thus, the user (i.e. the company implementing the STEP AP) can configure the tool to choose among certain mapping parameters and obtain a schema more adapted to the manner that its own internal system handles XML information. The EXP2XSD is a tool that is part of the UniSTEP-toolbox. [prototype]

3. [ISO 10303 Part 28 XML Schema Transformation Tool to Relational Database](#). The main goal of this work is to provide an addition to STEP's part 28 and to persist any of the application protocols described in STEP, that can be expressed through part 28 in XSD, into a relational model in the form of SQL scripts for different dialects of different relational database vendors. The application can automatically generate the SQL scripts for some relational databases, given as input part 28 conforming XML Schemas that represent any application protocol. This functionality will permit a widening of possibilities in the use of STEP applications because it will be possible for users of these technologies to become free from the details and implementation of the relational model that supports the application protocol. [prototype]
4. [UNINOVA STEP-EXPRESS Toolbox](#). In the demand of the global market, organizations have been searching for flexible integrated environments to better manage their services and product life cycle, where their software applications could be easily integrated independently of the platform in use. However, with so many different modeling and implementation standards being used, interoperability problems arises when the chosen product model is described using one particular technology (e.g. EXPRESS) and is required to be integrated with systems that use totally different technologies with different degrees of expressiveness. This way, it would be an added value if the original model could be described in more than one language/technology depending of the environment where it is being used. UniSTEP is a toolbox that gathers different model transformation tools able to parse STEP models represented in the EXPRESS language, and apply to them model morphisms capable of modifying the original model. In the case of UniSTEP toolbox the modifications implemented by the different tools are only at the representation language level. UniSTEP, and its constituting tools relies on a framework that applies the OMG MDA principles, handling of information at different meta-levels for integration purposes. At that level, the effort to define valid transformation morphisms from the EXPRESS modeling language to others is heavily reduced since there is more information available about both the operand model languages (input and output). Hence, for the UniSTEP framework development, an EXPRESS metamodel as been defined specifying all the possible variations that a STEP data model can have. [prototype]
5. [AP236 Front End](#). Front-end to act with AP236 data model, with an innovative graphical interface, allowing easy navigation and comprehension of the model. Among its features, there is the capability to work directly with the model database, import/export xml catalogues according to Step Part 28. [prototype]
6. [E-Procurement Document Exchange Tool](#). This tool permits the various stakeholders involved in the e-procurement scenario to exchange correspondent documents. It allows the edition and validation of the correspondent documents. It's integrated with an external conformance testing service that validates the correctness of the documents, both structurally and semantically. [demonstrator]
7. [EXPRESS 2 XML converter](#). This tool converts an ISO10303-11 (EXPRESS) schema in to XML format. The transformation process is based on the ISO10303-25 specification, which regulates the mapping between an EXPRESS schema and a UML model. [prototype]
8. [Enterprise Ontology Interoperability](#). Enterprise Ontology Interoperability (EOI) is a methodology that establishes guidelines for a reference ontology building process, based on the UPON methodology. The process summary is to build an ontology from the enterprise knowledge concepts to the glossary, and then to build the reference ontology by harmonization processes taking as input the glossary and the enterprise ontologies. In the glossary creation it is gathered the semantic mismatches information in order to be used for the mapping processes which will establish the relations between the enterprise sources ontologies and the new built one, the enterprise organisation reference ontology. This mapping will enable the possibility of remain in use the old ontologies for intra-enterprises business processes and the reference ontology for the inter-enterprises business processes. [prototype]
9. [Interoperability Training](#). The ATHENA Training Curriculum offers specialised training and aims to generate an extensive impact in the field of Interoperability for Enterprise Software and Applications. The objective is to facilitate students' understanding, the whys and hows of today's common problems at the application and business levels, which are directly or indirectly caused by interoperability difficulties. A further goal is to provide academia and industry with the necessary skills to develop research and technical solutions for interoperability problems. The curriculum courses and its training programmes are designed to meet the specific interests of different participants' profiles. Each training programme has its own target audience, and students can choose from a variety of courses addressing different interoperability application areas, and levels of expertise. The curriculum addresses an international perspective, intending to soften the impact of international competition and growing globalisation,

helping the organizations involved in all areas of global business.

<http://moodle.fct.unl.pt/course/view.php?id=1127> [product]

10. [Tool4Glossary](#). The Tool4Glossary is a Glossary viewer that is able to extract taxonomic structures and concept definitions from a specific table structure in excel text format. The future functionalities will be a glossary building tool that will be able to record semantic mismatches. [prototype]
11. [Ontology Mapping Tool](#). The Ontology Mapping (OnMa) tool is a GUI that helps the users establishing the mapping relations between ontologies represented in a RDF-schema format. A specific class from a specific ontology could be mapped to other ontology classes. This tool records this relations in a new auto built ontology prepared for this purpose. The actual stage of the tool only enables mapping between "literal" class elements. In the near future it is expected to establish mappings between other ontology elements as properties, instances and a mix of elements. [prototype]
12. [FunStep reference ontology for furniture products classification](#). The funStep reference ontology it was built following an harmonization procedure. In a summary description the process was to make a furniture existing ontologies and taxonomies analysis in order to gather in a new ontology the best characteristics from the old ones. The harmonisation procedure was made in a total agreement of the involved experts and actors in the furniture area. The result it was an ontology with 512 classes for furniture products classification. [product]
13. [SMART-grid eMarketplace](#). The prototype intends to present the potential behind enhanced management of re-sources in collaborative engineering environments on furniture industry by clustering manufacturer's resources. The prototype is based on an architecture that will enable manufacturers to share online services in a pool of resources managed by grid technology. This approach offers an added value to all the participants in two major vectors: first they can join efforts and services to provide major output that alone could never be possible and with that explore new business opportunities, once only reachable by big companies; secondly, all together can provide a front-end with homogenized business methods and services, rich in resources that will make possible an improved customer service. [demonstrator]
14. [Conformance Testing services for XML data](#). With the increase of the competition cause by the globalization of market, companies need to establish new partnership and show that its products are the best. Conformance testing can help the companies to reach these objectives. Using conformance testing as support to its data systems or in data exchange, companies can ensure the conformance of XML data with models or standards, improving facilities to be interoperability and certifying its data conformance. Conformance Testing (CT) services for XML data, analyse data in two ways, semantically and syntactically. Using XSD models to analyse the XML data syntactically and complementing it with Schematron schemas to semantic analyses, CT provides a full exam to XML data. CT allows only one of the tests, syntactic or semantic, but is the full test that guaranty data conformance. Using CT with standards as input for knowledge base (ex.: AP236), CT can help to certify XML data by international organizations of standards like ISO. [prototype]
15. [Set of STEP Application and Implementation Models used in AP236 and other STEP Application Protocols](#). Set of modular components to be used as resources in the development of ISO 10303 Application Protocols. They are standards by themselves but are only to be used when integrated in the Application Protocols. The published modules are: - ISO 10303-1109 "Alternative_solution" - ISO 10303-1111 "Classification_with_attributes" - ISO 10303-1129 "External_properties" - ISO 10303-1349 "Incomplete_data_reference_mechanism" - ISO 10303-1350 "Inertia_characteristics" - ISO 10303-1345 "Item_definition_structure" - ISO 10303-1147 "Manufacturing_configuration_effectivity" - ISO 10303-1116 "Pdm_material_aspects" - ISO 10303-1344 "Numerical_interface" - ISO 10303-1115 "Part_collection" - ISO 10303-1103 "Product_class" - ISO 10303-1063 "Product_occurrence" - ISO 10303-1343 "Product_placement" - ISO 10303-1108 "Specification_based_configuration" - ISO 10303-1112 "Specification_control" - ISO 10303-1104 "Specified_product" - ISO 10303-1110 "Surface_conditions" - ISO 10303-1347 "Wireframe_2d" - ISO 10303-1143 "Building_component" - ISO 10303-1144 "Building_item" - ISO 10303-1145 "Building_structure" - ISO 10303-1146 "Location_in_building" - ISO 10303-1114 "Classification_assignment" - ISO 10303-1113 "Group" - ISO 10303-1342 "Expression" - ISO 10303-1341 "Generic_expression" - ISO 10303-1346 "Numeric_function" - ISO 10303-1133 "Single_part_representation" - ISO 10303-1351 "catalog_data_information" - ISO 10303-1352 "catalog_data_information_and_shape_representation" - ISO 10303-1353 "parameterized_catalog_data_information" - ISO 10303-1354 "furniture_interior_decoration" - ISO 10303-1355 "parameterized_catalog_data_and_shape_representation" - ISO 10303-436 "ap236_furniture_catalog_and_interior_design" [product]
16. [European Master Degree in Construction IT](#). A new postgraduate programme developed by a consortium of seven European universities supported by the Socrates Erasmus of the European Commission. The accepted degrees are Civil Engineering, Architecture, Built Environment and related disciplines with a duration of 2 years and 120 ECTS credit points. The curriculum consists of 12 taught units (subjects) and a dissertation element. The taught units have been developed and are delivered

jointly by leading European experts in Construction IT. The courses will be taught through a combination of face-to-face teaching and Internet based distance learning teaching methods.

<http://euromaster.itcedu.net/> [product]

Projects

1. ATHENA (507849) - Advanced Technologies for Interoperability of Heterogeneous Enterprise Networks and their Applications - Dates: 01-02-2004/31-03-2007(36 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/IST; Funding: 14.399.999,00€ (564.400,00€)
2. AVOEC (POSI/SRI/32546/99) - Agentes para Comércio Electrónico e Formação de Organizações Virtuais - Dates: 01-01-2000/01-12-2003(); Type: RTD; Role: Partner; Sponsor: FCT; Programme: POSI/SRI; Funding: 19.951,92€ (4.987,98€)
3. BIOPATTERN (C2) (508803) - Computational Intelligence for Biopattern Analysis to Support eHealth - Dates: 01-01-2004/31-12-2007(48 months); Type: Network; Role: Partner; Sponsor: EC; Programme: FP6/IST; Funding: 2.666.666,67€ (133.289,58€)
4. CIT-EU (60869a-IC-1-2003-1-SI-ERASMUS-DISSUC) - European Master Course in Construction IT - Dates: 01-10-2004/30-09-2005(12 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: SOCRATES/ISOC; Funding: 0,00€ (0,00€)
5. CoSpaces (IST-5-034245) - Innovative collaborative work environments for individuals and teams in design and engineering - Dates: 21-05-2006/31-10-2009(42 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/IST; Funding: 8.000.000,00€ (365.080,00€)
6. FUNSIEC (42059) - Feasibility for a Unified Semantic Infrastructure for the European Sector - Dates: 01-03-2004/28-02-2005(12 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/eContent; Funding: 307.008,00€ (48.289,00€)
7. IDEAS (IST-2001-37368) - Interoperability Development for Enterprise Application and Software – Roadmaps - Dates: 01-06-2002/31-05-2003(12 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/IST; Funding: 399.993,00€ (30.242,00€)
8. INNOVAFUN (31139) - Apply open standards to innovate furniture business processes - Dates: 01-11-2006/31-10-2008(24 months); Type: RTD; Role: Technical Coordination; Sponsor: EC; Programme: FP6/INNOVA; Funding: 799.996,00€ (250.439,00€)
9. INTEROP (508011) - Interoperability Research for Networked Enterprises Applications and Software - Dates: 01-11-2003/31-10-2006(36 months); Type: Network; Role: Partner; Sponsor: EC; Programme: FP6/IST; Funding: 6.500.000,00€ (226.160,00€)
10. prodAEC (IST-2001-32035) - European Network for Product and Project Data Exchange, E-Work and E-Business in Architecture, Engineering and Construction - Dates: 01-02-2002/30-04-2004(27 months); Type: RTD; Role: Technical Coordination; Sponsor: EC; Programme: FP5/IST; Funding: 381.584,00€ (147.241,00€)
11. SEEMSEED (502515) - Study, Evaluate, and Explore in the Domain of the Single Electronic European Market - Dates: 23-12-2003/30-06-2006(30 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/IST; Funding: 1.499.393,00€ (176.968,00€)
12. SMART-FM (IST-2001-52224) - A Standards compliant framework to support complete integrated product life-cycle information Management And electronic commerce foR the furniture manufacturing (FM) industry, in THE advent of the smart enterprises - Dates: 01-06-2002/31-05-2005(36 months); Type: RTD; Role: Technical Coordination; Sponsor: EC; Programme: FP5/IST; Funding: 1.770.854,00€ (295.201,00€)
13. STAND-INN (31133) - Integration of performance based building standards into business processes using IFC standards to enhance innovation and sustainable development - Dates: 01-09-2006/30-09-2008(); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/INNOVA; Funding: 987.405,00€ (28.503,00€)
14. VIVACE (502917) - Value Improvement through a Virtual Aeronautical Collaborative Enterprise - Dates: 01-01-2004/31-12-2007(48 months); Type: RTD; Role: Partner; Sponsor: EC; Programme: FP6/AERO; Funding: 43.299.803,00€ (266.746,60€)

4. Infrastructures

4.1. Research Laboratories



Laboratory of Computing Aid Design

Number of work posts (WP): 13

Number of students/WP: 2/3

Equipment/WP: Computers.



Electric Drives Research Laboratory

Number of work posts (WP): 5

Number of students/WP: 1

Equipment/WP: Computers and other equipment.



General Purpose R&D Laboratory

Number of work posts (WP): 5

Number of students/WP: 1

Equipment/WP: Workstation SUN SunBlade 150, PCs, and testing equipment.



Laboratory for MSc Students on Digital and Perceptual Systems

Number of Work posts (WP): 9

Number of students/WP: 1

Equipment/WP: Computers and specific set-ups.



Laboratory for MSc Projects on Tele-robotics and Remote Supervision

Number of Work posts (WP): 4

Number of students/WP: 3

Equipment/WP: Robotic dispenser, Pcs, AGVs

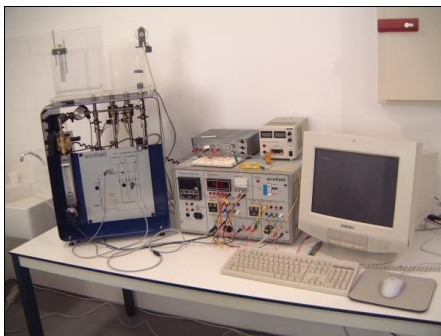


Laboratory for Research

Number of Work posts (WP): 5

Number of students/WP: 3

Equipment/WP: PCs, Sony Assembly Cell



Laboratory of MSc Project in Decision and Control

Number of Work posts (WP): 6

Number of students/WP: 3

Equipment/WP: Electronic components, power supplies, oscilloscopes, etc.. Several control set-ups built in our laboratory.



Laboratory MSc Projects on Telecommunications

Number of Work posts (WP): 10

Number of students/WP: 1/2

Equipment/WP: Network equipment; computers, etc.



Flexible cell for Manufacturing

4.2. Teaching & Training Laboratories



Laboratory of Electrical Machines

Number of work posts (WP): 8

Number of students/WP: 3/4

Equipment/WP: Electrical Machines.



Laboratory of Instrumentation and Electrical Measurements

Number of work posts (WP): 5

Number of students/WP: 3/4

Equipment/WP: Measurement devices.



Laboratory of Basic Electronics I

Number of work posts (WP): 9

Number of students/WP: 3

Equipment/WP: Oscilloscopes, Generators Function, Power Supplies and PCs.



Laboratory of Electronic for Telecommunications

Number of Work posts (WP): 8

Number of students/WP: 3

Equipment/WP: Digital Oscilloscopes with FFT module, function generation and power supplies.



Laboratory for Design in Electronics

Number of Work posts (WP): 5

Number of students/WP: 1

Equipment/WP: PCs and 1 workstation SUN Ultra 60 with CADENCE IC Package Software.



Laboratory of EDA tools for Electronics

Number of Work posts (WP): 8

Number of students/WP: 3

Equipment/WP: PCs with Tanner-Tools e MATLAB.



Laboratory of Logic Systems I

Number of Work posts (WP): 10 a 12

Number of students/WP: 2/3

Equipment/WP: Teaching system with power supply, inputs, outputs and breadboard, computer.



Laboratory of Digital and Perceptual Systems

Number of Work posts (WP): 12

Number of students/WP: 2/3

Equipment/WP: Teaching system with power supply, inputs, outputs and breadboard, computer, image acquisition board, data acquisition board, FPGA and CPLD based programmable logic devices experimental systems, specific set-ups.



Laboratory of Logic Systems II & Microprocessors

Number of Work posts (WP): 11

Number of students/WP: 2/3

Equipment/WP: Teaching system with power supply, inputs, outputs and breadboard, computer, 8031 development system, CPLD based programmable logic devices experimental system, specific set-ups.



Laboratory of Data Modelling in Engineering

Number of Work posts (WP): 10

Number of students/WP: 2/3

Equipment/WP: PCs.

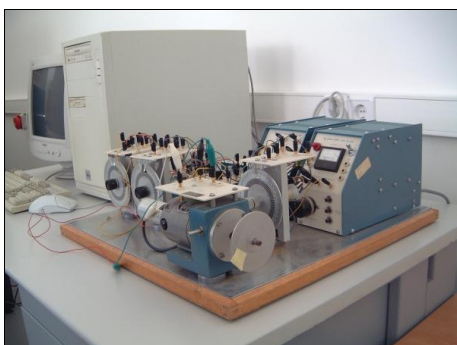


Laboratory of Robotics and Real Time System

Number of Work posts (WP): 10

Number of students/WP: 2/3

Equipment/WP: Computers, AGVs, lifts, boards of simulation of crossovers, robots, fischertermir system, flexible system with 2 funcad-axis.

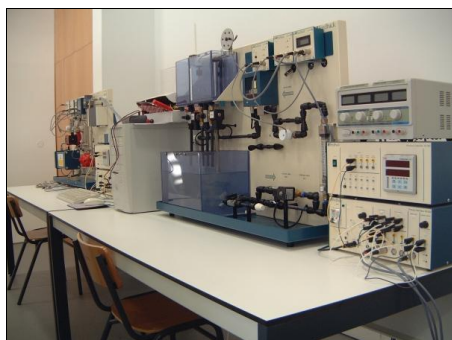


Laboratory of Systems Theory

Number of Work posts (WP): 8

Number of students/WP: 3

Equipment/WP: Computers for simulation.



Laboratory of Control

Number of Work posts (WP): 9

Number of students/WP: 3

Equipment/WP: Process for controlling: flow, position, speed, temperature, climate, inverted pendulum and winch. Analog and digital PID controllers, Signal acquisition systems, fuzzy inference systems, computers.



Laboratory of Automation

Number of Work posts (WP): 9

Number of students/WP: 3

Equipment/WP: PLCs, automation discrete components.



Laboratory of Telecommunications

Number of Work posts (WP): 10

Number of students/WP: 2

Equipment/WP: Learning kits of frequency and temporal modulation; computer simulators of transmission modulations.



Laboratory of Propagation

Number of Work posts (WP): 4

Number of students/WP: 3

Equipment/WP: Antennas, guided transmission.



Laboratory of Networks

Number of Work posts (WP): 10

Number of students/WP: 2/3

Equipment/WP: Computers; switches; routers.

5. Annexes

5.1. Publications List

5.1.1. Book – Author

1. Ortigueira, Manuel. 2005. [Processamento Digital de Sinais](#). Fundação Calouste Gulbenkian..
2. Barata, José. 2005. [Coalition Based Approach For ShopFloor Agility](#). ORION, Lisboa..
3. Rodrigues, Amadeu and Scutaru, Gheorghe and Gogiou, Aurel. 2005. [Electric Machines-didactic book "e-learning Virtual-Electro-Lab" Leonard da Vinci Project RO/01/BF/PP141024](#). Romanian Academy of Sciences..
4. Onori, M. and Barata, José and Lastra, J. and Tichem, M.. 2003. [European Precision Assembly - Roadmap 2010](#). European Commission. ISBN 91-7283-637-7.

5.1.2. Book – Editor

1. Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds. 2005. [Virtual Organizations: Systems and Practices](#). Springer. ISBN 0387237550.
2. Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds. 2004. [Collaborative networked organizations – A research agenda for emerging business models](#). 1st Print: Kluwer Academic Publishers (sold-out); 2nd Print: Springer. ISBN 978-1-4020-7823-1.
3. Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds. 2003. [Processes and foundations for virtual organizations](#). IFIP International Federation for Information Processing, 134. Kluwer Academic Publishers. ISBN 978-1-4020-7638-1.

5.1.3. Book – Proceedings

1. Adamski, Marian and Gomes, Luís and Wegrzyn, Marek and Labiak, Grzegorz, eds. 2006. [Discrete-Event System Design 2006](#). In: 3rd IFAC Workshop on Discrete-Event System Design (DESDes'06), 26-28 Sep 2006, Zielona Gora, Poland.
2. Camarinha-Matos, Luís and Afsarmanesh, Hamideh and Ollus, M., eds. 2006. [Network-centric collaboration and Supporting Frameworks](#). In: IFIP TC5/WG5.5 - Seventh IFIP Working Conference on Virtual Enterprises, 25-27 Sep 2006, Helsinki, Finland.
3. Camarinha-Matos, Luís and Afsarmanesh, Hamideh and Ortiz, A., eds. 2005. [Collaborative networks and their breeding environments](#). In: IFIP TC5/WG 5.5 - Sixth IFIP Working Conference on VIRTUAL ENTERPRISES, 26-28 Sep 2005, Valencia, Spain.
4. Camarinha-Matos, Luís, ed. 2004. [Emerging Solutions for Future Manufacturing Systems](#). In: IFIP TC-5/WG 5.5 - Sixth IFIP International Conference on Information Technology for Balanced Automation Systems in Manufacturing and Services, 27-29 Sep 2004, Vienna, Austria.
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7. Borza, Paul N. and Gomes, Luís and Scutaru, Gheorghe, eds. 2004. [VIRTUAL-LAB'2004 e-learning and Virtual and Remote Laboratories](#). In: 1st International Workshop on e-learning and Virtual and Remote Laboratories, 24-25 Aug 2004, Setúbal, Portugal.
8. Cha, Jianzhong and Jardim-Gonçalves, Ricardo and Steiger-Garção, Adolfo, eds. 2003. [Advanced Design, Production and Management Systems](#). In: 10th ISPE International Conference on Concurrent Engineering, Research and Applications, 26-30 Jul 2003, Madeira, Portugal.
9. Jardim-Gonçalves, Ricardo and Cha, Jianzhong and Steiger-Garção, Adolfo, eds. 2003. [Enhanced Interoperable Systems](#). In: 10th ISPE International Conference on Concurrent Engineering, Research and Applications, 26-30 Jul 2003, Madeira, Portugal.

5.1.4. Book Chapter

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2. Bernardo, Luís and Pinto, Paulo. 2006. [*A Decentralized Location Service: Applying P2P technology for picking replicas on replicated services*](#). In: e-Business and Telecommunication Networks (Ascenso, João and Belo, Carlos and Saramago, Mónica and Vasíu, Luminita, eds.), Springer. ISBN 101402047606.
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11. Camarinha-Matos, Luís. 2005. [*ICT Infrastructures for VO*](#). In: Virtual Organizations: Systems and Practices, Springer. ISBN 0387237550.
12. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2005. [*Brief historical perspective for virtual organizations*](#). In: Virtual Organizations: Systems and Practices, Springer. ISBN 0387237550.
13. Camarinha-Matos, Luís and Afsarmanesh, Hamideh. 2005. [*Collaborative networks: A new scientific discipline*](#). In: Virtual Organizations: Systems and Practices, Springer. ISBN 0387237550.
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15. Barata, José. 2005. [*FETISH-ETF: Federated European Tourism Information System Harmonization – Engineerink Task Force*](#). In: Virtual Organizations – Systems and Practices (Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds.), Springer Science, pp. 301-302..
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35. Ribeiro, Rita and Moreira, A. M. and Declercq, E.. 2003. [A fuzzy evaluation model: a case for intermodal terminals in Europe](#). In: Applied Decision Support with Soft Computing (Yu, Xinghuo and Kacprzyk, Janusz, eds.), Studies in Fuzziness and Soft Computing, 124. Springer, pp. 218-233. ISBN 3540024913.
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5.1.5. Papers in International Scientific Periodicals with Referees

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2. Vieira, Manuela and Fantoni, A. and Louro, P. and Fernandes, M. and Martins, J. and Schwarz, R. and Lavareda, G. and Carvalho, C. N.. 2006. [*Colour filtering in a-SiC:H based p-i-n-p-i-n cells: A trade-off between bias polarity and absorption regions*](#). Sensors and Actuators A: Physical, Vol. 132 (1). pp. 218-223. Indexed at ISI Web of Science.
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5.1.8. Special Issue

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3. Jardim-Gonçalves, Ricardo, ed. 2005. [Special Issue on E-Business Standards](#). International Journal of IT Standards and Standardization Research (IJITSR), Vol. 3 (2). i-ii. ISSN 1539-3062.
4. Ortigueira, Manuel and Machado, J. A., eds. 2003. [Special Issue on Fractional signal Processing and applications](#). Signal Processing, Vol. 83 (11). pp. 2285-2286. ISSN 0165-1684.
5. Jardim-Gonçalves, Ricardo and Steiger-Garção, Adolfo, eds. 2003. [Special Issue on Applications in Industry of Product and Process Modelling Using Standards](#). International Journal of Computer Applications in Technology (IJCAT) and International Journal of Technology Management (IJTM), Vol. 18 (1/2/3/4). ISSN 0952-8091.
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9. Camarinha-Matos, Luís and Afsarmanesh, Hamideh, eds. 2003. [*Special issue on Brokerage and contract negotiation*](#). International Journal of Networking and Virtual Organizations, Vol. 2 (1).
10. Afsarmanesh, Hamideh and Camarinha-Matos, Luís, eds. 2004. [*Special issue on Infrastructures for New Virtual Organisations*](#). International Journal of Networking and Virtual Organizations, Vol. 2 (3).
11. Jardim-Gonçalves, Ricardo and Steiger-Garção, Adolfo, eds. 2005. [*Integration in Engineering*](#). International Journal of Internet and Enterprise Management (IJIEM), Vol. 3 (2). ISSN 1476-1300.
12. Jardim-Gonçalves, Ricardo, ed. 2006. [*Special Issue on Interoperability in Manufacturing Systems*](#). International Journal of Advanced Manufacturing Systems (IJAMS), Vol. 9 (1). ISSN 1536-2647.
13. Panetto, Hervé and Jardim-Gonçalves, Ricardo and Pereira, Carlos, eds. 2006. [*E-Manufacturing and Web-Based Technology for Intelligent Manufacturing and Networked Enterprise Interoperability*](#). Journal of Intelligent Manufacturing, Vol. 17 (6). pp. 639-640. ISSN 0956-5515.
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5.2. Theses List

5.2.1. PhD Theses

1. Evans, Guiomar. 2006. [*Geradores de Ruído Branco Gaussiano e Uniforme para a Realização de Teste e Calibração Automática de ADC'S em Circuitos Integrados CMOS*](#). PhD thesis, FCUL – Faculdade de Ciências da Universidade de Lisboa/FCT-Faculdade de Ciências e Tecnologia.
2. Barros, João. 2006. [*Modularidade em Redes de Petri*](#). PhD thesis, (Gomes, Luís, supervisor), Faculdade Ciências e Tecnologia/UNL.
3. Pimentão, João. 2006. [*Comunicação Segura sem Recurso a Cifra*](#). PhD thesis, (Steiger-Garção, Adolfo, supervisor), Faculdade Ciências e Tecnologia/UNL.
4. Rosado, António. 2006. [*Fuzzy Conceptual Queries Based on Object-role Modeling*](#). PhD thesis, Faculdade Ciências e Tecnologia/UNL.
5. Vaz, Bruno M.. 2005. [*Conversores Analógico/Digital de Elevada Velocidade e Tensão de Alimentação Reduzida*](#). PhD thesis, Faculdade Ciências e Tecnologia/UNL.
6. Barata, José. 2005. [*Uma Aproximação Baseada em Coligações para a Agilidade da Planta Fabril Usando Multiagentes*](#). PhD thesis, (Camarinha-Matos, Luís, supervisor), FCT/UNL.
7. Niehus, Manfred. 2005. [*Disorder related optical properties and electronic transport in gallium nitride*](#). PhD thesis, Instituto Superior Técnico/UTL.
8. Sousa, Pedro. 2004. [*Um enquadramento para a catalogação automática de dados. Uma abordagem Multiagentes*](#). PhD thesis, FCT/UNL.
9. Jardim-Gonçalves, Ricardo. 2004. [*A Framework for Multilevel Standard Protocols and Interoperability*](#). PhD thesis, FCT/UNL.
10. Sanguino, Pedro. 2004. [*Growth of Gallium Nitride with the Cyclic Pulsed Deposition System*](#). PhD thesis, Instituto Superior Técnico/UTL.
11. Nunes, Isabel. 2003. [*Modelo de Sistema Pericial Difuso para apoio à Análise Ergonómica de Posto de Trabalho \(fuzzy Expert System Model to Support Workstation Ergonomic Analysis\)*](#). PhD thesis, Faculdade de Ciências e Tecnologia/UNL.

5.2.2. MSc Theses

1. Oliveira, Ana Inês. 2006. [*Multi-agent Infrastructure for Elderly Care Support*](#). MSc thesis, (Camarinha-Matos, Luís, supervisor), Faculdade Ciências e Tecnologia/UNL.
2. Fernandes, João. 2006. [*Máquina Síncrona em Regime Transitório após Brusco Curto Circuito no Estator*](#). MSc thesis, (Rodrigues, Amadeu, supervisor), Faculdade Ciências e Tecnologia/UNL.
3. Serrazina, Marco. 2006. [*Técnica de Codificação/Recepção para Sistemas com Espalhamento Espectral*](#). MSc thesis, (Bernardo, Luís and Montezuma-Carvalho, Paulo, supervisors), Faculdade Ciências e Tecnologia/UNL.
4. Ferrada, Filipa. 2006. [*Telecare time bank: a virtual community in the elderly care domain*](#). MSc thesis, (Camarinha-Matos, Luís, supervisor), Faculdade Ciências e Tecnologia/UNL.
5. Amaral, Pedro. 2006. [*Sistema de comunicação distribuída segundo usando agentes*](#). MSc thesis, Faculdade Ciências e Tecnologia/UNL.

6. Santos, Bruno R.. 2006. [Sistema Inteligente Baseado em Agentes para Catalogação de Informação Existente na Internet](#). MSc thesis, (Steiger-Garção, Adolfo, supervisor), Faculdade Ciências e Tecnologia/UNL.
7. Morganho, Hugo. 2006. [Uma proposta de técnicas de aprendizagem em texto para agentes inteligentes](#). MSc thesis, (Steiger-Garção, Adolfo, supervisor), Faculdade Ciências e Tecnologia/UNL.
8. Sarraipa, João. 2006. [Uma Solução para a Interoperabilidade Semântica em Ambientes Globais de Negócios](#). MSc thesis, (Jardim-Gonçalves, Ricardo, supervisor), Faculdade Ciências e Tecnologia/UNL.
9. Vieira, Hugo. 2006. [Arquitetura para Execução de Processos de Negócio Baseados em Planos Parametrizáveis de Serviços](#). MSc thesis, (Jardim-Gonçalves, Ricardo, supervisor), Faculdade Ciências e Tecnologia/UNL.
10. Agostinho, Carlos. 2006. [Plataforma para a adopção e implementação de modelos conceptuais normalizados ISO 10303](#). MSc thesis, (Jardim-Gonçalves, Ricardo, supervisor), Faculdade de Ciências e Tecnologia/UNL.
11. Monteiro, Telma. 2006. [Análise de riscos na Construção Civil. Construção e validação da base de conhecimentos de um sistema pericial](#). MSc thesis, (Nunes, Isabel, supervisor), Faculdade de Ciências e Tecnologia/UNL.
12. Pantoquilha, Marta. 2006. [A Space Environment Information System For Mission Control Purposes: System Analysis and Data Integration Design](#). MSc thesis, (Ribeiro, Rita A., supervisor), Faculdade Ciências e Tecnologia/UNL.
13. Pinto, Hugo. 2006. [Modulador Delta-Sigma de baixo consumo e área reduzida para aplicações biomédicas utilizando técnicas de partilha e comutação de amplificadores](#). MSc thesis, (Goes, João, supervisor), Faculdade de Ciências e Tecnologia/UNL.
14. Marques, Maria C.. 2005. [Metodologia de Simulação e Controlo em Sistemas Avançados de Gestão de Tráfego Rodoviário](#). MSc thesis, (Neves-Silva, Rui, supervisor), Faculdade de Ciências e Tecnologia/UNL.
15. Pereira, Pedro. 2005. [Desenvolvimento de Ambiente para Caracterização Automática de PLLS](#). MSc thesis, (Rodrigues, Amadeu, supervisor), Faculdade Ciências e Tecnologia/UNL.
16. Conceição, Paulo. 2005. [Dos casos de uso às redes de Petri: uma aplicação à monitorização de edifícios](#). MSc thesis, (Gomes, Luís, supervisor), Faculdade de Ciências e Tecnologia/UNL.
17. Lino, Rui. 2005. [Deteção de falhas em sistemas de automação utilizando redes de Petri](#). MSc thesis, (Gomes, Luís, supervisor), Faculdade de Ciências e Tecnologia/UNL.
18. Pais, Rui. 2005. [Geração de Executores e Analisadores de Redes de Petri](#). MSc thesis, (Gomes, Luís, supervisor), Faculdade de Ciências e Tecnologia/UNL.
19. Viana, Nuno. 2005. [Analysis, Design and Development of an Extraction, Transformation and Loading Software Architecture for Space-Oriented Business Intelligence Activities with Real-time Constraints](#). MSc thesis, (Ribeiro, Rita A., supervisor), Faculdade Ciências e Tecnologia/UNL.
20. Cabrita, Ricardo. 2004. [Plataforma Facilitadora de Integração de Aplicações ao Nível do Modelo \(Baseada na Norma ISO 10303\)](#). MSc thesis, (Steiger-Garção, Adolfo, supervisor), Faculdade Ciências e Tecnologia/UNL.
21. Oliveira, Rodolfo. 2003. [Supervisão e Controlo da Missão de Veículos Autónomos](#). MSc thesis, (Silvestre, Carlos, supervisor), IST - Instituto Superior Técnico.
22. Unterweissacher, Martin. 2003. [A Digital-Domain Self-Calibration and On-Chip Self-Testing Technique for Pipeline A/D Converters using Gaussian-White-Noise](#). MSc thesis, (Goes, João and Soser, Peter, supervisors), Universidade Técnica de Graz.
23. Costa, Anikó. 2003. [Estradogmas em Co-Design de Sistemas Embutidos](#). MSc thesis, (Gomes, Luís, supervisor), Faculdade de Ciências e Tecnologia/UNL.

5.3. Projects List

708434/2003 - Electronic transport and magnetic dynamics in low-dimensional magnetic systems and nanostructures			
Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	PTDC/FIS
Project Type:	RTD	Role:	Partner
Start Date:		Finish Date:	
Funding:	109.188 €	CTS Funding:	0 €
Abstract:			
<p>We propose to study several related problems of the modern magnetoelectronics by combining methods of quantum field theory, condensed matter physics and computer calculations. The main problem we are going to address is the relation between the electronic transport in a magnetic system and the magnetic dynamics. Usually, these problems are considered separately in the theoretical analysis of magnetoelectronic problems. The dynamics of a magnetic subsystem is commonly studied by using the Landau-Lifshits-Gilbert equations, which do not directly include the electrons. Correspondingly, the electrons are considered as moving in a static magnetic profile. However, in real nanostructures the interaction of the magnetic and electronic systems is not purely adiabatic, and it is important to describe the interaction as dynamic. This problem is especially important for quantum computation, trying to manipulate a single spin or a small system of strongly interacting moments. The proposed project includes other theoretical problems related to the spin dynamics in nanostructures. The experimental part of the project is mostly directed to the development of systems and structures with magnetic components.</p>			
Partners:			
Instituto Superior Técnico (IST/UTL); Instituto Superior de Engenharia de Lisboa (ISEL/IPL); Universidade de Évora (UE)			

ACODUASIS - Automatic control design using advanced simulation software			
Responsible:	<u>Rui Neves da Silva</u>	Group	B2
Sponsor:	EC	Programme:	FP5/IST
Project Type:	RTD	Role:	Partner
Start Date:	01-02-2003	Finish Date:	31-01-2006
Funding:	1.720.317 €	CTS Funding:	189.900 €
Abstract:			
<p>The ACODUASIS project concerns a new and revolutionary methodology of automatic control design to be applied on the robotic field. The "new" and "revolutionary" aspect consists in the fact that starting from the "user requirements" the methodology allows to design, in an easy and friendly way, a control system "compliant" with the "user requirements", that is, a control system that, once built, offers the required performance without the need of any experimental "adjusting" or "parameters tuning".</p> <p>The above aspect is really "new" and "revolutionary", in fact in Europe (and according to what is known, in whole the world), at the present state-of-the art, the following scenario appears:</p> <ul style="list-style-type: none"> - almost all the industrial automatic control systems (particularly the ones devoted to the robotic and tool machine field) are not specifically designed for the considered application on the basis of the "user requirements", but are general purpose control systems produced by few companies in the world. Such general purpose control systems are based on heuristic control design approaches (like the PID: Proportional-Integral-Derivative) which do not require any a priori precise knowledge of the plant to be controlled, but instead ask an experimental set-up of the control system, involving skilled technical people especially trained for that job. For complex control systems the experimental set-up may ask for months of tiring work. The control performance is the result of such an experimental set-up and it can only be known a priori (that is, at the plant design step, before its implementation) for what could be derived from previous similar experiences. - the largest part of the remaining automatic control systems, which are specifically developed for a defined application, need of a significant experimental set-up in field, so that, also in this case, the control system compliance with the user requirement performance cannot be fully guaranteed at the plant design level. - the available methodologies which can guarantee the control system performance since the design step without requiring any set up in field, have the common drawback of requiring an high mathematical knowledge. 			
Partners:			
EICAS Automazione S.p.A. (Italy), COMAU Robotics (Italy), IPSIS (France), Swisslog Telelift (Germany), UNI-Karlsruhe (Germany) / FZI - Research Center Information Technology, UNINOVA (Portugal), CLAWAR-Network (EU), Cybernetix (France)			

ADOPT - Optimisation of Parallel Pipeline Analogue-to-Digital Converters to High-Speed Applications			
Responsible:	<u>João Goes</u>	Group	A1
Sponsor:	FCT	Programme:	POCTI/ESE
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2000	Finish Date:	31-12-2003
Funding:	93.126 €	CTS Funding:	93.126 €
Abstract:			
<p>The major goal of this project is to develop a systematic (computer-assisted) design methodology for the optimisation of Parallel Pipelined Analogue-to-Digital Converters (ADCs) for high-speed applications. In order to clearly demonstrate the attractiveness of the</p>			

proposed design methodology, a parallel pipelined ADC in the range of 100-150 MS/s and 8-10 bit will be fully integrated in an advanced CMOS technology and experimentally evaluated. Associated with the referred methodology, a dedicated software-tool envisaging automatic synthesis as well as auto-definition of all specifications for the optimised basic building blocks will be developed and available for future Research and Development projects.

Data Converters are paramount in modern data, voice and image communication systems where increasingly complex processing of analogue signals is performed digitally. The feasibility of these analogue/digital interfaces highly depends on the feasibility of the ADCs, since future specifications will require very large input signal bandwidths (50-150 MS/s) for medium resolutions (8-10 bit).

High-Definition Television (HDTV), Digital Radio, VDSL and Cable-Modems are only a few examples over a wide range of potential applications.

During the past ten years, several works have been published about pipelined ADCs with and without parallelism to cover the range of specifications of 8-10 bit resolution and 100 MS/s of sampling frequency. Monolithic integrated circuit (IC) solutions already exist in Bipolar and in CMOS technologies. However, the overall power dissipated by these systems is still very large and about 1 W.

With the trend to incorporate these ADCs into battery-powered portable equipment such as, next generation of mobile videophones, Digital Radio and Cable-Modems for portable-PCs, high levels of power dissipation are not acceptable. On the other hand, since a reduced cost and high reliability are desired from the commercial point of view, low silicon area must also be envisaged in order to obtain a competitive product for mass production. Therefore, the main goal of the proposed design methodology for optimisation is to minimise both power dissipation and silicon area. Using this methodology, it is expected to reduce the power dissipation of the ADCs in about one order of magnitude (100mW for ADCs within the same range of specifications).

For a very general parallel pipelined architecture related issues such as, distribution of the thermal noise per stage employing simulated annealing algorithms, self-calibration requirements, optimal amplifier topologies and compensations, feasibility of the active components and circuitry sharing are taken into account in the optimisation process. On the other hand, also all problems intrinsically associated with advanced low-voltage deep sub-micron technologies will be carefully considered.

Partners:

Instituto de Desenvolvimento de Novas Tecnologias - UNINOVA

ALFA - Creación de una biblioteca digital de objetos de aprendizaje interoperables, accesibles y reutilizables, orientados a la formación en las Tecnologías de la Información

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	EC	Programme:	EuropeAid/Regional Cooperation
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2004	Finish Date:	31-12-2006
Funding:	0 €	CTS Funding:	0 €

Abstract:

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Partners:

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AMBIDISC - Adaptive and nonlinear control of distributed parameter systems with environmental impact

Responsible:	<u>Rui Neves da Silva</u>	Group	B2
Sponsor:	FCT	Programme:	POSI/SRI
Project Type:	RTD	Role:	Partner
Start Date:	01-11-2001	Finish Date:	30-10-2004
Funding:	49.880 €	CTS Funding:	0 €

Abstract:

The aim of the project is the development of techniques of adaptive and non-linear control for distributed parameter systems and its demonstration on system models with environmental impact, viz. river pollution control and regulation of energy production in distributed collector solar fields. The original contribution consists mainly in the combination of semigroup decomposition techniques with nonlinear adaptive Lyapunov based control using variable time sampling.

Partners:

Instituto de Engenharia de Sistemas e Computadores - INESC, Universidade Nova de Lisboa - Fundação da Faculdade de Ciências e Tecnologia

AMPLE - Aspect Oriented, Model Driven Product Line Engineering

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	EC	Programme:	FP6/?
Project Type:	RTD	Role:	Partner
Start Date:	01-10-2006	Finish Date:	30-09-2009
Funding:	3.790.000 €	CTS Funding:	166.000 €

Abstract:

The aim of this project is to provide a Software Product Line (SPL) development methodology that offers improved modularisation of variations, their holistic treatment across the software lifecycle and maintenance of their (forward and backward) traceability during SPL evolution. Currently, there is a big gap between research in requirements analysis, architectural modelling and implementation technology, and the industrial practice in SPL engineering. Furthermore, the focus tends to be on the design and code level when variations need to be identified, managed and analysed from the very early stage of requirements engineering. Architecture models are related to requirements models in an ad-hoc fashion and implementation tends to rely on pre-processors which are inadequate

substitute for proper programming language support for variability. Nor is there any systematic traceability framework for relating variations across a SPL engineering lifecycle. Aspect-Oriented Software Development (AOSD) can improve the way in which software is modularised, localising its variability in independent aspects as well as improving the definition of complex configuration logic to customise SPLs. Model-Driven Development (MDD) can help to express concerns as a set of models without technical details and support traceability of the high-level requirements and variations through model transformations. AMPLE will combine AOSD and MDD techniques to not only address variability at each stage in the SPL engineering lifecycle but also manage variations in associated artefacts such as requirements documents. Furthermore, it aims to bind the variation points in various development stages and dimensions into a coherent variability framework across the life cycle thus providing effective forward and backward traceability of variations and their impact. This makes it possible to develop resilient yet adaptable SPL architectures for exploitation in industrial SPL engineering processes.

Partners:

HOLOS - Soluções Avançadas em Tecnologias de Informação Lda. (Portugal); Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa (Portugal); Association pour la Recherche et le Développement des Methodes et Processus Industriels (France); SAP AG (Germany); Universidad de Malaga (Spain); Universiteit Twente (Netherlands); Technische Universiteit Darmstadt (Germany); Siemens Aktiengesellschaft (Germany); Lancaster University (United Kingdom).

ASSD - Aspects Specification for the Space Domain

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	ESA	Programme:	ESTEC/
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-03-2006	Finish Date:	30-03-2007
Funding:	150.000 €	CTS Funding:	60.000 €
Abstract:			
The main objective of the ASSD project is to apply an Aspect-Oriented (AO) methodology to the early steps of software development in the ground segment of space domain projects. The consortium proposes to determine the applicability and usefulness of AO methodology, as a way of reducing the complexity of software development, thus providing improved support for maintenance and evolution of the software.			
Partners:			
UNINOVA (Portugal), Fundação da Faculdade de Ciências e Tecnologia (Portugal), Deimos Engenharia (Portugal), EADS Test and Services			

ASSEMBLY-NET - Precision Assembly Technologies for Mini and Micro Products

Responsible:	<u>Luís Camarinha Matos</u>	Group	C1
Sponsor:	EC	Programme:	FP5/GROWTH
Project Type:	Network	Role:	Partner
Start Date:	01-10-2001	Finish Date:	31-08-2004
Funding:	750.500 €	CTS Funding:	0 €
Abstract:			
The Assembly-Net thematic network is focused on technologies for short lifecycle products which require mini and/or micro assembly solutions. It aims to link together key precision assembly technologies, industrial users and providers, and research and academic organisations in order to assist the wider application of innovative precision assembly solutions in Europe. It also aims to enhance the competence and skill levels and solve immediate and future problems affecting both small and large European companies dealing with precision assembly. The network will provide a European wide forum based on formal and informal networking, information exchange, physical and virtual meetings and special interest groupings for strategic planning and information support on introducing the latest technological developments in precision assembly.			
Partners:			
THE UNIVERSITY OF NOTTINGHAM UK, TECHNICAL RESEARCH CENTER OF FINLAND FIN, THE ROYAL INSTITUTE OF TECHNOLOGY S, TECHNISCHE UNIVERSITEIT DELFT NL, UNIVERSITE LIBRE DE BRUXELLES B, UNIVERSITE DE LOUVAIN B, UNIVERSITAET DES SAARLANDES D, LINKÖPING INSTITUTE OF TECHNOLOGY S, TAMPERE UNIVERSITY OF TECHNOLOGY FIN, WORLD WIDE LINK AB S, BPR LIMITED UK, DIPARTIMENTO DI INGEGNERIA MECCANICA, NUCLEARE E DELLA PRODUZIONE I, INSTITUT DE PRODUCTIONS F, TECHNICAL UNIVERSITY OF BERLIN D, ECOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE CH, UNIVERSIDADE NOVA DE LISBOA - FACULDADE CIÊNCIAS E TECNOLOGIA P, CONSIGLIO NAZIONALE DELLE RICERCHE I, ERICSSON MOBILE COMMUNICATIONS AB S, TQC LTD UK, TUOTEKEHITYS OY TAMLINK LTD FIN, EASY-LIVING AB (PUBL) S			

ATHENA - Advanced Technologies for Interoperability of Heterogeneous Enterprise Networks and their Applications

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP6/IST
Project Type:	RTD	Role:	Partner
Start Date:	01-02-2004	Finish Date:	31-03-2007
Funding:	14.399.999 €	CTS Funding:	564.400 €
Abstract:			
Increasing collaboration among enterprises during the entire product life cycle is a global trend. Organizations are transforming themselves into "networked organizations". To achieve this, enterprise systems and applications need to be interoperable in order to achieve seamless business interaction across organizational boundaries.			
Currently, enterprises face many difficulties related to lack of interoperability. Interoperability, defined as "the ability of two or more			

systems or components to exchange information and to use the information that has been exchanged", needs to be addressed in respect of all layers of an enterprise (including ICT Systems, Knowledge, Business and Semantics). It needs to be tackled using a holistic perspective, a multi-disciplinary approach, and by bringing together the best research teams, industry expertise and ICT suppliers.

ATHENA aims to be the most comprehensive and systematic European research initiative in IT to remove barriers to interoperability, to transfer and apply the research results in industrial sectors, and to foster a new-networked business culture. Building on its vision statement ". By 2010, enterprises will be able to seamlessly interoperate with others", ATHENA aims to enable interoperability by providing a comprehensive Interoperability Framework.

In ATHENA, Research and Development will be executed in synergy and collaboration with Community Building: research will be guided by business requirements defined by a broad range of industrial sectors and integrated into Piloting and Training. ATHENA will be a source of technical inventions for interoperability. It will also lead to prototypes, technical specifications, guidelines and best practices that form a common European repository of knowledge.

ATHENA will mobilise a critical mass of interoperability stakeholders across Europe and lay the foundation for a permanent, world-class European hub for interoperability for advancing European Leadership in a global context.

Partners:

Consiglio Nazionale delle Ricerche (Italy); Intracom S.A. Hellenic Telecommunications and Electronics Industry (Greece); Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung E.V.(Germany); Fundacion European Software Institute (Spain); EADS CCR (France); Computas Holding AS (Norway); IBM United Kingdom Limited (United Kingdom); Université de Bordeaux I (France); Institut Europeen D'Administration des Affaires (France); ITREC - Gestion (France); Siemens Aktiengesellschaft (Germany); Universitat St Gallen (Switzerland); Gruppo Formula S.P. (Italy); TXT E-Solutions SPA (Italy); UNINOVA-Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Troux Technologies AS (Norway); Asociacion de Investigacion Y desarrollo en la Industria del Mueble Y Afines -AIDIMA (Spain); IC Focus Limited (United Kingdom); Graisoft (France); Deutsches Forschungszentrum fuer Kuenstliche Intelligenz GmbH (Germany); SINTEF-Stiftelsen for Industriell og Teknisk Forskning Ved Norges Tekniske Hoegskole (Norway); Centro Ricerche Fiat Societa Consortile per Azioni (Italy); SAP AG (Germany).

AVOEC - Agentes para Comércio Electrónico e Formação de Organizações Virtuais

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	FCT	Programme:	POSI/SRI
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2000	Finish Date:	01-12-2003
Funding:	19.952 €	CTS Funding:	4.988 €

Abstract:

O objectivo último do Projecto AVOEC é explorar os processos pelos quais a tecnologia baseada em agentes poderá influenciar a gestão de Organizações assim como o comércio pela utilização do espaço de informação acessível pela internet.

O Projecto AVOEC abrange:

- As actividades de Comércio Electrónico(CE) entre Empresas e Consumidores, nos dois sentidos, tendo por finalidade a conclusão de negócios;
- As actividades, na fase pré-contractual, de Empresa a Empresa, permitindo a formação e monitorização de Empresas Virtuais (EV).

Guiado por estes objectivos de alto nível, AVOEC irá explorar Modelos relativos a:

- Descrição de Conhecimento (de produtos ou serviços) que permita o seu entendimento e partilha em sistemas abertos, acessíveis pelas redes de comunicação;
- Estratégias de interacção em cenários quer cooperativos quer competitivos;
- Estratégias de pesquisa e filtragem adaptativa para disponibilizar informação relevante sobre mercados, produtos ou parceiros comerciais.

As questões acima mencionadas, necessitam de métodos e técnicas baseadas em Sistemas Multi-Agentes (SMA) e noutras técnicas de Inteligência Artificial.

Mais concretamente, o projecto contribuirá para:

- a definição de Ontologia(s) para definir características de produtos/serviços, usando princípios de linguagens baseadas em restrições em conjunto com linguagens de comunicação de agentes;
- o desenvolvimento de estratégias de interacção de agentes envolvendo negociação e incluindo:
 - protocolos para leilões e negociações multi-laterais e multi-critério;
 - protocolos para formação dinâmica de coligações.
- Melhorar algoritmos de aprendizagem simbólica permitindo a adaptação à dinâmica dos mercados;
- Desenvolver softbots pesquisadores que procurem na WWW informação relevante, usando filtros evoluindo com a experiência e aprendendo com as preferências do utilizador.

A tecnologia para implementar tais modelos e técnicas será baseada em agentes computacionais, dada a sua modularidade, autonomia, pro-actividade e propriedades ditas "mentalistas" das arquitecturas BDI. Um SMA permitirá a interacção, a distribuição, descentralização e a cooperação.

Finalmente, para atingir os objectivos abaixo sumariados, isto é, para disponibilizar:

- Facilidades para o CE, através de um "sítio" onde os utilizadores possam configurar agentes para compra e venda usando estratégias de negociação, e
- "ferramentas" permitindo a formação de EVs e a sua monitorização, descrevendo os objectivos e necessidades e seleccionando estratégias de negociação,

o resultado final de AVOEC será um sítio da WWW, baseado num SMA, facilitando o Mercado e como repositório de ferramentas para construir agentes representantes de compradores/vendedores ou de empresas procurando/oferecendo serviços.

AVOEC propõe um avanço no uso de técnicas para adequar aos mercados usando a internet, Empresas pela sua reconfiguração dinâmica e indivíduos delegando operações comerciais em agentes.

Partners:

Universidade do Porto - Faculdade de Engenharia (Portugal); Instituto de Desenvolvimento de Novas Tecnologias - UNINOVA

(Portugal); Guião, Divulgação Promocional de Indústria e Comércio, S.A. (Portugal).

BIOPATTERN (B1) - Computational Intelligence for Biopattern Analysis to Support eHealth

Responsible:	<u>José Manuel Fonseca</u>	Group	B1
Sponsor:	EC	Programme:	FP6/IST
Project Type:	Network	Role:	Partner
Start Date:	01-01-2004	Finish Date:	31-12-2007
Funding:	2.666.667 €	CTS Funding:	133.290 €

Abstract:

The BIOPATTERN Network of Excellence is a groundbreaking project that integrates key elements of European research to enable Europe to become a world leader in eHealth. The Grand Vision is to develop a pan-European, coherent and intelligent analysis of a citizen's bio-profile; to make the analysis of this bio-profile remotely accessible to patients and clinicians; and to exploit bio-profile to combat major diseases such as cancer and brain diseases.

A bio-pattern is the basic information (pattern) that provides clues about underlying clinical evidence for diagnosis and treatment of diseases. Typically, it is derived from specific data types, e.g. genomics information and vital bio-signals such as the EEG. A bio-profile is a personal 'fingerprint' that fuses together a person's current and past medical history, bio-patterns and prognosis. It combines data, analysis and predications of possible susceptibility to diseases.

BIOPATTERN proposes to provide novel computational intelligent techniques for bio-pattern analysis and a pan-European integrated, intelligent analysis of an individual's bio-profile. Information from distributed databases will be made available, securely, over the Internet to provide on-line algorithms, libraries and processing facilities for such analysis.

BIOPATTERN integrates the research efforts of 31 institutions across Europe to tackle and reduce fragmentation in the new field of bio-pattern and bio-profile analysis, which will underpin eHealthcare in the post genome era. It brings together leading researchers in medical informatics and bio-informatics from academia, the healthcare sector and industry in a new way, harnessing expertise and information to put Europe at the forefront of eHealth.

BIOPATTERN aims to identify how bio-profile could be exploited for individualised healthcare such as disease prevention, diagnosis and treatment. Its ultimate goal is to become a Virtual Research Institute recognised as a world-leading scientific resource.

Partners:

Stichting Katholieke Universiteit (Netherlands); Istituto Nazionale per lo Studio e la Cura dei Tumori (Italy); University of Crete (Greece); Gap Infomedia LTD (United Kingdom); Liverpool John Moores University Higher Education Corporation (United Kingdom); Aristotle University of Thessaloniki (Greece); Telecommunications Systems Institute (Greece); National and Kapodistrian University of Athens (Greece); Bioelf LTD (United Kingdom); Nottingham Trent University (United Kingdom); Università ta Malta (Malta); Tampereen Teknillinen Yliopisto (Finland); Hoegskolan i Borås (Sweden); Daedalus Informatics LTD (Greece); Hellenic Telecommunication and Telematics Applications Company S.A. (Greece); Universitatii Ecologice din Bucuresti (Romania); The University of Nottingham (United Kingdom); The University of Liverpool (United Kingdom); Università Degli Studi di Milano (Italy); Katholieke Universiteit Leuven (Belgium); Aston University (United Kingdom); Università di Pisa (Italy); SYNAPSIS - Società a Responsabilità Limitata (Italy); Technological Educational Institute of Crete (Greece); Neoventor Medicinsk Innovatio AB (Sweden); Plymouth Hospitals National Health Service Trust (United Kingdom); UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Università Degli Studi di Firenze (Italy); Sheffield Hallam University (United Kingdom); University of Plymouth Higher Education Corporation (United Kingdom).

BIOPATTERN (C2) - Computational Intelligence for Biopattern Analysis to Support eHealth

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP6/IST
Project Type:	Network	Role:	Partner
Start Date:	01-01-2004	Finish Date:	31-12-2007
Funding:	2.666.667 €	CTS Funding:	133.290 €

Abstract:

The BIOPATTERN Network of Excellence is a groundbreaking project that integrates key elements of European research to enable Europe to become a world leader in eHealth. The Grand Vision is to develop a pan-European, coherent and intelligent analysis of a citizen's bio-profile; to make the analysis of this bio-profile remotely accessible to patients and clinicians; and to exploit bio-profile to combat major diseases such as cancer and brain diseases.

A bio-pattern is the basic information (pattern) that provides clues about underlying clinical evidence for diagnosis and treatment of diseases. Typically, it is derived from specific data types, e.g. genomics information and vital bio-signals such as the EEG. A bio-profile is a personal 'fingerprint' that fuses together a person's current and past medical history, bio-patterns and prognosis. It combines data, analysis and predications of possible susceptibility to diseases.

BIOPATTERN proposes to provide novel computational intelligent techniques for bio-pattern analysis and a pan-European integrated, intelligent analysis of an individual's bio-profile. Information from distributed databases will be made available, securely, over the Internet to provide on-line algorithms, libraries and processing facilities for such analysis.

BIOPATTERN integrates the research efforts of 31 institutions across Europe to tackle and reduce fragmentation in the new field of bio-pattern and bio-profile analysis, which will underpin eHealthcare in the post genome era. It brings together leading researchers in medical informatics and bio-informatics from academia, the healthcare sector and industry in a new way, harnessing expertise and information to put Europe at the forefront of eHealth.

BIOPATTERN aims to identify how bio-profile could be exploited for individualised healthcare such as disease prevention, diagnosis and treatment. Its ultimate goal is to become a Virtual Research Institute recognised as a world-leading scientific resource.

Partners:

Stichting Katholieke Universiteit (Netherlands); Istituto Nazionale per lo Studio e la Cura dei Tumori (Italy); University of Crete (Greece); Gap Infomedia LTD (United Kingdom); Liverpool John Moores University Higher Education Corporation (United Kingdom); Aristotle University of Thessaloniki (Greece); Telecommunications Systems Institute (Greece); National and Kapodistrian University of Athens (Greece); Bioelf LTD (United Kingdom); Nottingham Trent University (United Kingdom); Università ta Malta (Malta); Tampereen Teknillinen Yliopisto (Finland); Hoegskolan i Borås (Sweden); Daedalus Informatics LTD (Greece); Hellenic Telecommunication and

Telematics Applications Company S.A. (Greece); Universitatii Ecologice din Bucuresti (Romania); The University of Nottingham (United Kingdom); The University of Liverpool (United Kingdom); Universita Degli Studi di Milano (Italy); Katholieke Universiteit Leuven (Belgium); Aston University (United Kingdom); Universita di Pisa (Italy); SYNAPSIS - Societa a Responsabilita Limitata (Italy); Technological Educational Institute of Crete (Greece); Neoventor Medicinsk Innovatio AB (Sweden); Plymouth Hospitals National Health Service Trust (United Kingdom); UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Universita Degli Studi di Firenze (Italy); Sheffield Hallam University (United Kingdom); University of Plymouth Higher Education Corporation (United Kingdom).

BIOPATTERN (A1) - Computational Intelligence for Biopattern Analysis to Support eHealth

Responsible:	<u>Manuel Ortigueira</u>	Group	A1
Sponsor:	EC	Programme:	FP6/IST
Project Type:	Network	Role:	Partner
Start Date:	01-01-2004	Finish Date:	31-12-2007
Funding:	1.066.667 €	CTS Funding:	53.316 €
Abstract:			
<p>The BIOPATTERN Network of Excellence is a groundbreaking project that integrates key elements of European research to enable Europe to become a world leader in eHealth. The Grand Vision is to develop a pan-European, coherent and intelligent analysis of a citizen's bio-profile; to make the analysis of this bio-profile remotely accessible to patients and clinicians; and to exploit bio-profile to combat major diseases such as cancer and brain diseases.</p> <p>A bio-pattern is the basic information (pattern) that provides clues about underlying clinical evidence for diagnosis and treatment of diseases. Typically, it is derived from specific data types, e.g. genomics information and vital bio-signals such as the EEG. A bio-profile is a personal 'fingerprint' that fuses together a person's current and past medical history, bio-patterns and prognosis. It combines data, analysis and predications of possible susceptibility to diseases.</p> <p>BIOPATTERN proposes to provide novel computational intelligent techniques for bio-pattern analysis and a pan-European integrated, intelligent analysis of an individual's bio-profile. Information from distributed databases will be made available, securely, over the Internet to provide on-line algorithms, libraries and processing facilities for such analysis.</p> <p>BIOPATTERN integrates the research efforts of 31 institutions across Europe to tackle and reduce fragmentation in the new field of bio-pattern and bio-profile analysis, which will underpin eHealthcare in the post genome era. It brings together leading researchers in medical informatics and bio-informatics from academia, the healthcare sector and industry in a new way, harnessing expertise and information to put Europe at the forefront of eHealth.</p> <p>BIOPATTERN aims to identify how bio-profile could be exploited for individualised healthcare such as disease prevention, diagnosis and treatment. Its ultimate goal is to become a Virtual Research Institute recognised as a world-leading scientific resource.</p>			
Partners:			
<p>Stichting Katholieke Universiteit (Netherlands); Instituto Nazionale per lo Studio e la Cura dei Tumori (Italy); University of Crete (Greece); Gap Infomedia LTD (United Kingdom); Liverpool John Moores University Higher Education Corporation (United Kingdom); Aristotle University of Thessaloniki (Greece); Telecommunications Systems Institute (Greece); National and Kapodistrian University of Athens (Greece); Bioelf LTD (United Kingdom); Nottingham Trent University (United Kingdom); Universita ta Malta (Malta); Tampereen Teknillinen Yliopisto (Finland); Hoegskolan i Boras (Sweden); Daedalus Informatics LTD (Greece); Hellenic Telecommunication and Telematics Applications Company S.A. (Greece); Universitatii Ecologice din Bucuresti (Romania); The University of Nottingham (United Kingdom); The University of Liverpool (United Kingdom); Universita Degli Studi di Milano (Italy); Katholieke Universiteit Leuven (Belgium); Aston University (United Kingdom); Universita di Pisa (Italy); SYNAPSIS - Societa a Responsabilita Limitata (Italy); Technological Educational Institute of Crete (Greece); Neoventor Medicinsk Innovatio AB (Sweden); Plymouth Hospitals National Health Service Trust (United Kingdom); UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Universita Degli Studi di Firenze (Italy); Sheffield Hallam University (United Kingdom); University of Plymouth Higher Education Corporation (United Kingdom).</p>			

BIOSENSOR - Development of a biosensor based on ISFET system for assay of toxic amides

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	PTDC/AGR-AAM
Project Type:	RTD	Role:	Prime Contractor
Start Date:		Finish Date:	
Funding:	81.000 €	CTS Funding:	0 €
Abstract:			
<p>The overall aim of this research project involves a biosensor development to assay for toxic amides by using either whole cells, cell-free extract or purified preparation of recombinant wild-type and altered amidase from <i>Escherichia coli</i>. Preliminary experiments carried out in our laboratory have revealed that immobilized whole cells and cell-free extracts containing amidase activity exhibited higher enzyme stability compared with the immobilized purified preparation of altered enzyme. This biosensor will be based on ion sensitive field effect transistor (ISFET) sensor system adapted to the chemical reactions involved. This work is of great scientific interest because there are no biosensors to assay for either aliphatic or aromatic amides. On the other hand, there is a great concern as far as general public health is concerned because significant levels of acrylamide were detected in food (eg. chips and breakfast cereals) and drinking water. Therefore, this research proposal involves four tasks as follows: 1. Production and purification of recombinant wild-type and altered amidases from <i>E. coli</i>; 2. Immobilization of whole cells, cell-free extract and purified altered amidase on ISFET sensor by using several immobilization techniques; 3. Biosensor development based on ISFET by using whole cells of <i>E. coli</i> exhibiting amidase activity and 4. Biosensor development based on ISFET by using a cell-free extract and purified recombinant amidase from <i>E. coli</i>. The 1st task involves the production of recombinant <i>E. coli</i> cells containing wild-type and altered amidases. Subsequently, recombinant wild-type and altered amidases will be purified and characterized regarding its kinetic behaviour. The 2nd task consists of immobilization of whole cells of <i>E. coli</i> containing amidase activity, cell-free extract and purified amidase by using several immobilization chemistries on ISFET sensor such as a crosslinking agent (i.e. glutaraldehyde and BSA), photopolymerisation with PVA/SbQ (poly(vinyl alcohol) containing styrylpyridinium) polymer and a novel immobilization chemistry which cannot be disclosed because a patent is being filed. The operational and storage stability of immobilized purified enzyme preparation/cell-free extract/whole cells will be investigated as a</p>			

function of pH, temperature, ionic strength and nature of buffer. The 3rd task consists of studying the performance of ISFET based biosensor containing whole cells of E. coli as a bio-component, as a function of pH, buffer, temperature, half-life, reproducibility, selectivity and response time. The 4th task involves studying the performance of ISFET based biosensor containing either cell-free extract or purified altered amidase. Several analytical parameters will be studied such as pH, half-life, sensitivity, specificity/selectivity, speed/response time, accuracy, simplicity and cost. This study will provide valuable information about biosensor development for toxic amides (i.e. acrylamide and formamide) by using either whole cells, cell-free extract or purified altered amidase. On the other hand, it will be possible to increase the sensitivity, specificity/selectivity, speed/response time, accuracy, simplicity, cost and half-life of the biosensor. The proposed research activities will contribute markedly to the advancement of science in the following aspects: i- Biosensor development for assay of amides based on ISFET system; ii- Differential behaviour of the biosensor containing either the whole cells, cell-free extract or purified altered amidase as the bio-component, regarding sensitivity, specificity/selectivity, speed/response time, accuracy, simplicity, cost and half-life; iii- Novel properties of these biosensors regarding their performance; iv- To author's knowledge, there are no reports in the literature about the use of either whole cells containing amidase activity, cell-free extract or purified recombinant amidases for biosensor development to assay for toxic amides.

Partners:

Instituto Superior de Engenharia de Lisboa (ISEL/IPL); Universidade de Évora (UE).

CE-NET II - Concurrent Enterprise Network of Excellence**Responsible:** Luís Camarinha Matos**Group** C1**Sponsor:** EC**Programme:** FP5/IST**Project Type:** Network**Role:** Partner**Start Date:** 01-01-2001**Finish Date:** 30-06-2004**Funding:** 732.000 €**CTS Funding:** 15.888 €**Abstract:**

CE-NET aims to establish and further develop a well co-ordinated and effective support infrastructure throughout Europe in order to share and exchange the latest developments in the domain of Concurrent Engineering and Virtual Enterprising.

Specifically, the sub goals are:

- To initiate the analysis of current trends and to provide a strategic vision on CE in Europe (long term focus);
- To act as a catalyst for supporting the implementation of CE in industry and for identifying research needs;
- To collect, categorise and present knowledge on CE to a wide industrial and academic community in order to capitalise the existing know how;
- To provide a forum for developing focused initiatives in the CE domain such as special interest groups and international collaboration.

The CE-NET will develop and update a strategic CE roadmap which will describe industrial and research needs and visions for Concurrent Engineering in the Virtual Enterprise in Europe. This document will be the rationale from which the direction of all tasks in CE-NET will be controlled.

The CE-NET will develop and update a strategic CE roadmap which will describe industrial and research needs and visions for Concurrent Engineering in the Virtual Enterprise in Europe. This document will be the rationale from which the direction of all tasks in CE-NET will be controlled.

Partners:

Valon Teknillinen Tutkimuskeskus (VTT) (Finland); European Society for Concurrent Engineering (France); Verein zur Foerderung der Wissenschaftlichen Forschung in der Freien Hansestadt Bremen E.V. (Germany); CETIM - Center for Technology and Innovation Management GmbH (Germany); Cranfield University (United Kingdom); CEC - Concurrent Engineering Consulting- SRL Unipersonale (Italy); Universitatea Politehnica din Bucuresti (Romania); Tampereen Teknillinen Yliopisto (Finland); Universiteit Twente (Netherlands); Agence Nationale pour le Developpement de la Productique Appliquee a L'Industrie (France); The University of Nottingham (United Kingdom).

CERN2001 - Resistência à radiação de detectores de SiC microcristalinos**Responsible:** Maria Manuela Vieira**Group** A2**Sponsor:** FCT**Programme:** CERN/ESE**Project Type:** RTD**Role:** Prime Contractor**Start Date:** 01-01-2002**Finish Date:** 31-12-2004**Funding:** 20.000 €**CTS Funding:** 0 €**Abstract:**

O objectivo deste projecto é o desenvolvimento de detectores baseados em SiC microcristalino para detecção de partículas.

Partners:

Instituto Superior de Engenharia de Lisboa (coordenador), Instituto Superior Técnico, U. Algarve

CERTAIN - CryoSat Event Reporting Tool for Analysis and Investigation**Responsible:** Rita Ribeiro**Group** B1**Sponsor:** ESA**Programme:** ESOC/**Project Type:** RTD**Role:** Partner**Start Date:** 01-11-2005**Finish Date:** 01-02-2007**Funding:** 176.424 €**CTS Funding:** 48.500 €**Abstract:**

CryoSat is the first of the ESA "Earth Explorer" missions, designed to measure changes in the Earth's land and marine ice cover. CryoSat (along with the GOCE mission) is also the first of the ESA missions relying on Spacecraft Operators single shift per day for monitoring and control tasks during the routine phase. CryoSat is a low earth orbit satellite, visible for approximately 10 minutes every

100 minutes from the Kiruna ground station (the only GS used for this mission) and completes approximately 14 orbits per day. Of these, roughly 10-11 are visible from the Kiruna ground station. Due to the non-sun-synchronous orbit and the fact that SPACON coverage is not 24 hours, not all of the passes are manned in the control room. Because of this, some events may occur in the non-manned periods that can go unnoticed and potentially lead to problems.

The main objective described of this project consists in the development of a flexible reporting tool to provide the CryoSat Flight Control Team with status summary reports for the mission, describing events, performance and the S/C status during non-manned periods. Further, it will provide, when available, diagnosis evaluations of the inference result as well as remote alarms notification (via e-mail, SMS) to an on-call operator.

Partners:

UNINOVA, Holos, Soluções Avançadas em Tecnologia de Informação, Lda.

CESADS - INTELMO Test-bed for Failure Anomaly and Diagnostic Support

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	ESA	Programme:	ESOC/
Project Type:	RTD	Role:	Partner
Start Date:	01-04-2002	Finish Date:	30-07-2004
Funding:	299.982 €	CTS Funding:	106.419 €

Abstract:

CESADS/INTELMO Project is an ESA/ESOC program with the objective of demonstrate the advantages and limitations of using "Knowledge Engineering" to support multi-ground stations, namely in: System-level health status monitoring, Failure recognition and diagnostic, Failure recovery & System reconfiguration, and Operational performance monitoring & diagnostic. The tool developed in the framework of this project will be installed and made available to the operators for use and evaluation.

The project is split into two parts though closely related: the Knowledge Engineering one that intends to first understand where exactly a knowledge-based system can be useful in ESOC context (i.e. problems and opportunities), and then to gather all the require experts' knowledge in that sense; finally, the second part will consist in designing and implementing the referred knowledge-based system.

Partners:

GTD, UNINOVA

CHINA - Novel architectures for radio receivers and transmitters for Multi-Standard Applications

Responsible:	<u>João Goes</u>	Group	A1
Sponsor:	ICCTI	Programme:	MCT/Radio-Frequency Microelectronics
Project Type:	RTD	Role:	0
Start Date:	01-01-2002	Finish Date:	31-12-2005
Funding:	0 €	CTS Funding:	0 €

Abstract:

Study and investigate novel architectures for radio receivers and transmitters capable of very high bit-rates data communication for Multi-Standard Applications. Conventional superheterodyne architecture is not amenable to a highly integrated solution and, on the other hand, the off-chip filters also must be specific to a particular communications standard implying that this architecture can not be made multi-standard capable! Many Receiver architectures should be analyzed and considered, namely, direct-conversion (in spread-spectrum receivers), low-IF, wideband IF double-conversion, etc. The adopted (novel) architecture should support multi-standard transmit/receiver systems. GSM, UMTS, BLUETOOTH, GPS and IEEE 802.11 (Wireless LANs) Standards; It may comprise a single ultra-wide-band (small) antenna (probably off-chip) some RF interfaces (ideally only a configurable/programmable one) and high dynamic-range CMOS ADC/DAC suitable for all standards.

Partners:

0

CIT-EU - European Master Course in Construction IT

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	SOCRATES/ISOC
Project Type:	RTD	Role:	Partner
Start Date:	01-10-2004	Finish Date:	30-09-2005
Funding:	0 €	CTS Funding:	0 €

Abstract:

The main aim of the project was to establish conditions that would allow systematic and efficient implementation and dissemination of the previously developed postgraduate program on Construction IT. These conditions are:

- an effective organisation of partners in the program
- a fully functional distant learning environment and appropriate organisation of the program
- formal recognition of the program or parts of it at partner institutions
- informal international recognition of the program and project in the relevant scientific / professional area
- an open model of the program that will allow further cooperations and exchange of knowledge.

We believe that the aims and objectives of the project have been reached. There are currently 10 students enrolled in the program, 9 teachers are giving courses in a well organised way, and discussions are in progress to start cooperation with the American colleagues.

Description:

The main activities in the dissemination of the European master in construction IT programme include

1. Programme accreditation or enhancement of relevant existing postgraduate programme with selected ITC Euromaster

2. Organisation of the inter-university postgraduate programme
3. Further improvement of the eLearning environment
4. Improvement of course materials in digital form
5. Experimental lectures and other course activities
6. Organising the 3rd and 4th ITC@EDU workshop, co-operation in organising other relevant conferences (see <http://www.itcedu.net>)

Partners:

Delft University of Technology (NL); Glasgow Caledonian University(UK); Luleå Tekniska Universitet(SE); Technische Universität Dresden(DE); Universidade do Algarve(PT); Universidade Nova de Lisboa(PT); University of Salford(UK); Univerza v Ljubljani(SI)

CLIMBER - Climber Robot for Ferromagnetic Surfaces

Responsible:	<u>Amadeu Leão</u> <u>Rodrigues+Fernando</u> <u>Coito</u>	Group	A21
Sponsor:	FCT	Programme:	POSI/SRI
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2000	Finish Date:	31-12-2003
Funding:	99.760 €	CTS Funding:	99.760 €
Abstract:			
<p>The aim of this project is to develop a teleoperated robotic platform able to climb ferromagnetic surfaces with any inclination in aggressive environments. As a result of contacts with a shipyard enterprise the growing need of this kind of equipment for operations, such as, tank inspection, welding, painting and blasting, was found. The project has three main tasks: Vehicle Development, Control and basic Supervision, Task Planning and Supervision.</p> <p>Traditionally, rotating electrical motors of the induction type are the most popular drives. However, being the induction motor a relative high-speed machine, a step-down gearbox is needed for this application. Magnetic adherence between the vehicle and the ferromagnetic surface is obtained by employing blocks of rare-earth permanent magnets.</p> <p>The key aspect of the project is the replace the Rotative Induction Motor by a Linear Induction Motor (LIM) to drive the platform. This idea is based on the simplicity of the LIM configuration giving directly a linear motion without the need of any mechanical contact.</p> <p>Additionally, using a single-sided linear motor, a normal attractive force appears between the primary and the secondary, which is made of solid steel (hull of the vessel). This normal attractive force can contribute to help adhesion of the platform. Due to its simple geometry, the stator can be encapsulated with epoxy resin resulting a strong structure and electric insulation to the motor, enabling it to work in rough environment, such as, the docks and, even, underwater. The platform guiding can be obtained by rotating the single-sided stator by an angle relative to the longitudinal axis of the platform. This rotation can be accurately controlled by a small step-motor with a strong enough shaft fixed to the LIM.</p> <p>In the view of the possible applications, the control must be able not only to allow tele-operation, but also the autonomous execution of simple tasks. Thus, precise positioning and displacement capabilities are needed. As the LIM driven robotic platform presents higher coupling among the displacement properties (speed, direction, robot attitude) than conventional robots, it requires de development of an integrated control structure.</p> <p>The robotic platform is an under-actuated vehicle. Thus, there are restrictions to its positioning. This problem may be tackled either by path planning control techniques or by the use of restricted sets of pre-defined movements. While the second solution is simpler to implement, the first one yields a more flexible equipment. Both solutions will be analysed taking into account the type of application. A module for planning, controlling, monitoring and error recovering of the task to be executed by the robot, will be also developed.</p> <p>The control and supervision of the robot position and of the task execution require the integration of absolute position measuring system and a set of sensors, which will be acquired in the market.</p> <p>At the end of the project an application will be implemented, in order to demonstrate the platform features.</p>			
Partners:			
Instituto de Desenvolvimento de Novas Tecnologias - UNINOVA			

CLSP - Sensores de cor e de imagem com endereçamento e leitura óptica

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	?	Programme:	??
Project Type:	RTD	Role:	0
Start Date:	01-01-2006	Finish Date:	31-12-2008
Funding:	0 €	CTS Funding:	0 €
Abstract:			
0			
Partners:			
0			

COMPLETE (A1) - New Strategies of Competence acquisition for Lifelong Learning in Energy-Transport-Environment Engineering

Responsible:	<u>Luís Gomes</u>	Group	A12
Sponsor:	EC	Programme:	Leonardo da Vinci /
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2005	Finish Date:	31-12-2007
Funding:	170.389 €	CTS Funding:	16.023 €
Abstract:			

The COMPLETE project proposes to develop new strategies for increasing the trainers' lifelong teaching and learning competences by using interactive methods and modern training programmes in energy – transport - environment engineering (ETEE). These new strategies consist in:

- Training of trainers in ETEE, through updating and upgrading trainers' didactical competences to adopt and implement two interactive, interdisciplinary and complementary methods - Problem-based Learning (PbL) and Project-based Learning (PjL) - and improving the European dimension of trainers and learners through development of linguistic, communication and ITC competences;
- Producing the practical tools required for implementing this innovative approach, through developing and adapting an e-lifelong learning platform and designing and developing e-products taking into account the training needs in ETEE domains, facilitating interactive and innovative teaching and learning methods;
- Applying and using the human and material resources of the partners in ETEE training programmes, through organizing and developing training programmes and through developing a Lifelong Learning Center in ETEE for delivering training programs, for counseling and expertise, facilitating the collection exchange and dissemination among partners and allowing the extension of the interactive training methods through a transnational network.

Partners:

- P1. Transilvania University of Brasov - Romania
- P2. Gent University - Belgium
- P3. Paris 7 – Denis Diderot University - France
- P4. Laboratorio delle Idee - Italy
- P5. UNINOVA - Portugal
- P6. ARCE- Romania
- P7. ASTEC – Romania
- P8. SC INAR – Romania
- P9. Louis Pasteur University STRASBOURG - France

COMPLETE (A2) - New Strategies of Competence acquisition for Lifelong Learning in Energy-Transport-Environment Engineering

Responsible:	<u>Amadeu Leão</u>	Group	A21
Sponsor:	EC	Programme:	Leonardo da Vinci /
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2005	Finish Date:	31-12-2007
Funding:	340.779 €	CTS Funding:	32.047 €

Abstract:

The COMPLETE project proposes to develop new strategies for increasing the trainers' lifelong teaching and learning competences by using interactive methods and modern training programmes in energy – transport - environment engineering (ETEE). These new strategies consist in:

- Training of trainers in ETEE, through updating and upgrading trainers' didactical competences to adopt and implement two interactive, interdisciplinary and complementary methods - Problem-based Learning (PbL) and Project-based Learning (PjL) - and improving the European dimension of trainers and learners through development of linguistic, communication and ITC competences;
- Producing the practical tools required for implementing this innovative approach, through developing and adapting an e-lifelong learning platform and designing and developing e-products taking into account the training needs in ETEE domains, facilitating interactive and innovative teaching and learning methods;
- Applying and using the human and material resources of the partners in ETEE training programmes, through organizing and developing training programmes and through developing a Lifelong Learning Center in ETEE for delivering training programs, for counseling and expertise, facilitating the collection exchange and dissemination among partners and allowing the extension of the interactive training methods through a transnational network.

Partners:

- P1. Transilvania University of Brasov - Romania
- P2. Gent University - Belgium
- P3. Paris 7 – Denis Diderot University - France
- P4. Laboratorio delle Idee - Italy
- P5. UNINOVA - Portugal
- P6. ARCE- Romania
- P7. ASTEC – Romania
- P8. SC INAR – Romania
- P9. Louis Pasteur University STRASBOURG - France

COSIS - Coimbra Observatory Solar Information System

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	FCT	Programme:	POCTI/CTEAST
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2005	Finish Date:	31-12-2007
Funding:	12.000 €	CTS Funding:	5.000 €

Abstract:

The COSIS project (financed by FCT, MCES, Lisbon, Portugal: POCTI-CTE-AST/58333/2004) purpose is to develop a software tool for automatic image processing and feature recognition of sunspots (K1), chromospheric plages (K3), and filaments (Ha) for usage by astronomers and other interested parties.

The long-term objective is to create a data center (Solar/Astronomical Data Center of the OAUC – under consideration) and to integrate this data center in the Virtual Observatory project.

In collaboration with Dr. M. Kivana and Dr. V. Bumba from the Astronomical Institute, Czech Academy of Sciences, Ondrejov, Czech Republic it is foreseen to install in 2005 a CCD camera at the spectroheliograph of the OAUC to perform directly digitized observations

of the Sun.

All this process would enable to make available daily images at the website of the OAUC (Solar Datacenter of the OAUC – under consideration).

Partners:

Coimbra Observatory; UNINOVA

CoSpaces - Innovative collaborative work environments for individuals and teams in design and engineering

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP6/IST
Project Type:	RTD	Role:	Partner
Start Date:	21-05-2006	Finish Date:	31-10-2009
Funding:	8.000.000 €	CTS Funding:	365.080 €

Abstract:

The overall objective of CoSpaces is to develop organisational models and distributed technologies supporting innovative collaborative workspaces for individuals and project teams within distributed virtual manufacturing enterprises to establish effective partnerships, collaborate, be creative, improve productivity, reduce length of design cycles and take a holistic approach to implementing product phases. This will be achieved through enhanced human communication, innovative visualisation, knowledge support and natural interaction and will transform the current working practices to be more competitive in the global market.

CoSpaces proposes to validate these collaborative workspaces against three sectors: aerospace, automotive and construction. However, the impact of this research will go beyond these three sectors due to the generic nature of the technologies. CoSpaces will undertake the ambitious challenge of developing the technical, organisational and human networks to build collaborative workspaces. This will be achieved through a systematic and integrated programme of RTD activities, dissemination, training, demonstration and exploitation activities, led by a core consortium of European experts who are committed to this mission.

CoSpaces IP focuses on implementing the roadmap developed by the Future Workspaces roadmap project, involving over 100 key players from large number of areas. As a result of this roadmap activity, this consortium has already defined a 10-year European Vision for future collaborative working environments together with future scenarios, research challenges and key players for implementing this roadmap.

The aim of this IP is to initiate a programme of activities to implement this 10-year European vision to the benefit of European business, workforce, society and the ERA with a selection of the identified key players. CoSpaces directly address the three-layered tasks that are the strategic objective Collaborative Working Environments.

Partners:

PRAGMASHIS - Sistemas de Informação Lda. (Portugal); Societa Finanziaria Laziale di Sviluppo - FI.L.A.S. S.P.A. (Italy); Varinex Informatikai RT (Hungary); VIRCE - Kompetenzzentrum Virtuelle Realitaet und Kooperative Engineering W.V. (Germany); Centre Europeen de Recherche et de Formation Avancee en Calcul Scientifique (France); CIMPA (France); Fietuna Computer Consultants Limited (Germany); Consultores de Automatizacion y Robotica S.A. (Spain); The University of Nottingham (United Kingdom); Technology Application Network Lminited (Germany); Stichting Telematica Instituut (Netherlands); The University of Salford (Germany); UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Esoce Net (European Society of Concurrent Engineering) (Italy); COWI AS (Denmark); Universitaet zu Koeln (Germany); National Technical University of Athens (Greece); Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung E.V. (Germany); Universitet Stuttgart (Germany); X/Open Company Limited (Germany).

Dialugares - Educação Arte e Cultura

Responsible:	<u>Pedro Sousa</u>	Group	B1
Sponsor:	ICCTI/CNPq	Programme:	??
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2006	Finish Date:	31-12-2006
Funding:	0 €	CTS Funding:	0 €

Abstract:

O projecto Dialugares pretende implementar uma estratégia educativa através de uma abordagem integrada nas áreas da educação, da arte e da cultura, constituindo o património natural, cultural e artístico, um meio e um processo para o desenvolvimento de uma acção transversal à vida na cidade.

A transversalidade formaliza-se pelo contacto com o património da Cidade de Almada, promovendo um diálogo com múltiplas formas de comunicação e apreensão da realidade, recorrendo à complementaridade de recursos e métodos. Deste modo, viabilizam-se estratégias que exercitem permanentemente a relação entre a mobilidade física e digital através das seguintes propostas: O Lugar, Falar do Lugar, O Dia nos Lugares, Re(criar) o Lugar, Lugar ao Olhar, Lugar ao Jogo, Lugar às Ideias, conversar e publicar os seus trabalhos.

Estas propostas têm como principal finalidade criar condições aos cidadãos (crianças, jovens e adultos) para experimentarem os diferentes espaços, físicos e digitais, assumindo estes a centralidade do processo educativo.

Partners:

Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL)

DRUSAS - Automatic detection of Drusens in fundus images

Responsible:	<u>José Manuel Fonseca</u>	Group	B1
Sponsor:	FCT	Programme:	POCI/Health Sciences - Epidemiology and Public Health
Project Type:	RTD	Role:	Prime Contractor

Start Date:	01-09-2005	Finish Date:	30-03-2008
Funding:	62.772 €	CTS Funding:	38.000 €
Abstract:			
<p>Drusen is a retina abnormality considered a risk factor for age-related macular degeneration (ARMD) that is one of the leading causes of blindness. It is noticed in retina images as small sized yellow spots. To evaluate therapy effectiveness ophthalmologists usually do a visual inspection what is fastidious and not reproducible. Published data shows that the agreement between medical specialists in Drusen identification is only 67%.</p> <p>The goal of this project is the development of a methodology for automatic unsupervised detection and modeling of Drusen spots using image processing techniques. The methodology will be validated with a software prototype that will certainly improve the detection and quantification of Drusen.</p> <p>It is also a main objective for the project to do a clinical validation of it, to compare the results with the ones obtained by ophthalmologists.</p>			
Partners:			
Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL); Faculdade de Ciências Médicas (FCM/UNL); Fundação da Faculdade de Ciências e Tecnologia (FFCT/FCT/UNL)			

DRX2D - Detector digital de raios X para radiografia digital			
Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	EC	Programme:	FP5/?
Project Type:	RTD	Role:	0
Start Date:	01-01-2006	Finish Date:	31-12-2008
Funding:	0 €	CTS Funding:	0 €
Abstract:			
0			
Partners:			
0			

DSCMI - Desenvolvimento de sistemas de captação e monitoração de imagens			
Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	ICCTI/CNPq	Programme:	?/?
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2002	Finish Date:	31-12-2004
Funding:	0 €	CTS Funding:	0 €
Abstract:			
<p>Projecto de colaboração entre o governo português ICCTI) e o governo Brasileiro (CNPq).</p> <p>Pretende-se com este projecto desenvolver sistemas de captação e monitorização de imagens para aplicações em medicina, metalomecânica e segurança.</p>			
Partners:			
Portugal (ISEL, CFM), Brasil (CTI, Universidade da Bahia).			

ECOLEAD - European Collaborative Networked Organizations Leadership Initiative			
Responsible:	<u>Luís Camarinha Matos</u>	Group	C1
Sponsor:	EC	Programme:	FP6/IST
Project Type:	Network	Role:	Scientific Coordination
Start Date:	01-04-2004	Finish Date:	31-03-2008
Funding:	9.747.001 €	CTS Funding:	1.079.920 €
Abstract:			
<p>European Collaborative networked Organisations LEADership initiative, ECOLEAD, aims to create strong foundations and mechanisms needed to establish the most advanced collaborative and network-based industry society in Europe: "In ten years most enterprises will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations in response to fast changing market conditions."</p> <p>The fundamental assumption in ECOLEAD is that a substantial impact in materialising networked collaborative business ecosystems requires holistic approach. Area's complexity and the multiple inter-dependencies among the involved business entities, social actors, and technologies, substantial breakthroughs cannot be achieved with incremental innovation in isolated areas. On the other hand, project plans must remain manageable. Thus ECOLEAD addresses the most fundamental and inter-related focus areas, which form the basis for dynamic and sustainable-networked organizations: the VO Breeding Environments, Dynamic Virtual Organizations and Professional Virtual Communities. In addition to these three vertical focus areas, the holistic approach is reinforced and sustained on two horizontal areas: the theoretical foundation for collaborative networks and the horizontal ICT infrastructure.</p> <p>The horizontal activities support and affect all three vertical focus areas. The theoretical foundation shall provide the basis for technology-independent understanding of the area and its phenomena. The existence of an invisible, low-cost ICT infrastructure is a pre-condition for the establishment of truly dynamic collaborative networks. ECOLEAD is expected to impact industrial competitiveness and societal mechanisms, by providing means to effectively exploit opportunities deriving from the deployment of VOs, and by designing and enabling new professional work paradigms, capable of enacting the knowledge-based society throughout Europe.</p>			
Partners:			

Comarch S.A. (Switzerland); Stichting Aiesec International (Netherlands); Siemens Aktiengesellschaft Oesterreich (Austria); France Telecom SA (France); LogicaCMG Nederland B.V. (Netherlands); Enigma GmbH (Germany); Instituto Tecnológico y de Estudios Superiores de Monterrey (Mexico); Universidade Federal de Santa Catarina (Brazil); Ceske Vysoke Ucení Technické V Praze (Czech Republic); Universität Bremen (Germany); Institut Jozef Stefan (Slovenia); Software AG España SA (Spain); TES - Teleinformática e Sistemas S.R.L. (Italy); Gruppo Formula S.P.A. (Italy); T.X.T. E-Solutions SPA (Italy); Universiteit van Amsterdam (Netherlands); Virtuelle Fabrik AG (Switzerland); UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Certicon A.S. (Czech Republic); Valtion Teknillinen Tutkimuskeskus (Finland).

ECOPADEV - Developing new decision-making tools to promote the sustainable development in European cities based on eco-industrial park strategy

Responsible:	<u>Adolfo Steiger Garção</u>	Group	B1
Sponsor:	EC	Programme:	FP5/?
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2002	Finish Date:	31-07-2004
Funding:	2.196.880 €	CTS Funding:	99.897 €

Abstract:

The sustainable development is an European strategy to promote the competitiveness and growth, but preserving natural resources and improving quality of life conditions. The European objectives require efforts oriented to develop tools and management systems involving industry, administration and citizens. The ECOPADEV project is focused in developing decision-making tools for local authorities to improve town planning and local living conditions. Local authorities are an important catalyst to achieve sustainable development objectives, but in order to facilitate the application and suitability of these tools, the project will use an approach through Eco-industrial parks development in cities, as a potential strategy to join industry, citizens and administration efforts, integrating environmental socio-economic aspects.

Partners:

Parque Tecnológico S.A.; Energy Research Centre of The Netherlands; Fundacion Gaiker; Fundacion Robotiker; Royal Institute of Technology; Town council of Zamudio; Tampere Technology Centre LTD.; City of Tampere; Madan Parque - Parque de Ciencia e Tecnologia Almada/Setubal; Camara Municipal de Almada; UNINNOVA - Instituto de desenvolvimento de novas Tecnologias; Erasmus Universiteit Rotterdam; Ingenieurbuero Dr. Ing. W. Trinius

EE-II - Evolution and Ecology of Interacting Infohabitants

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	EC	Programme:	FP5/FET
Project Type:	RTD	Role:	Partner
Start Date:	01-05-2000	Finish Date:	30-04-2003
Funding:	602.561 €	CTS Funding:	188.000 €

Abstract:

This project is about a study of evolution and ecology of interacting infohabitants. We will study a population of infohabitants, with carefully designed interaction. An ontology will be defined, and soft computing used as a model for interaction. Properties to be studied are scalability, openness, adaptability, and stability. We aim at deriving concrete results that can be used in the design of universal information ecosystems. A demonstrator will be constructed as well.

Our main objective is to study the ecology of a system of interacting intelligent infohabitants, especially the scalability, openness, adaptability, and stability of the ecosystem. A sub-objective is to define intelligent interaction, or interaction of intelligent infohabitants. Another sub-objective is to study how the complexity of interaction of the infohabitants influences the behaviour of the ecology. Another sub-objective is to find what are the properties of the ecology of infohabitants that are worth studying. Another sub-objective, related to scalability, is the openness with respect to integration of new types of intelligent infohabitants. Our last technical sub-objective is the specification of conditions of stability of the ecosystem. Validation is also an objective of our project.

Partners:

Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa (Portugal); Technische Universiteit Eindhoven (Netherlands); Imperial College of Science, Technology and Medicine (United Kingdom).

EIE-Surveyor - REFERENCE POINT FOR ELECTRICAL AND INFORMATION ENGINEERING IN EUROPE

Responsible:	<u>Luís Gomes</u>	Group	A12
Sponsor:	EC	Programme:	SOCRATES Thematic Network/
Project Type:	Network	Role:	Partner
Start Date:	01-10-2005	Finish Date:	30-09-2008
Funding:	0 €	CTS Funding:	0 €

Abstract:

OBJECTIVES:

- Reflection on generic competences and subject-specific competences in Electrical and Information Engineering (EIE),
- Implementation of quality assessment methodologies on some educational resources available in EIE,
- Reflection and proposition of a methodology for accreditation, in order to enhance comparability and common certification procedures,
- Proposition of a census of the existing curricula in EIE in Europe, the multinational degrees, and the situation of the implementation of the -- Bologna-process in EIE, at the bachelor, master and PhD levels.

TARGET GROUPS:

- Professional engineering associations, Life Long Learning institutions,
- Students, teachers and learners,

- Accreditation boards.

MAIN ACTIVITIES:

- Application of the TUNING methodology to EIE, to identify competences,
- Observatory on the degrees available in EIE in Europe, and state of the implementation of the Bologna-process,
- Quality assessment of some resources in EIE available through internet,
- Analysis of existing accreditation procedures, proposition of a methodology.

EXPECTED OUTPUTS:

- Update of the monograph on the degrees and international degrees available in EIE in Europe,
- Guidelines for contents as generic competences and subject-specific competences in EIE,
- Guideline for a proposition for an accreditation methodology, together with a census on existing accreditation boards and methodologies,
- Mediatheque of selected pedagogical resources available in EIE, with a quality assessment.

Partners:

University of Applied Sciences Upper Austria, Campus Wels; Graz University of Technology; e-LEE Association; Karel de Grote Hogeschool; University college Sint-Lieven; Ghent University; H.É.P.L. Rennequin SUALEM University of Applied Sciences; Ghent University; Board of European Students of Technology (BEST); Faculty of Communication Technique and technologies, TU-Sofia; Russe University "Angel Kanchev"; Bmo University of Technology; Technical University of Liberec; edaw; Czech Technical University in Prague; Universitat politècnica de catalunya; University of Oviedo; Universitat de Girona; Universidad Politécnica de Valencia; University of Vigo; University of Zaragoza; universidad de vigo; Universidade de Vigo; Universitat de Barcelona; University of Cantabria; Tallinn University of Technology; Lappeenranta University of Technology, Electrical Engineering; University of Oulu; Université Joseph Fourier Grenoble; Ucbi-cegely; Iut d'epinal - université de nancy 2; Université Henri Poincaré Nancy 1 ESSTIN; Ecole des Hautes Etudes d'Ingénieur; University of Savoie, ESIA; University Bordeaux 1; Université d'Angers, LISA-ISTIA; IUT Le Creusot/Université de Bourgogne; Institut National des Sciences Appliquées (INSA); ENSEA; Univ. Toulouse 3 - Paul Sabatier; Université de Rennes 1; Club EEA (INSA de Lyon, CREATIS); Ecole Nationale d'Ingénieurs de Brest; ENSIM - Université du Maine; Polytech'Montpellier - Université Montpellier 2; Université Pierre Mendès-France; Université Pierre et Marie Curie - Paris 6; University of Ulm, Department of Microwave Techniques; MA&T Sell & Partner GmbH; Fraunhofer Institute Digital Media Technology; German Chapter IEEE EdSoc; Technische Universitaet Ilmenau; Technical University of Crete; Technological Educational Institute of Crete; Technological Educational Institution (TEI) of Kavala; John von Neumann Faculty of Informatics Budapest Tech; Budapest University of Technology and Economics; University of Limerick; Board of European Students of Technology (BEST); Univ of Cagliari; University of Cagliari; University of Genoa - DIBE; Politecnico di Torino; University of Siena - Department of Information Engineering; Riga Technical University; Kaunas University of Technology; Dept University of Malta; Delft University of Technology; AGH University of Science and Technology; Delphi Steering; University of Bielsko Biala; The Silesian University of Technology; Politechnika Krakowska (Cracow Univ. of Technology); Instituto superior tecnico, deec, ac- telecomunicações; Instituto Superior de Engenharia/Politécnico do Porto; FEUP; Instituto Superior de Engenharia/Politécnico do Porto; Instituto Politécnico do Porto; EST Setubal; Univ. Nova Lisboa - Faculdade Ciências e Tecnologia; Technical University Gh. Asachi Iasi; University of Craiova; "Politehnica" University of Timisoara, Faculty of Automation and Computers; Technical University of Cluj Napoca; National R&D Institute for Isotopic and Molecular Technologies; "Vasile Goldis" Western University; Slovak University of Technology; Technical university kosice; Uppsala University, Dept. of Engineering Sciences; Ege Univ. International Computer Inst.; Eastern Mediterranean University; Bogazici University; Priazovskyi State Technical University; University of York

EO-KES - Earth Observation domain-specific Knowledge Enabled Services

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	ESA	Programme:	ESRIN/
Project Type:	RTD	Role:	Partner
Start Date:	01-10-2002	Finish Date:	01-10-2004
Funding:	299.982 €	CTS Funding:	124.996 €
Abstract:			
<p>The EO-KES project deals with the artificial and (semi-) automatic reproduction (in an Earth Observation oriented domain) of several of the following human being capabilities and processes: knowledge capture; knowledge reception; knowledge archive; knowledge retrieval; knowledge organization; and knowledge application. Hence, the 'services' (i.e., the transformations) provided and/or supported by the EO-KES system are referred to as 'Knowledge Enabled' ones.</p> <p>Our goal is to develop:</p> <p>Specific 'knowledge access' interfaces - thus assuming that it shall be feasible to standardize knowledge formalization. De-facto standards to represent wide types of knowledge are now available, from rule and complex ontology to neural networks.</p> <p>'Knowledge services', categorized as general purpose to grant the effective handling of the knowledge.</p> <p>'Domain Knowledge Enabled Services', which are those applications specific constructed with all the general purpose available services (data, information and knowledge ones).</p> <p>'Applications: knowledge exploitation and formalization'. Resulting from the combination of knowledge services as well as applications, which allow the system to be 'instructed', support (supervised/unsupervised) learning or - in general - bring knowledge into the system.</p> <p>'HMI knowledge formalization and application'.</p>			
Partners:			
GTD - Ingenieria de Sistemas y Software Industrial, Starlab, Tor Vergata Università			

EUI-Net - European University-Industry Network

Responsible:	<u>Luis Gomes</u>	Group	A12
Sponsor:	EC	Programme:	Socrates Erasmus/
Project Type:	Network	Role:	Partner
Start Date:	01-10-2005	Finish Date:	30-09-2008
Funding:	0 €	CTS Funding:	0 €
Abstract:			

The EUI-Net Thematic Network project intends to approach the transversal theme of the university role in a knowledge-driven society, namely the University - Industry cooperation.

As a policy issue, the network will contribute to the cultural, economic and technical construction of the European Union. EUI-Net will be a mean in itself to stimulate and adapt higher education for a better cooperation with industry, by systematically addressing the traditional U-I cooperation areas, such as curriculum development and professional insertion, research and development and services. The EUI-Net has in view the two basic tasks supported by Socrates programme i.e. mapping and enhancing education and facilitating European cooperation together with the four new defined tasks i.e. defining and updating generic and specific competences; promoting synergies between teaching and research; reinforcing the link between education and society; creating links with other continents.

The project aims to create an European network of universities and industrial partners to strengthen the university - industry cooperation in the field of education, research and services in a wider European perspective, contributing to the defining and strengthening the role of University within the European Education Area.

Therefore, the main objectives of the proposed Thematic Network are:

Defining and updating generic and specific competences relevant to the industrial sector by adapting the "Tuning" methodology, as well as generic and specific competences for the practical stages of the students as part of the curriculum;

Promoting synergies between teaching -learning -research in the Higher Education European structures, both at initial and continuing education level, in accordance with current industry labour force, demand by integrating research results in the teaching programmes and for stimulating the innovation capacity.

Partners:

"Transilvania" University of Brasov, Romania - coordinator; European Association for Training and Technology Transfer (ATTT), Bruxelles, Belgium; Catholic University of Applied Science KoHo Sint-Lieven, Belgium; EuroPACE 2000, Heverlee, Belgium; Vraa College, Denmark; Aalborg University, Institute of Energy Technology, Aalborg, Denmark; Technical University of Ilmenau, Germany; University of Applied Science Konstanz, Germany; Aachen University of Applied Sciences, Germany; Technological Educational Institute of Patras, Greece; IVIS Information and Telecommunication Systems LLC, Athens, Greece; Technical Institute of Thessaloniki, Greece; National Technical University of Athens, Greece; Information and communications ltd, Athens, Greece; ; Daedalus Informatics Ltd, Glyfada, Greece; Polytechnic University School of Donostia - San Sebastian, University of the Basque Country, Spain; Compostela Group of Universities, Santiago de Compostela, Spain; University of La Rochelle, France; University Paris 7, Paris, France; CEREALOG SARL, La Rochelle, France; GMIT - Galway - Mayo Institute of Technology, Galway, Ireland; University of Sacred Heart, Milano, Italy; Laboratory of Ideas, Fabriano, Italy; MECCANO SpA, Fabriano, Italy; INFO s.r.l., Rome, Italy; H.T.G. - High Technology Group s.n.c., Rome, Italy; ENEA, Rome, Italy; Systems & Services, Livorno, Italy; Institute of Population and Social Politic Research, Rome, Italy; Institute for Development of Third Sector, Rome, Italy; ; Italian Institute for Research in Mountain Regions, Rome, Italy; ; International Excellence Reserve - I.E.R., Eindhoven The Netherlands; Amadeus Association, Vienna, Austria; UNINOVA - Institute for the Development of New Technologies, Monte de Caparica, Portugal; Polytechnic Institute of Porto, Portugal; ADITEC - Assoc for Technical Develop and Innov., Porto, Portugal; Universidade do Algrave, Faro, Portugal; Portuguese Catholic University - College of Biotechnology, Porto, Portugal; ; Tampere University of Technology, Finland; Mälardalen University, Sweden; De Monfort University, Leicester, United Kingdom; Henley Management College, Oxon, United Kingdom; Staffordshire University, Stafford, United Kingdom; Cranfield University, Bedford, United Kingdom; Technical University of Iceland, Reykjavik, Iceland; University of Bergen, Bergen, Norway; Technical University of Sofia, Sofia, Bulgaria; Tomas Bata University in Zlin, Faculty of Management and Economics, Zlin, Czech Republic; Tallinn Technical University, Estonia; MTU QUIN, Tallinn, Estonia; University of Cyprus, Nicosia, Cyprus; Rezekne Higher Education Institution, Rezekne, Latvia; Business Innovation Center of Latvian Electronic Industry, Riga, Latvia; Banking Institution of Higher Education, Riga, Latvia; Kaunas University of Technology, Lithuania; Baltic Education Technologies Institute, Vilnius, Lithuania; Budapest University of Economic Sciences & Public Administration, Budapest, Hungary; University of Pecs, Budapest, Hungary; Eszterházy Károly College, Eger, Hungary; University of Malta, Msida, Malta; Poznan University of Technology, Poznan, Poland; State Governed Vocational School for Higher Education (PWSZ), Gorzow Wlp, Poland; Polytechnic University of Bucharest, Romania; ASTEC - TEMPUS Association for Continuing Education, Bucharest, Romania; Chamber of Commerce and Industry, Brasov, Romania; Canam Steel, Brasov, Romania; Institute for Retraining in Mechanical and Electrical Engineering - IPIMEA, Brasov, Romania; Romanian Foundation for Energy and Environment, Bucharest, Romania; University of Maribor, Maribor, Slovenia; Centre of Distance Education at Technical University in Zvolen, Slovakia ; Ankara University, Turkey; University "Ovidius" of Constanta ; SIEMENS Program and Systems Engineering S.R.L.;

EUPASS - Evolvable Ultra-Precision assembly Systems

Responsible:	<u>Luis Camarinha Matos</u>	Group	C1
Sponsor:	EC	Programme:	FP6/?
Project Type:	RTD	Role:	Partner
Start Date:	10-12-2004	Finish Date:	31-10-2008
Funding:	10.709.183 €	CTS Funding:	278.520 €

Abstract:

Notwithstanding recent technological advances, the social and economic situation for assembly-intensive companies in Europe is in serious decline (European outsourcing of assembly at 21% in 2000, predicted over 40% by 2007). The alarming issue behind such forecasts are, among others, the long-term consequences of outsourcing assembly to non-European countries, in spite of the fact that entire industries have already been lost through such practices.

Strategically speaking, new technologies such as micro products, and their production systems, could be exploited to turn these threats into opportunities, which has happened outside Europe. To date, no comparable measures have been taken in Europe. Industrialists and some academic partners of the Assembly-Net Thematic Network, propose such an initiative as an Integrated Project titled EUPASS. The EUPASS project aims to develop affordable, cost effective and sustainable ultra-precision manufacturing solutions by offering rapidly deployable ultra-precision assembly services on demand.

This will be achieved by developing and delivering a number of breakthrough technologies and solutions including:

- European wide pilot infrastructure of depots of micro-assembly modules and integration software, enabling rapid configuration and deployment of flexible precision assembly systems with minimum investment cost.
- Next generation ultra-precision enabling technologies, including modular high-precision manipulators, grippers and feeders.
- Novel micro joining techniques including micro-mechanical joints, nano-dispensing, and laser welding.
- Robust and legacy-compliant knowledge driven methodology, cost models and software tools to support the offering of rapidly deployable ultra-precision assembly services with low investment cost, high capacity utilisation and improved equipment reusability
- New standards for seamless integration of precision assembly modules and control systems using open architecture approach

Partners:

MASMEC S.r.l. (Italy); Fachhochschule Nordwestschweiz Solothurn, University of Applied Sciences (Switzerland); The University of Nottingham (United Kingdom); Consiglio Nazionale delle Ricerche-Institute di Tecnologie Industriali ed Automazione (Italy); TQC Ltd (United Kingdom); VDI/VDE Innovation + Technik GmbH (Germany); Université de France-Comté (France); Tampere University of Technology (Finland); Robert Bosch GmbH (Germany); Kungliga Tekniska Hogskolan (Sweden); Forschungszentrum Karlsruhe GmbH (Germany); Festo AG & Co. KG (Germany); École Polytechnique Fédérale Lausanne (Switzerland); UNINOVA-Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Electrolux Home Products Italy Spa. (Italy); Flexlink AB (Sweden); Electro Beckhoff GmbH (Germany); IEF Werner GmbH (Germany); FEINTOLL Automation AG (Switzerland); Fraunhofer-Gesellschaft zur Förderung der angewandten e.V. (Germany); Philips Centre for Industrial Technology (CFT) (Netherlands).

FAST-ERGO X - Method to support workstation ergonomic analysis

Responsible:	<u>Isabel Nunes</u>	Group	B1
Sponsor:	EC	Programme:	FP5/?
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-06-2006	Finish Date:	31-12-2007
Funding:	57.000 €	CTS Funding:	57.000 €
Abstract:	0		
Partners:	0		

FLOW - Advanced Control of Processes with Transport Phenomena

Responsible:	<u>Rui Neves da Silva</u>	Group	B2
Sponsor:	FCT	Programme:	POSC/EEA-SRI
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-03-2005	Finish Date:	30-03-2008
Funding:	65.256 €	CTS Funding:	15.720 €
Abstract:	<p>The FLOW project aims the development of Advanced Non-Linear and Adaptive Control methodologies for distributed parameter systems with transport phenomena. These methods are to be applied in different case studies such as</p> <ul style="list-style-type: none"> (i) the control of car density in highway traffic flow and; (ii) the control of water flow in a water distribution channel system; (iii) the control of temperature in large-scale distributed heat-exchangers. <p>Although these applications can be viewed as quite different in their essence, they share an important common characteristic, as the three of them can be modelled by a hyperbolic partial differential equation (PDE) resulting from the natural transport phenomena. This forms a strong common basis for control.</p> <p>Examples of large-scale heat-exchangers include superheated steam in thermoelectric power plants and distributed collector solar fields. In both cases the dynamics are affected by the flow. For the car density in highways the transport phenomena is direct (with diffusion associated with the dispersion of behaviours between the different vehicles in the stream), the control being made through variable speed limits in certain road segments. The water channel system case study has again mass transportation (water distribution) but the control is performed by changing the flow through the actuation on several floodgates along the channel. Also, for the three cases different disturbance effects are present.</p> <p>The proposed strategy for controlling these systems consists of two main steps: a) Adequate spatial and/or temporal discretization; b) Application of methods of Adaptive and/or Non Linear control to the resulting system. While classical methods consider grids which are uniform in time and space, this project follows another approach allowing better integration of steps a) and b) and which reflects in increased control performance. It amounts in practice to a variable change in the time scale and/or a change of the variable to control. The approach to follow assumes an engineering standpoint reflected in the practical examples discussed above that don't deplete the number of other applications of these methods. Besides the aspects of control algorithm structure, two important questions to consider are the study of the stability of the internal dynamics and the robustness with respect to modelling errors, using non-linear methods.</p>		
Partners:	<p>Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL); Instituto de Engenharia de Sistemas e Computadores, Investigação e Desenvolvimento em Lisboa (INESC ID/INESC/IST/UTL); Universidade de Évora (UE)</p>		

FORDESIGN - Formal methods for Embedded Systems Co-Design

Responsible:	<u>Luís Gomes</u>	Group	A12
Sponsor:	FCT-POSC	Programme:	EIA/
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-05-2005	Finish Date:	30-04-2008
Funding:	90.000 €	CTS Funding:	90.000 €
Abstract:	<p>Several distinct models of computation have already proved their adequacy for the embedded systems' design. Among these, we find state diagrams and other related formalisms, namely statecharts and Petri nets. This project explores the similarities among these formalisms in several directions: on one hand it groups them in one single methodology and associated development tools; on the other hand, it builds upon known developments in the Petri nets' field to propose the use of a class of low-level nets. This class is then used as the underlying system-level specification language to which all the mentioned formalisms are translated before being verified and implemented.</p> <p>Message sequence charts will also be considered and their translation to the used Petri nets class will be defined.</p>		

The embedded system development underlying methodology, considering hardware-software co-design techniques, is roughly described in Figure "Abstract" (attached).

A set of procedures will be formally defined enabling the partitioning of the model and identification of sub-models, from here on identified as components. Each component can be afterwards mapped into hardware or software, according to specific cost function metrics, using hardware-software co-design techniques. For some of the referred formalisms lifting of hierarchical structuring mechanisms has to be applied first in order to enable the production of autonomous components (as a set of parallel non-hierarchical models). Statecharts are the paradigm for this modification type.

The project will define a set of mappings between the referred models of computation and a class of low-level Petri net with a few non-autonomous extensions.

A set of tools will be developed, relying on the representation of Petri net models through the emergent PNML standard (being prepared inside ISO), that will be the glue to assure interoperability between the computational tools to be developed in this project and other computational tools already available. Two main tools will be developed: the first will allow graphical editing of low-level Petri net models and will support interactive simulation through interaction with an external token-player. It will support a uniform way to specify hierarchical constructs, composition dependencies between models (allowing model's reusability), and crosscutting modification to those same models. To this end a simple algebraic language, with an associated graphical representation, will be defined and represented in PNML.

- The second one is responsible for automatic code generation from PNML representations (ANSI C or VHDL code for software or hardware implementations), that can be used for verification, simulation, and execution purposes. All three goals will have in common the same generated code for net execution.

In the end, the project will allow an effective use of several distinct models of computation for the co-design of embedded systems, using Petri nets as the system-level specification language.

Partners:

Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL)

FRF - Fabrico Rápido de Ferramentas

Responsible:	<u>Adolfo Steiger Garção</u>	Group	B1
Sponsor:	EU/PRIME	Programme:	??
Project Type:	RTD	Role:	0
Start Date:	01-01-2003	Finish Date:	31-12-2005
Funding:	0 €	CTS Funding:	0 €

Abstract:

O Projecto Mobilizador FRF – Fabrico Rápido de Ferramentas, visa criar as competências e instalar as condições que permitem fabricar em tempo útil os protótipos técnicos de que a Indústria necessita, aumentando deste modo a sua capacidade para oferecer produtos de maior qualidade e tecnicamente mais evoluídos e contribuindo para reforçar a sua presença no mercado internacional. O projecto tem como principais objectivos, o desenvolvimento, validação e demonstração de cadeias de produção para fabrico de Moldes Rápidos para Injecção, de Ferramentas Rápidas para Fundição, de Ferramentas Protótipo para Estampagem e de Electrodos Rápidos.

Partners:

IBEROMOLDES, S.A.; FERESPE, Lda; M.C.Graça, Lda; SONAFI; INETI; INEGI; CENTIMFE

FUNSIEC - Feasibility for a Unified Semantic Infrastructure for the European Sector

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP6/eContent
Project Type:	RTD	Role:	Partner
Start Date:	01-03-2004	Finish Date:	28-02-2005
Funding:	307.008 €	CTS Funding:	48.289 €

Abstract:

The general aim of the FUNSIEC project is to study the feasibility of building and maintaining an Open Semantic Infrastructure for the European Construction Sector (OSIECS) at a technical, organisational and business level. Such an infrastructure is to be built by gathering semantic resources devoted to the construction sector in different languages, including public results produced by international initiatives and EC-funded projects. OSIECS will be made available to content and service providers, as well as to other actors in the construction area, to help them exploit fully the advantages of Construction-oriented semantic-based e-resources. In order to develop OSIECS, the work to be carried out in FUNSIEC follows major trends and strategies currently in place in Europe on one hand and, on the other hand, it can (likely) be a good mechanism to provide answers to the business needs related to the use of what is named Semantic Resource (SR) in FUNSIEC. A Semantic Resource is a generic term used to refer dictionaries, taxonomies, ontologies, and other similar types of resources where semantics play a crucial role.

Partners:

Centre Scientifique et Technique du Bâtiment (France); UNINOVA - Instituto de desenvolvimento de Novas Tecnologias (Portugal); University of Salford (United Kingdom).

ICT Standardization - EU Study on the specific policy needs for ICT standardisation

Responsible:	<u>Paulo Pinto</u>	Group	A11
Sponsor:	EC	Programme:	??
Project Type:	RTD	Role:	Partner
Start Date:	01-05-2006	Finish Date:	31-12-2007
Funding:	289.900 €	CTS Funding:	32.850 €

Abstract:

The project is studying the current reality of EU ICT standardization policy in Europe, putting it in perspective at a global scale, and must propose recommendations for the definition of future policies for Europe

Partners:

DLA Piper; Tudelft, Uninova

IDEAS - Interoperability Development for Enterprise Application and Software – Roadmaps

Responsible: Adolfo Steiger Garção

Group C2

Sponsor: EC

Programme: FP6/IST

Project Type: RTD

Role: Partner

Start Date: 01-06-2002

Finish Date: 31-05-2003

Funding: 399.993 €

CTS Funding: 30.242 €

Abstract:

The objectives of IDEAS project is to create and to manage a Working Group to elaborate a strategic roadmap in the domain of enterprise application and software interoperability for the next ten years and to propose to EC a structure and an organisation to support the implementation of this roadmap in the sixth FP. For each of the technology areas of the interoperability study: architecture, modelling and ontology, the Working Group will provide a State of the Art and User requirements. IDEAS WG will provide a "vision" and scenarios on how the European Industry will face the challenges of interoperability. The Technology Roadmaps for the interoperability will be extracted from the gap analysis between the state of the art and the vision. Then, management tools to pilot roadmaps implementation will be defined, based on the tools proposed by EC for FP6.

Partners:

Computas Holding AS (Norway); Asociacion de Investigacion Y Desarrollo en la Industria del Mueble Y Afines (Spain); Centro Ricerche Fiat Societa Consortile per Azioni (Italy); IC Focus Limited (United Kingdom); Graisoft (France); UNINOVA-Instituto de Novas Tecnologias (portugal); Intracom S.A. Hellenic Telecommunications and Electronics Industry (Greece); Sap Aktiengesellschaft Systeme, Anwendungen, Produkte in Der Datenverarbeitung (Germany); EADS CCR (France); Baan Development B.V. (Netherlands); Gruppo Formula S.P.A. (Italy); Université de Bordeaux I (France).

IDENTITY - INDIVIDUALIZED LEARNING ENHANCED BY VIRTUAL REALITY

Responsible: Luís Gomes+Fernando Coito

Group A12

Sponsor: EC

Programme: SOCRATES/

Project Type: RTD

Role: Partner

Start Date: 01-10-2006

Finish Date: 30-09-2008

Funding: 332.639 €

CTS Funding: 20.970 €

Abstract:

Objective: the overall project objective is to produce a high level quality learning environment in an academic European network ensuring an open access to improved educational resources. Target group: the primary target group is composed of tutors and students enrolled in educational process at university level, in electrical engineering domain. Expected outputs: 1) Consolidated report concerning the using of VR and remote experiments in education; 2) Enhanced Individualized Learning Environment (EILE); 3) VR-Learning Resources Centre (VR-LRC); 4) Educational report; 5) Examples of good practice. Main activities: benchmarking the solutions using remote experiment and VR, which are in use today; EILE & VR-LRC producing; action-research analysis concerning the EILE & VR-LRC impact on the learning process.

Partners:

Transilvania University of Brasov, Romania
Noema Competency Management International Oy, Finland
Technical University of Ilmenau, Germany
Department of Biophysical and Electronic Engineering - University of Genoa, Italy
Laboratorio delle Idee, Italy
Universidade Nova de Lisboa – Faculdade de Ciências e Tecnologia, Portugal
SIEMENS PROGRAM AND SYSTEM ENGINEERING, Romania
Faculty of Electrical Engineering and Informatics Technical University of Kosice, Slovak
Swedish TelePedagogic Knowledge Centre, Sweden
EMMERCE EEIG, Sweden

InAml - Innovative Ambient Intelligence Based Services to Support Collaborative Work in Flexible Assembly and Manufacturing Systems

Responsible: Rui Neves da Silva

Group B2

Sponsor: EC

Programme: FP6/IST

Project Type: RTD

Role: Prime Contractor

Start Date: 01-10-2005

Finish Date: 30-09-2008

Funding: 1.449.029 €

CTS Funding: 149.469 €

Abstract:

InAml will explore how a combination of Agents, Ambient Intelligence (Aml) and Semantic-Based Knowledge Management (SBKM) can support a collaborative man-agement of industrial installations over the production-cycle. Industrial experience will be collected in Portugal, Germany and Spain.

InAml aims to develop an innovative methodology and platform for optimisation of production-cycle man-agement of complex Assembly

and Manufacturing Systems (AMS) and its products, including a platform to provide different collaborative services needed for optimal design and improvement/innovation of AMS. Its principal benefit will be improvements in quality and reliability in manufacturing leading to decreased consumption of natural resources and increased added-value. InAml seeks to strengthen and use the value chains between vendors of industrial installations and their customers, by provision of services and by utilising Aml systems to improve production-cycle management of such installations. The project intends to bring considerable impact upon competitiveness, economic growth and sustainability of both vendors of installations and industrial end-users.

The crucial impact of InAml can be expected in pushing a bright introduction of Aml systems in industrial environment. By demonstrating the efficiency of using Aml systems to provide radical improvement in collaborative work within manufacturing Extended Enterprise (EE), InAml is likely to contribute to increase awareness of the benefits in application and introduction of Aml technology in industry.

By using the InAml project results to foster collaborative work in manufacturing companies will improve competitiveness and business development of both vendors of AMS, service provider and end-users (manufacturers using AMS).

By fostering application of Aml and KM systems in industry, InAml will directly contribute to a promotion of human centred manufacturing concepts and by this will considerably contribute to radical improvement of working conditions in manufacturing industry.

The main objective is to provide a breakthrough in the e-collaborative management of AMS based on effective usage of advanced combination of Agent, Ambient Intelligence (Aml) and Semantic-Based Knowledge Management (SBKM) technologies to support efficient collection and utilisation of information/knowledge relevant for the collaborative decision-making process among sub-systems in the working environment.

Partners:

UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias (Portugal); ATB - Institut fuer angewandte Systemtechnik Bremen GmbH (Germany); ATECNIC Air Conditioning - Aparelhos de Ar Condicionado, SA.(Portugal); AISIAKIN - Aguirregomezkorta Hermanos S.A.(Spain); LSW Maschinenfabrik GmbH (Germany); Siemens AG (Germany); Bosch Rexroth AG (Germany); Fundacion Fatronik (Spain); GER - Máquinas herramienta, S.L. (Spain)

InLife - Integrated Ambient Intelligence and Knowledge-Based Services for Optimal Life-Cycle Impact of Complex Manufacturing and Assembly Lines

Responsible:	<u>Rui Neves da Silva</u>	Group	B2
Sponsor:	EC	Programme:	FP6/NMP
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-11-2005	Finish Date:	31-10-2008
Funding:	1.698.012 €	CTS Funding:	215.840 €

Abstract:

InLife project will explore how a combination of advanced Ambient Intelligence (Aml) and Knowledge Management (KM) technologies can be used to assure a sustainable and safe use of manufacturing and assembly lines (MAL) and their infrastructure over their life-cycle. InLife specifically will improve the whole service-life operational costs and impact of MAL, providing new ways to monitor on-line Life-Cycle Parameters of MAL and improved services to support MAL along its whole life-cycle. To achieve these strategic objectives the project will provide: (a) new InLife methodology on how to apply a combination of Aml technology integrated in manufacturing processes and KM solutions to provide services and optimise life-cycle management of a MAL, addressing organisational issues regarding cooperation strategy within the extended enterprise (EE) concept, and (b) generic and widely applicable, modular Life-Cycle Management System (LCMS) based on multi-agent technology. These approaches will provide cost and time effective ways to collect higher amount of information/knowledge that up to now were practically impossible to acquire. The main originality lies in an effective combination of Aml and KM technologies to optimise life-cycle of complex MAL. Aml information and knowledge gathered within an EE environment along different life-cycle sectors of a MAL represent an untapped resource for optimisation of life-cycle of industrial installations and processes and for provision of services over the whole life of MAL. The InLife system and methodology will be tested by different business cases with end-users and vendors in the consortium, addressing different manufacturing concepts: highly automated and a combination of manual and automation MAL. The project will provide as exploitable results: methodology to apply Aml and KM technologies to assure optimal life-cycle impact of MAL, and a set of LCMS components applicable in different industrial environments.

Partners:

UNINOVA - INSTITUTO DE DESENVOLVIMENTO DE NOVAS TECNOLOGIAS; SCHNEIDER ELECTRIC GMBH; GSN MASCHINEN-ANLAGEN-SERVICE GMBH; LSW MASCHINENFABRIK GMBH; AGUIREGOMEZCORTA HERMANOS SA.; INSTITUT FUER ANGEWANDTE SYSTEMTECHNIK BREMEN GMBH; FUNDACION FATRONIK; ATECNIC - AIR CONDITIONING - APARELHOS DE AR CONDICIONADO S.A.

INNOVAFUN - Apply open standards to innovate furniture business processes

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP6/INNOVA
Project Type:	RTD	Role:	Technical Coordination
Start Date:	01-11-2006	Finish Date:	31-10-2008
Funding:	799.996 €	CTS Funding:	250.439 €

Abstract:

INNOVAFUN will build industrial consensus on the innovative funStep standard-based solution, facilitating the integration of open standards in the furniture industry into the design of new products and services. The project identifies new services for a better improvement in business processes, implementing an action plan for its harmonization, and delivering outreach activities supported by focused user-oriented material.

INNOVAFUN strategic objectives are:

- Facilitate SME's integration and adoption of the funStep standard-based solutions
- Lead SMEs to a better position in the competitive global market, stimulating the innovation by improving their business processes
- Develop and execute an action plan for the exploitation of the funStep standard by promoting business practices and services and providing practical guidance for their implementation

The objectives will be achieved through:

- Identification and evaluation of common business process requirements to help companies becoming more competitive
- Building on innovative solutions, facilitating the integration of the funStep standard into the design of new business practices and services and supporting novel business networking activities
- Implementing Outreach actions to provide the furniture industry with complete awareness on the advantages of integrating funStep standard-based solutions

Partners:

AIDIMA; Ufurniture, Wood and Packaging Technology Institute - AIDIMA (ES), Instituto de Desenvolvimento de Novas Tecnologias - UNINOVA (PT), Union Européenne de l'Ameublement - UEA (BE), DESIGNMARKET.COM (SE), FEDERMOBILI (IT), Fundación Comunidad Valenciana - Región Europea - FCVRE (ES), Fira International (GB) and Université Henri Poincaré Nancy I (FR).

INTEROP - Interoperability Research for Networked Enterprises Applications and Software

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP6/IST
Project Type:	Network	Role:	Partner
Start Date:	01-11-2003	Finish Date:	31-10-2006
Funding:	6.500.000 €	CTS Funding:	226.160 €

Abstract:

World-class competitiveness of European Enterprises, including SMEs, strongly depends, in the future, on their ability to concretise massively and rapidly networked dynamic organisations. New Technologies for Interoperability within and between enterprises, have to emerge to radically solve the recurrent difficulties - largely due to the lack of conceptual approaches - encountered to structure and interlink enterprises' systems (information, production, decision).

Today, research on Interoperability of Enterprise Applications does not exist as such at the European level. As a result of the IST Thematic Network IDEAS, the roadmaps for interoperability research emphasises the need for integrating three key thematic components:

- Ontology to identify interoperability semantics in the enterprise
- Enterprise Modelling to define interoperability requirements
- Architectures and Enabling Technologies to provide implementation frameworks.

INTEROP aims to extract value from the sustainable integration of these thematic components and to develop industrially significant new knowledge. Network's role will be to create the conditions of a technological breakthrough to avoid that enterprise investment be simply pulled by incremental evolution of IT offer. To ensure efficient industrial impact, INTEROP proposes, as a validation and dissemination strategy, to have strong interactions with IPs in the same domain of interest, like ATHENA in which the major enterprise-oriented IT providers are involved, in particular regarding future standardisation.

The Joint Programme of Activities aims to:

- integrate the knowledge in Ontology, Enterprise Modelling and Architectures to give sustainable sense to interoperability
- structure the European research community and influence organisations' programmes to achieve critical research mass
- animate the community and spread industrially significant research knowledge outside the network.

Partners:

Universitaet Klagenfurt (Austria); Université de Nantes (France); École Centrale de Lille (France); Univ. de Valenciennes et du Hainaut-Cambresis (France); École Centrale de Nantes (France); Helsingin Yliopisto (Finland); Cimmedia Limited (United Kingdom); Universidad Politécnica de Valencia (Spain); Gruppo Formula S.P.A. (Italy); Consiglio Nazionale Delle Ricerche (Italy); Deutsches Forschungszentrum fuer Kuenstliche Intelligenz GmbH (Germany); Cimos Association E.V. (Germany); Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung E.V. (Germany); Université Henri Poincaré Nancy 1 (France); Stichting Katholieke Universiteit Brabant (Netherlands); Université de Lausanne (Switzerland); Université de Geneve (Switzerland); Univ. of Kent at Canterbury (United Kingdom); Univ. Jaume I de Castellon (Spain); Hogskolan i Skovde (Sweden); Kungliga Tekniska Hogskolan (Sweden); Universitet i Bergen (Norway); Boc Information Systems GmbH (Austria); Centre de Recherche Public Henri Tudor (Luxembourg); Centro Studi Sistemi Concettuali (Italy); Univ. Degli Studi di Roma "La Sapienza" (Italy); Politecnico di Bari (Italy); Univ. Politecnica Delle Marche (Italy); Singular Software Anonymos Etairia Michanografikon Efarmogon (Greece); National and Kapodistrian University of Athens (Greece); Universitaet Duisburg-Essen - Standort Essen (Germany); Technische Universitaet Berlin (Germany); Carl von Ossietzky Universitaet Oldenburg (Germany); TXT E-Solutions SPA (Italy); UNINOVA - Inst. de Des. de Novas Tecnologias (Portugal); Univ. Degli Studi di Milano (Italy); Trough Technologies AS (Norway); Computas Holding AS (Norway); Asociacion de Investigacion y Desarrollo en la Industria del Mueble y Afines (Spain); Graisoft (France); Facultes Universitaires Notre-Dame de la Paix (Belgium); Stichting Telematica Instituut (Netherlands); Libera Università di Bolzano (Italy); Politecnico di Milano (Italy); Università Degli Studi di Torino (Italy); Norges Teknisk-Naturvitenskapelige Universitet NTNU (Norway); SINTEF - Stiftelsen for Industriell og Teknisk Forskning ved Norges Tekniske Høgskole (Norway); Università Degli Studi di Brescia (Italy); Centro Ricerche Fiat Societa Consortile per Azioni (Italy); Technische Universiteit Eindhoven (Netherlands); Université de Bordeaux I (France).

LAPLAS - Group III Nitrides Prepared by Cyclic Laser and Plasma Process (LAPLAS)

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	POCTI/?
Project Type:	RTD	Role:	Partner
Start Date:		Finish Date:	
Funding:	80.000 €	CTS Funding:	0 €

Abstract:

Os filmes de nitratos do grupo III (GaN, AlN, InN e suas ligas) têm elevado interesse prático para aplicações em inúmeros dispositivos optoelectrónicos. Presentemente assiste-se em todo o mundo a um desenvolvimento intensivo das tecnologias envolvendo estes semicondutores. Neste projecto pretendemos desenvolver os resultados que obtivemos durante a actividade de um projecto anterior (PRAXIS/C/FIS/ 10178/1998). Durante este projecto propusemos um processo original por modulação temporal para a preparação de filmes semicondutores de nitratos do grupo III (deposição por laser/plasma cíclica L/P-D); completamos ainda a construção de um sistema para a implementação do processo de L/P-D e obtivemos amostras de filmes de GaN pela primeira vez em Portugal. A

técnica de L/P-D permite filmes ultra-limpas de nitratos do grupo III depositados em diferentes substratos a temperaturas baixas e com um controlo melhorado da incorporação de azoto.

Neste projecto pretendemos explorar as vantagens da L/P-D (referida no State of the Art e tarefas) de forma a alcançar os seguintes objectivos principais:

- Desenvolver e optimizar a L/P-D até um nível tecnológico aceitável para a produção de filmes de nitratos do grupo III com "qualidade para dispositivos".
- Aplicar os filmes preparados por L/P-D em dispositivos optoelectrónicos e demonstrar oportunidades para aplicações práticas.
- Estudar as propriedades dos nitratos do grupo III em conjugação com as suas condições de preparação.

O projecto será implementado nas seguintes 7 tarefas:

- 1) Preparação e estudo do GaN com diferentes estruturas.
- 2) Preparação de ligas baseadas em GaN (AlGaIn, InGaIn).
- 3) Preparação de estruturas de nitratos do grupo III em multi-camada.
- 4) Aplicações dos filmes obtidos.
- 5) Caracterização básica.
- 6) Defeitos
- 7) Estudo do efeito piezoelectrónico em estruturas baseadas em GaN.

A equipa no Departamento de Física do IST em colaboração com o Complexo-IST e o ISEL, em Lisboa, terão a seu cargo a maioria do trabalho. Amostras dos filmes obtidos serão também fornecidas a equipas de outros institutos em Portugal (Aveiro) e no estrangeiro (Uni-Giessen), que mostraram interesse em efectuar estudos sobre estes materiais. Uma parte importante das medidas de caracterização básica poderão ser efectuadas pelos nossos parceiros na Rede Científica Europeia TIMOC, que tem uma experiência de longa data no estudo de materiais relacionados com GaN (equipas da Uni-Giessen, TU-Munich, PTI A. F. Ioffe, St. Petersburg).

A longo prazo os resultados poderão ter interesse para aplicação em tecnologia de displays e informática, em conversão de energia solar e em telecomunicações.

Partners:

Universidade Técnica de Lisboa - Instituto Superior Técnico - IST; Centro de Química - Física Molecular; Instituto Superior de Engenharia de Lisboa - ISEL

LAXOR - Large area X-Ray Detectors with an optical readout

Responsible: Maria Manuela Vieira

Group: A2

Sponsor: FCT

Programme: POCI/?

Project Type: RTD

Role: Prime Contractor

Start Date: 01-01-2004

Finish Date: 31-12-2007

Funding: 80.000 €

CTS Funding: 0 €

Abstract:

The purpose of this project is to build a large area X-ray flat detector with optical readout and additional capability of real time digital radiography having a level of performance far above the classic film-screen. Furthermore, high frame rate at very low dose for fluoroscopy will also be addressed giving a new realm of possibilities in medical imaging such as: improved image quality; easier and faster data transmission, processing and archiving; reduced running costs; potentially lower dose. This technology also will help industries see defect easier, establish better quality control, and facilitates the storage and transmission of images. The detector to be developed comprises a converter layer, a large area a-Si panel and connections to external electronics and readout. Essentially two concepts have to be implemented: intermediate conversion of the X-rays image into an optical image by a scintillator and the conversion of the optical image into an electric one by a large area Laser Scanned Photodiode (LSP). An optical scanner is used for charge readout.

To overcome problems associated with CCDs and flat-panel arrays the use of an LSP sensor is proposed. The stumbling blocks in this development are large size and high signal-to-noise ratio at low dose. Dynamic imaging higher than 30 frames/s is our goal. The technical challenges at the level of the a-Si image sensors are the light-to-dark sensitivity of the LSP, the memory effects associated with traps in a-Si:H. Of course, long-term reliability and stability are major concerns for medical components.

The project plans to use the existing know-how distributed into six tasks. The first one deals with the project specification and requirements. The next two are dedicated to transducer technology research and developments. Different configurations and readout architectures will be proposed and tested taking into account the imaging requirements. The task four deals the stability of scintillators and thin film detectors under X-ray irradiation. Task five is dedicated to the development and implementation of a suitable optical readout system. Finally, task six combines the expertise of the partners in allied areas (sensors and transducers, simulation and remote control and medical equipment) in order to develop large area X-ray imaging prototype to be used in remote static and dynamic medical imaging applications (radiography, fluoroscopy and non destructive material inspection).

As demonstrators of the proposed technology the following set of films, devices and systems will be produced: (i) Stable intrinsic and doped silicon thin films and scintillators. (ii) LSP single and stacked p-i-n optical image sensors and flat X-ray detectors with optical readout. (iii) Analogue sensor readout and signal conditioning, A/D and calibration of the sensor transfer curve, digitally programmable. (iv) Integrated sensor network able to communicate over a standard network, for sensor/actuator, data acquisition sub-system interconnection and remote control.

Partners:

Escola Superior de Tecnologia da Saúde de Lisboa (ESTeSL/IPL); Instituto Superior Técnico (IST/UTL); Instituto Superior de Engenharia de Lisboa (ISEL/IPL)

LEADER - Low Energy Analogue-to-Digital converter with Enhanced effective Resolution

Responsible: João Goes

Group: A1

Sponsor: FCT

Programme: PTDC/EEA-ELC

Project Type: RTD

Role: Prime Contractor

Start Date: 01-09-2007 **Finish Date:** 30-08-2009
Funding: 44.994 € **CTS Funding:** 28.512 €

Abstract:

High-Resolution Medium-Speed Analogue-to-Digital converters (ADCs) are required in a broad area of high performance applications. Several over-sampled architectures, either continuous-time or switched-capacitor had already been proposed to achieve this kind of performance and they have shown that Sigma-Delta (SD) converters can simultaneously achieve high bandwidths, high resolutions and very low power dissipation. However, the output digital decimation filter required for reducing the data rate from the original sampling frequency to the Nyquist rate can increase significantly the power dissipation and the overall area. For input-signal bandwidths frequencies above a few tens MHz, self-calibrated pipelined ADCs have proved to be a better solution to minimize, simultaneously, power dissipation and die area. Although digital calibration techniques do not require sophisticated analogue circuitry, they put an extra burden on the digital part and require either additional stages or additional resolution in each calibrated stage to overcome the loss in effective resolution produced by the digital truncation errors during calibration. Furthermore, the complexity in the design of such systems is significantly increased as well as the resulting area.

The major goal of this project is to design, integrate (in an advanced 130nm or 90nm CMOS technology), and experimentally evaluate a Calibration-Free Low-Power and Low-Area 1.2 V 14-b resolution and 1-2.5 MHz BW (8-20 MHz clock frequency) recycling-pipeline ADC (also known as multi-stage algorithmic). The target performance is compatible with a power figure-of-merit (FOM) of $FOM1 < 0.4 \text{ pJ}$ of energy per conversion and, simultaneously, occupying a ultra small silicon area ($FOM2 < 0.2 \text{ pJ} \cdot \text{mm}^2$). The expected static and dynamic performance will be compatible with, at least, 13 bits (DNL, INL and ENOB) at Nyquist rate. The architecture will consist of a cascade of 2 stages with minimum resolution per stage and the amplified residue will be recycled during 7-or-8 clock cycles depending on re-configuring (or not) the first stage as a sample-and-hold (S&H) during the first clock cycle. Each stage comprises a low-resolution quantizer for local quantization and a 1.5-bit multiplying-digital-to-analog converter (MDAC) for residue computation and amplification. This MDAC will be based in a novel mismatch insensitive amplifier with an accurate gain of two recently disclosed by the authors of this proposal in [1] but never demonstrated in a practical integrated circuit before. The new MDAC circuit will operate within a single clock cycle and uses only one amplifier. Efficient amplifier-sharing and dynamic current-reduction techniques will be used to improve the energy efficiency of the ADC [2]. In [2] a $FOM2$ as small as $0.07 \text{ pJ} \cdot \text{mm}^2$ was measured by the Primary Investigator of this proposal, but only for a 10 kHz BW (for biomedical applications) of a 0.9V SD modulator. The required amplifier (a single one) will be properly sized and compensated following a time-domain design methodology for optimization supported by our proprietary CAD-tool [3]. Moreover, the circuit will not employ any clock-bootstrapping circuits for driving the most critical switches but, rather, a much more reliable and area efficient solution, described by the authors in [4] but further improved for high-linearity (not published yet) and, again, never demonstrated in silicon before.

1. João Goes, João Cardoso Pereira, Nuno Paulino, Manuel Medeiros Silva, "Switched-Capacitor Multiply-By-Two Amplifier Insensitive to Component Mismatches", accepted for future publication in IEEE Transactions on Circuits and Systems – II, 2006.

2. J. Goes, B. Vaz, R. Monteiro, N. Paulino, "A 0.9V SD Modulator with 80dB SNDR and 83dB DR Using a Single-Phase Technique", Proc. IEEE ISSCC'2006, pp. 74-75, Feb. 2006.

3. R. Tavares, N. Paulino, J. Goes and J. P. Oliveira, "Optimum Sizing and Compensation of Two-Stage CMOS Amplifiers Based On a Time-Domain Approach", To appear in IEEE International Conference on Electronics, Circuits and Systems, France, Dec. 2006.

4. A. Galhardo, J. Goes, N. Paulino, "Novel Linearization Technique for Low-Distortion High-Swing CMOS Switches with Improved Reliability", IEEE International Symposium on Circuits and Systems, Isle of Kos, Greece, May 2006.

Partners:

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MINERVA - Artificial Intelligence and Neural Network Tools for Innovative ODL

Responsible: João Goes **Group** A1
Sponsor: EC **Programme:** SOCRATES/ISOC/ODL
Project Type: RTD **Role:** Partner
Start Date: 01-10-2000 **Finish Date:** 01-09-2003
Funding: 0 € **CTS Funding:** 0 €

Abstract:

The aim of this three-year project is to provide and use a set of innovative ODL tools for on-line and Internet-based learning, using the methods and techniques of artificial intelligence (AI) and neural networks (NN).

The project will provide a model of the collaborative learning process involving human and artificial intelligent agents as well as a set of tools based on AI and NN techniques to develop innovative ODL systems. Pilot implementation of ODL systems using these tools will be carried out and a methodology for intelligent ODL production and performance evaluation will be established.

The pedagogical approach and methodology developed should focus on collaborative, personalized and participative learning of teachers and students.

Partners:

(BE) VRIJE UNIVERSITEIT BRUSSEL; (DE) FRIEDRICH-ALEXANDER-UNIVERSITÄT ERLANGEN-NÜRNBERG; (FR) UNIVERSITÉ DE LA ROCHELLE - TECHNOFORUM; (PT) UNIVERSIDADE NOVA DE LISBOA; (RO) GLOBAL ONE COMMUNICATIONS ROMANIA; (UK) DARLINGTON COLLEGE OF TECHNOLOGY; (UK) UNIVERSITY OF EDINBURGH

MODI - Simulation of Knowledge Enabled Monitoring and Diagnosis Tool for Mars Lanfer Payloads (monitoring and Diagnosis for Mars Driller)

Responsible: Rita Ribeiro **Group** B1
Sponsor: ESA **Programme:** ?/
Project Type: RTD **Role:** Prime Contractor
Start Date: 01-05-2005 **Finish Date:** 01-11-2006
Funding: 250.000 € **CTS Funding:** 155.218 €

Abstract:

The aim of the MODI activity is to answer these two questions, taking as a case study the Monitoring & Diagnosis of the most complex subsystem taken on board the payload of the two first ESA Exploration missions (ExoMars and Mars Sample Return) i.e. a drilling and sampling system. The goal of this activity is thus to assess the feasibility of on-board or on-ground monitoring and diagnosis of devices of a drilling and sampling system (DSS) for Martian soil and to develop and demonstrate the MODI concept i.e. the benefits of a prototype Monitoring & Diagnosis software module (MDM) for this system. The software developed in the frame of this activity shall be of laboratory quality level.

Partners:

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mSiC2 - Detectores de partículas e de perfil de feixe baseados no a-SiC-H

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	POCTI/?
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2005	Finish Date:	31-12-2008
Funding:	20.000 €	CTS Funding:	0 €
Abstract:			
<p>Actualmente estamos a estudar a resistência à radiação de estruturas de detectores compostas por liga amorfa e microcristalina de silício-carbono (a-SiC:H) no âmbito dum projecto de investigação financiado pela FCT (MSIC). A maior parte dos filmes são preparados no ISEL por PE-CVD, sendo de seguida irradiados no acelerador do ITN em Lisboa com iões de He ou prótons de 1-2 MeV, e finalmente analisados pelos grupos parceiros. Os primeiros testes de monitores de feixe foram realizados com um detector de 23 micron do tipo barreira de Schottky e um detector pin de a-Si:H com 5 micron de espessura. O principal objectivo do projecto em curso é orientado para os materiais.</p> <p>Esta nova proposta, MSIC-2, irá focar a física dos dispositivos e a relação com os parâmetros dos materiais durante a irradiação com partículas. Iremos fundamentalmente contar com experiências de irradiação tal como efectuadas anteriormente no Departamento de Física do ITN e com uma comparação de irradiação de partículas de alta energia a ser efectuada no CERN. O grupo do ITN juntou-se a esta proposta como um novo parceiro.</p> <p>O trabalho em detectores baseados em a-Si:H foi despoletado pelos limites alcançados com detectores clássicos de silício monocristalino (c-Si) de elevada pureza, amplamente usados nas experiências físicas de alta energia no CERN. No entanto, com elevados fluxos de partículas até 10^{15} partículas por cm^2 por dia, o detector pode-se degradar devido à deterioração provocada pela radiação.</p> <p>Em alternativa, detectores de a-Si:H foram propostos, visto que, acredita-se que a desordem da estrutura Si-Si torna o material menos sensível aos danos provocados pela radiação. Por outro lado, nota-se o modesto valor do produto mobilidade*tempo de vida e uma tensão de ruptura relativamente baixa de 60 V/micron conjuntamente com inhomogeneidades no campo eléctrico.</p> <p>Da lista inicial de objectivos propostos do MSIC, foram atingidos os seguintes:</p> <ul style="list-style-type: none"> - Taxa de deposição de filmes intrínsecos de cerca de 5 Å/s - Preparação de filmes espessos de 23 micron - Dose crítica para filmes de a-Si:H - Primeiros testes de detectors do tipo a-Si:H como monitores de feixe no ITN. <p>Durante o resto do projecto em curso planeamos depositar camadas dopadas do tipo n e p e ligas de Si e C, aproveitando as potencialidades do método de Closed-Chamber Chemical Vapor (CC-CVD).</p> <p>O novo projecto deveria dar-nos a possibilidade de melhorar diferentes aspectos</p> <ul style="list-style-type: none"> - Taxa de deposição mais elevada e maior espessura (factor 2 acima do actual) - Campos de ruptura com ligas mais elvados (factor 3) - Estudo do transporte: SCLC, efeito Poole-Frenkel, transporte "tunneling & hopping" - Estudo de defeitos: DLTS, relaxação dieléctrica - Análise numérica dos detectores - Operação pulsada para recuperação de campo e eliminação de cargas <p>No aspecto da infraestrutura podemos utilizar dois reactores UHV instalados no ISEL. O grupo no IST e UALG farão uso da sua experiência na caracterização de filmes e estudos de danos provocados pela radiação. O grupo no ITN tem longa experiência na implantação de iões. Este projecto deverá dar-nos mais informação sobre a relação entre os parâmetros de deposição dos materiais e aspectos da física dos dispositivos como a cinética da degradação dos filmes e a sua recuperação, com perspectivas de aplicações em imagens de raios X, como sensores</p>			
Partners:			
Universidade Técnica de Lisboa - Instituto Superior Técnico - IST; Instituto Superior de Engenharia de Lisboa - ISEL; Universidade do Algarve; Instituto Tecnológico e Nuclear - ITN			

NOMDIS - New Operators for Monitoring and Diagnostic of Intelligent Systems

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	ESA	Programme:	ESOC/
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-08-2005	Finish Date:	01-06-2006
Funding:	50.000 €	CTS Funding:	22.500 €
Abstract:			
<p>Monitoring and diagnostic tools are essential for mission control purposes, as well as for assessing and monitoring the health status of spacecraft and satellite components.</p> <p>Even though there are proposals for fuzzy monitoring and diagnostic expert systems (e.g. ESOC/ ESA project ("Fuzzy Logic for Mission Control Purposes" - AO/1-3874/01/D/HK for the ENVISAT satellite) the important issue of how to perform rule aggregation and inferencing with synergetic operators (i.e. those aggregation operators that take into account the dependencies/synergies between overlapping rules/parameters) has never been addressed. The main reason for this is the lack of communication between the fields of mathematical multicriteria decision making, artificial intelligence, and space engineering.</p>			

Recent developments in the theory of weighted aggregation operators and fuzzy multicriteria decision making have established Choquet integration as an interesting and powerful generalization of both the standard weighted averaging (WA operators) and the ordered weighted averaging (OWA operators). The essential novel feature of Choquet integrals is their capability of modelling and encoding the interaction patterns which correlate the various criteria, making use of techniques borrowed from discrete mathematics, cooperative game theory and weighted aggregation theory.

Our main goal in this project is to translate the Choquet integral methodology from interacting fuzzy multicriteria decision systems to interacting rule-based expert systems for monitoring and diagnostic space problems. In this way we expect to extend significantly the effectiveness and applicability of interactive intelligent systems for monitoring and diagnostic, just as Choquet integration has largely extended the validity and scope of weighted aggregation in fuzzy multicriteria decision making.

Partners:

UNINOVA; University of Trento; Vega IT GmbH

OPTAR - Non linear optical effects in wide band gap semiconductors

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	POCTI/?
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2003	Finish Date:	31-12-2006
Funding:	108.000 €	CTS Funding:	0 €

Abstract:

Devido à sua larga banda proibida de 3.38 eV e à sua alta condutividade eléctrica, os filmes finos de Óxido de Zinco (ZnO) são amplamente utilizados em aplicações práticas tais como óxidos condutores transparentes para ecrãs planos e células solares. Um melhoramento muito recente da qualidade do material e em particular o sucesso de dopagem do tipo p do ZnO iniciou uma investigação intensa em duas direcções : (1) ZnO possui uma estrutura cristalina muito próxima da do nitreto de gálio (GaN) e por isso pode servir como substrato para lasers verdes-azuis, de LEDs, fotodetectores no ultravioleta (UV), e transistores de efeito de campo de AlGaIn/GaN. (2) Filmes de ZnO com elevada pureza têm recentemente mostrado "lasing" à temperatura ambiente e são candidatos promissores para lasers azuis-violeta. O ZnO possui propriedades piezoeléctricas semelhantes ao GaN, mas exibe uma vantagem para aplicações ópticas devido à sua grande energia de ionização do excitão de 60 meV.

Neste projecto propomo-nos a aplicar a nossa recentemente instalada tecnologia de deposição híbrida por ablação com laser pulsado e deposição com plasma de nitrogénio (LPA-CVD) para a deposição de filmes finos de ZnO. O processo cíclico permite-nos ir a temperaturas do substrato abaixo dos 600 °C. Difracção de raios-X, medidas de fotossensibilidade, energia de activação da condutividade no escuro, e resposta espectral, espectroscopia de fotoluminescência (PL), análise de defeitos com espectroscopia transiente de níveis profundos (DLTS), medidas de corrente estimulada térmicamente (TSC), e espectroscopia de transmissão e reflexão óptica serão efectuadas directamente no IST ou por grupos associados neste projecto, estas medidas constituem o essencial feed-back para o controlo da qualidade do filme e ajustamento óptimo dos parâmetros do processo de deposição.

Os principais propósitos do projecto estão ligados à determinação das propriedades ópticas não lineares dos filmes de GaN e de ZnO utilizando um sistema ps-laser com 355 nm na região espectral UV. Como função da densidade de excitação, nós iremos medir a relaxação das cargas através da absorção e reflexão fotoinduzidas em experiências de "pump-and-probe" e transporte electrónico monitorizado por interferência de quatro feixes (4-wave-mixing) que envolvem redes ópticas transientes. Em todos os casos os efeitos térmicos, piezoeléctricos, e piezoelétricos terão de ser cuidadosamente separados.

Estes estudos não são apenas importantes de um ponto de vista físico como também são necessários para o desenvolvimento de elementos ópticos na telecomunicação moderna a uma velocidade de vários Gbit/s. Por este motivo propomos o estudo de dois dispositivos de teste os quais serão fabricados com as facilidades da sala limpa do INESC MN na forma de um transistor de filme fino piezoelétrico (piezo-FET) e dispositivos de comutação óptica de alta frequência na forma de um interferómetro de Mach-Zehnder baseado em filmes de GaN e ZnO.

Partners:

Universidade Técnica de Lisboa - Instituto Superior Técnico - IST; Universidade de Aveiro; Instituto Superior de Engenharia de Lisboa - ISEL; Universidade do Algarve

OPTO-ESTÉTICA - Equipamentos para estética utilizando dispositivos opto-electrónicos

Responsible:	<u>Luís Gomes</u>	Group	A12
Sponsor:	0	Programme:	/
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2004	Finish Date:	31-12-2007
Funding:	20.000 €	CTS Funding:	20.000 €

Abstract:

The main goal of the Project is to produce laboratory prototypes of the electronic microcontroller-based control part of equipments used for treatments of aesthetic based on optoelectronics, namely leds and lasers; ultrasonic transducers were also used in one of the equipments. As a result, industrial products were produced by Barbieri & Marques Equipamentos Médicos Estéticos Lda., passed certification phase and are in the market under the brands HyperLaser 4, HyperLaser 8, HyperLaser 16, HyperLight 36 e HyperBody (see <http://www.hiperestetica.com> and <http://www.lifelight-laser.com> for additional details)

Partners:

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prodAEC - European Network for Product and Project Data Exchange, E-Work and E-Business in Architecture, Engineering and Construction

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP5/IST

Project Type:	RTD	Role:	Technical Coordination
Start Date:	01-02-2002	Finish Date:	30-04-2004
Funding:	381.584 €	CTS Funding:	147.241 €

Abstract:

The Architecture, Engineering and Construction sector -AEC- in Europe is one of the most important worldwide, with 26 million workers in the EU, depending directly or indirectly on the AEC sector. The aim of this initiative is to involve the AEC industry in the emerging digital economy and smart enterprises through the use of modern information technologies and standards. The primary objective of the project is the creation of a Thematic Network in the European AEC sector to promote the use and implementation of standards for product data exchange, the e-work and e-business. The project brings together material providers, construction companies, suppliers, designers, industrial federations, engineering consulting, software vendors, R&D centres and Universities; all of them from all around the EU and associated Eastern countries. The Architecture, Engineering and Construction sector -AEC- in Europe is one of the most important worldwide, with 26 million workers in the EU, depending directly or indirectly on the AEC sector. The aim of this initiative is to involve the AEC industry in the emerging digital economy and smart enterprises through the use of modern information technologies and standards. The primary objective of the project is the creation of a Thematic Network in the European AEC sector to promote the use and implementation of standards for product data exchange, the e-work and e-business. The project brings together material providers, construction companies, suppliers, designers, industrial federations, engineering consulting, software vendors, R&D centres and Universities; all of them from all around the EU and associated Eastern countries.

Partners:

Technische Universitat Dresden (Germany); Université Claude Bernard Lyon1 (France); Valton Teknillinen Tutkimuskeskus (VTT) (Finland); Stichting Standaardbesek Burgr - en Utiliteitsbouw (Netherlands); Sviluppo Italia Toscana S.C.P.A. (Italy); Centre Scientifique et Technique du Batiment - CSTB (France); Univerza V Ljubljani, Fakulteta za Elektrotehniko (Slovenia); Cervenka Consulting (Czech Republic); AEC3 LTD. (United Kingdom); Taylor Woodrow Construction Limited (United Kingdom); Asociacion de Investigacion Y Desarrollo en la Industria del Mueble Y Afines (Spain); Haas + Partner Ingenieurgesellschaft mit Beschränkter Haftung (Germany); UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Asociacion de Investigacion de las Industrias de la Construcción (Spain).

PUCARA - Rede de certificação de componentes e sistemas microelectrónicos

Responsible:	0	Group	A2
Sponsor:	FCT	Programme:	??
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2002	Finish Date:	31-12-2004
Funding:	0 €	CTS Funding:	0 €

Abstract:

Pretende-se através deste projecto promover a troca de experiências tecnológicas entre indústrias, centros de investigação e desenvolvimento, universidades e investigadores que desenvolvam trabalho no campo de certificação instrumental.

Partners:

U. de Buenos Aires (Argentina), CITEI (coordenador, Argentina), INTI (Brasil), INAOE (México), CMUA (Colômbia), U. del Valle (Colômbia), Faculdade de Engenharia (Uruguai), CSIC (Espanha), U. San Paulo (Brasil), U. Católica do Rio Grande do Sul (Brasil), U. Nuestra Señora da Asuncion (Paraguai), Instituto Superior de Engenharia de Lisboa (Portugal).

PWAVE -

Responsible:	<u>Araldo Batista</u>	Group	A1
Sponsor:	EC	Programme:	FP6/?
Project Type:	RTD	Role:	0
Start Date:	01-03-2004	Finish Date:	28-02-2006
Funding:	73.000 €	CTS Funding:	73.000 €

Abstract:

Atrial Fibrillation (AF) is the most common cardiac arrhythmia [15,16]. Occurrence increases with age, and may reach up to 10% of the population over 65 years old. This kind of arrhythmia has a high rate of morbidity and mortality. Cardioversion therapy may be applied either electrical or pharmacological. Anticoagulation drugs greatly reduce the risk of stroke and are normally given before and after the elective cardioversion method. Other techniques such as ablation and MAZE have been used. For any of the described procedures, the High-Resolution P wave analysis may rapidly provide information in the evaluation of the elected treatment success [13]. In addition, the anticoagulation therapy may be interrupted, with obvious advantages, namely in patients in risk of bleeding, if a sensitive evaluation technique is used.

Such technique is the High-Resolution P wave analysis, which looks for micro-potentials that may induce fibrillation, which are not detected in the conventional Electrocardiogram [8,9,12,14]. However, the role of HR-ECG in the Atrial Fibrillation diagnosis is still under investigation, unlike the proved success of the HR-ECG in the diagnosis of ventricular arrhythmia [17]. No standards have been established in the Atrial Fibrillation case.

In recent times, wavelet analysis has been successfully applied to the AF diagnosis, with different methods, that share the wavelet ability to distinguish the high frequency, short lived low amplitude electrical signals that may cause arrhythmia [7,13,14].

The proponent's method uses wavelet analysis to scan the High-Resolution Electrocardiogram (HR-ECG) for the micro-potentials. A prototype for heart arrhythmia diagnosis has been developed by the proponents of this application, and is currently being tested in patients of the Department of Cardiology of the Hospital Pulido Valente. This package has been designed for routine clinical use with user selectable parameters. However, unlike the available commercial software, state of the art signal-processing techniques such as wavelets are incorporated in the package, which is therefore also used for research purposes. Figures 1 and 2 show the screen shots of the user-friendly interface. Figure 3 shows the results of the novel wavelet analysis method applied to a synthetic HR-ECG here a 5 micro-volt intra-QRS late potential was added for assessment of the method's sensitivity. The late potential was detected in the wavelet decomposition.

The hardware acquisition system in use, from ART (Arrhythmia Research Technology), has sub-standard quality parameters regarding

the HR-ECG. A new acquisition system should be bought as is described in the equipment items to purchase, of this proposal. Furthermore the proponents plan to carry on with their work about developing a wavelet method for the reliable diagnosis of Atrial Fibrillation. Electrode placement variations, in the patient's chest, to maximize the P wave amplitude will be explored and compared with the results provided by the orthogonal lead system.

Partners:

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RIAT-AIP - Network of information and technical support

Responsible:	<u>Adolfo Steiger Garção</u>	Group	B1
Sponsor:	ESA	Programme:	?
Project Type:	RTD	Role:	0
Start Date:	01-01-2004	Finish Date:	30-06-2005
Funding:	0 €	CTS Funding:	0 €
Abstract:			
To create, develop and implement the necessary conditions to support SMEs towards the competitive integration of their business models using the techniques and technologies derived from the Information Society, towards the adoption of the concept of Digital Economy.			
The RIAT-AIP will select a group of 200 Portuguese SME's that will be accompanied by consultants in the process of adhering to the Information Society.			
The Role of UNINOVA's DEG will be to guarantee the Scientific and technological support to the methodologies employed and to the recommendations of RIAT-AIP.			
Partners:			
AIP – Associação Industrial Portuguesa (Portuguese Industrial Association); APEMETA – Associação Portuguesa das Empresas de Tecnologias Ambientais (Portuguese Association of Environmental Companies); APIC – Associação Portuguesa dos Industriais de Curtumes (Portuguese Association of leather industries); APICER – Associação Portuguesa da Indústria da Cerâmica (Portuguese Association of Ceramic Industries); Assimagra – Associação Portuguesa dos Industriais de Mármore e Ramos afins (Portuguese Association of Marble Related Industries); Faculty of Science and Technology of the New University of Lisbon			

SIMBA - Sensor Integration for Monitoring Biometric Applications

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	??
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2002	Finish Date:	31-12-2005
Funding:	71.000 €	CTS Funding:	18.233 €
Abstract:			
This project proposes to develop an "integrated optoelectronic sensor system" to be used in the conception of sensors for domestic and industrial applications. Through the design of an appropriated electronic interface the sensors will be integrated in an intelligent network to get a final "complete integrated system". It will be used as a prototype and a future goal is to improve it as an end product. The expected results generate spin-offs towards the smart sensors industry.			
Using the existing synergies among the partners, two basic routes to reach the main objective are proposed. The first one consists of optimizing the production of different kinds of transducers (UV/VIS/IR, image, temperature) based on amorphous silicon p-i-n structures in order to allow through the same deposition process (Closed Chamber Chemical Vapour Deposition) the production of different kind of sensors that can be used as individual sensors or to integrate d for specific applications.. The second route brings together the experience of the partners in the field of hardware and software to realize an intelligent network, for remote or local process control. Research will be carried out in order to develop special hardware to able processing the analogue signal produced by the optical sensors using digital signal processing techniques and processors. The result is a smart sensor able to be accessed through a communication network.			
The project plans to use the existing know-how distributed into seven tasks. The first one deals with the project specification and requirements. The next two are dedicated to the optical sensor technology research and developments. Three types of sensors are proposed: p-i-n mc-Si:H detectors for UV/VIS/IR range, image sensors, and temperature sensors. Task four comprises a practical realization on an Analog-to-Digital (A/D) interface. The design of a low-power and low-voltage (supplied by a single 1.5V battery) CMOS pipelined A/D converter is one of the aims. Task five deals with the digital signal processing applied to the design of smart sensor systems and development of dedicated hardware for the incorporation of sensors, namely, digital filtering, sensor calibration and linearization.			
As demonstrators of the proposed technology the following set of films, devices and systems will be produced:			
i. Stable intrinsic and doped microcrystalline silicon thin films, suitable for optical device applications.			
ii. Optical sensors (UV/VIS/NIR), Image sensors, Thermal sensors.			
iii. Analogue sensor readout and signal conditioning. Analog-to-digital (A/D) standard conversion, to provide a digital output signal. Calibration of the sensor transfer curve, digitally programmable.			
iv. Bus interface compliant with the IEEE 1451.2 standard, to simplify communication to microcontrollers, PCs, and other devices.			
Along the development of the project, mainly inside a Polytechnic institution, spin-offs for technology transfer will be created. Training activities of the future Electronic and Communications engineers will allow young students to acquire knowledge and experience needed for future national and local industry integration.			
Partners:			
Instituto Superior de Engenharia de Lisboa - ISEL			

SAMBA - Smart Analogue-to-digital (A/D) interface Module for Biomedical Applications

Responsible:	<u>João Goes</u>	Group	A1
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Sponsor:	FCT	Programme:	POCTI/?
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2002	Finish Date:	31-12-2005
Funding:	53.000 €	CTS Funding:	53.000 €

Abstract:

The major goal of this project is to develop a low power and low-voltage Smart Analogue-to-digital (A/D) interface Module for Biomedical Applications (SAMBAs). This interface should provide an A/D conversion for several electrical signals existing in the human body. The frequency content of different bio-potential signals covers different portions of the spectrum since, depending on the application, signal bandwidths can range from near DC to several kHz. On the other hand, some bio-potentials have higher amplitudes than others ranging from tens of micro-Volt to approximately 100 mV [1]. This system will be suitable for battery-powered (portable) medical equipment such as, Electrooculogram (EOG), Electroencephalogram (EEG), Electrocardiogram (ECG) and Electromyogram (EMG).

The proposed system comprises in the analogue domain a low-noise programmable gain amplifier (PGA) followed by a Sigma-Delta (SD) modulator and, in the digital domain, a decimation filter (DF), by a programmable low-pass/band-pass digital filter (LP/BP) and by a serial interface (SI). The study of the optimal architecture, namely, the maximum acceptable noise in the PGA, the order and the oversampling ratio (OSR) of the SD modulator and the templates of the digital filters, should result in a low cost system, with very low power dissipation and low voltage operation. The study should also produce redesign information on each block; this information will enable the rapid implementation for different specifications and for different technologies.

The design of the analogue building blocks using advanced CMOS technologies is a relatively difficult task. The noise level required for the PGA as well as the low-voltage operation of the SD modulator place several constraints on the design of these blocks. However, recent published works have proven the feasibility of such circuits using pure standard CMOS technologies together with supply voltages below 2.4 Volt [2, 3]. Different techniques envisaging low-voltage operation such as the switched-opamp technique [2] or clock-boosting techniques [3, 4] have to be considered as possible solutions.

The second major aim to be pursued is to achieve the lowest possible power dissipation. The Primary Investigator (PI) proposed for carrying-out this work has accumulated expertise in the field of the low-power data converters (with working silicon [7, 9]), as well as, in developing efficient design methodologies for power optimisation of analogue circuits [5, 6, 8]. Due to the low-power dissipation and since the overall system can be simply supplied with one or two single batteries of 1.5 V, the Galvanic isolation required by all medical instrumentation standards may be performed in the digital domain and after the serial interface. This is a very important advantage of the proposed interface since in traditional non-portable medical equipment this isolation is carried-out in the analogue domain and after the PGA and, as a consequence, linearity problems may limit the overall performance of these systems. A second advantage of this system is that the SAMBA interface can be used in portable systems (with some digital signal processing added) that may be "externally implanted" in Patients allowing a full-time monitoring and diagnosis.

Finally, the third objective is to integrate in an advanced CMOS technology and experimentally evaluate the complete SAMBA interface system. Practical realisations together with consistent measured results should be periodically reported.

Partners:

Instituto de Desenvolvimento de Novas Tecnologias - UNINOVA

SARP - Sistema de Apoio à Realização de Projectos

Responsible:	<u>Adolfo Steiger Garção</u>	Group	B1
Sponsor:	FCT	Programme:	??
Project Type:	RTD	Role:	0
Start Date:	01-06-2003	Finish Date:	31-12-2005
Funding:	266.507 €	CTS Funding:	266.507 €

Abstract:

The goal of the project is the development of a project management system for complex projects involving participants from several entities (with specific access profiles). The tool to develop will be accessible through the Internet and will be an integrated tool containing:

- contact management,
- document management and sharing,
- project information dissemination (content management),
- project management.

This project is based on the results of a previous RTD project (RNPR - National Network of Rapid Prototyping) and aims at the deployment of a prototype solution on a company who will be responsible for the wide dissemination of the technology used.

The Department of Electrotechnical Engineering of the Faculty of Science and Technology of the New University of Lisbon will also be involved on this project.

The Project Management Support System (SARP) submitted to the Operational Programme for Economic Activities (POE) has been approved by the Ministry of Economy on 2002/11/15.

This project was submitted under measure 3.1 "Stimulate the Technological, Training and Quality Systems", action B3 of the POE.

Partners:

Instituto de Desenvolvimento de Novas Tecnologias - UNINOVA

SDS - SDS silicon ribbons: a new path to low cost photovoltaics

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	PTDC/?
Project Type:	RTD	Role:	Partner
Start Date:		Finish Date:	
Funding:	140.000 €	CTS Funding:	0 €

Abstract:

1. Aim: To develop a new process of silicon sheet formation (SDS) for photovoltaic application using silane as feedstock.
2. Motivation: We believe our totally original approach may prove a path to high quality, low cost silicon sheet.
3. Originality of our technique: Silicon sheet formation from the gas phase needs a substrate. Previous R&D has focused on non-detachable silicon films on cheap substrates (with systematic poor results for material quality and final efficiency) or on detachable films on high quality substrates (with resulting good quality films but high cost). Our approach (SDS process, under study since 2002, to be patented): (i) we use a bed of silicon dust both as a cheap substrate and as a "sacrificial detachment layer", part of it being incorporated into a (ii) thick film obtained by fast CVD at low temperature and ambient pressure; (iii) the detached, free standing, film is then crystallized by a floating molten zone technique. The process is best suited for silane as feedstock, because of its homogeneous nucleation and high deposition rates at low temperatures and high pressures. (It was therefore excellent news that silane is part of the new generation of solar silicon feedstocks being developed now by industry for high volume production in ~3 years, namely by the REC Corp.). Notice that we will explore conditions which are normally catastrophic for regular CVD: powder formation, and fast, low quality growth. This is possible because of our decoupling of the CVD step from the crystallization step. The advantages of the SDS process are: (i) no substrate (therefore no cost and no contamination); (ii) low thermal budget (ambient pressure, low temperature CVD); (iii) high quality, free standing, crystalline silicon sheet (float zone crystallisation, no contact with foreign materials). REC's interest is shown by their intention to co-finance this project - see attached doc.
4. Results already obtained: We are working on this process for ~3 years; we designed laboratory test furnaces to study CVD on dust and crystallization. We explored and found conditions for low temperature deposition on dust of detachable films, which could be crystallized. We thus proved the concept and produced the first test cells with this new material, which showed high quality.
5. R&D work to be carried out and expected results:
Before we seriously approach industry, we need to advance further our process through the following tasks:
 - 5.1. Dust formation: we have been using silicon dust sent by REC Corp. This consists of nanoparticles, formed by homogeneous nucleation in silane, that are oxidised by simple exposure to atmosphere, whereas a future process must produce its powder in-line, with no oxidation. We must therefore study the conditions for dust formation from silane, and produce it in our lab for sequential use in the process, without exposure to the atmosphere.
 - 5.2. Raw sheet formation by CVD: Critical points for this step: gas convection, gas diffusion and decomposition in the powder bed, temperature distribution. As end results, we must prove high use of feedstock, low thermal budget, high quality of freestanding sheet, in a process compatible with in-line production. We need fundamental understanding, exploration of limits and relation to film quality.
 - 5.3. Crystallization of the raw sheet: this is a crucial step to form high quality crystalline sheet, and proved more difficult than expected, in particular due to frequent collapses of the molten zone. The cause of these problems has been tracked back to porosity and non-uniformity of the raw sheet. Sheet cracking due to thermal stress is another important problem to be tackled, that will need furnace re-design.
 - 5.4. Doping of the raw silicon sheet: bulk doping of sheet silicon is an unsolved problem, since all present techniques use large volumes of melt where it is easy to control dopant content. We have already successfully tried one alternative, but several others will be explored, with the condition that they must be compatible with future in-line process.
 - 5.5. Characterization of crystallized silicon sheet: necessary to assess sheet quality.
6. Solar cell formation on crystallized silicon sheet: final assessment of material quality in photovoltaics is always performed on devices (solar cells). Besides conventional np junction cells we will make heterojunction solar cells. The latter are useful for comparison with conventional ones (which involve very high temperature steps) since their formation involves no high temperature step, and therefore the base material will be unaffected, in the state "as grown". However, our motivation goes far beyond this. In fact, heterojunction amorphous-crystalline silicon cells have shown record efficiencies, due in particular to extremely efficient passivation of the silicon surface. The study of heterojunctions of amorphous/microcrystalline films on c-Si (on which the team has great expertise) is therefore a very interesting subject on its own.
7. Solar cell characterization

Partners:

Fundação da Faculdade de Ciências (FFC/FC/UL); Instituto Nacional de Engenharia, Tecnologia e Inovação (INETI); Instituto Superior de Engenharia de Lisboa (ISEL/IPL); Centro de Física da Matéria Condensada (CFMC/FC/UL)

SECA - A Low-Voltage Low-Power Digitally Self-Calibrated Pipeline ADC for Video-Frequency with On-Chip Self-Testing Capability

Responsible:	<u>João Goes</u>	Group	A1
Sponsor:	FCT	Programme:	POCTI/?
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2003	Finish Date:	31-12-2006
Funding:	33.000 €	CTS Funding:	19.925 €

Abstract:

Os conversores Analógico-Digital (ADCs) de alta resolução para ritmos de conversão entre 20 e 150 MHz são particularmente importantes em muitas das aplicações mais avançadas de processamento de sinal. São exemplos, os sistemas de processamento de imagem de elevada qualidade, os sistemas de radar, as modernas arquiteturas de transreceptores em comunicações móveis e os sistemas de comunicação de dados de alta frequência em linhas telefónicas (ADSL). A arquitetura apropriada para estes conversores emprega processamento concorrential (pipelined). A linearidade destes ADCs de média e alta resolução é, em geral limitada pela não-linearidade e pela precisão de emparelhamento dos componentes passivos que é possível obter nos processos de fabricação CMOS e BiCMOS. Actualmente esta precisão é da ordem de 9-10 bits, dependendo muito da tecnologia e das técnicas de projecto utilizadas. A obtenção de uma precisão superior a esta é possível em ADCs utilizando técnicas de ajuste pós-fabricação por raios laser de forma a conseguir aumentar a precisão no emparelhamento dos componentes constituintes. Contudo, em ambientes de processamento de sinal misto, não é desejável a utilização destes processos de ajuste pós-fabricação, uma vez que aumentam o custo de produção e a complexidade. Para ultrapassar estas limitações utilizam-se técnicas de auto-calibração. Adicionalmente, prevê-se que durante a presente década, as tensões de alimentação sejam reduzidas de 1.8 V para 0.6 V. Para além disso, com o objectivo de incorporar estes ADCs em equipamento portátil alimentado a baterias, elevados níveis de potência não serão certamente aceitáveis. Os ADCs concorrentiais auto-calibrados actuais consomem cerca de 2 a 4.4 pJ de energia por conversão, mas utilizam ainda tensões de alimentação de 5 V!

O objectivo principal deste projecto é projectar, realizar em circuito integrado e caracterizar experimentalmente um ADC pipelined auto-

calibrado de 12-13 bits de resolução que opere a um ritmo de amostragem de 40 MS/s alimentado por uma única bateria de 1.5 V e utilize apenas 1 pJ de energia por conversão. Para atingir este objectivo é necessário desenvolver as seguintes contribuições inovadoras:

- 1) Demonstrar em circuito integrado, pela primeira vez, uma nova técnica de auto-calibração digital. Esta consiste basicamente em estimular o ADC na entrada com ruído branco gaussiano (GWN) e determinar todos os códigos de calibração através de um histograma dos códigos de saída. Esta técnica tem a vantagem de permitir o auto-teste do circuito à frequência máxima de operação.
- 2) Para se conseguir utilizar apenas 1 pJ de energia por conversão a um ritmo de conversão tão elevado, a arquitectura deverá ser optimizada utilizando a metodologia proposta em e, por outro lado, os quantificadores dos diversos andares deverão ser substituídos por ADCs com dobragem (e interpolação) para reduzir a corrente e a área de silício e, consequentemente, o preço de fabrico.

Partners:

Instituto de Desenvolvimento de Novas Tecnologias - UNINOVA; Instituto de Engenharia de Sistemas e Computadores - Investigação e Desenvolvimento em Lisboa - INESC ID Lisboa

SEEMSEED - Study, Evaluate, and Explore in the Domain of the Single Electronic European Market

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP6/IST
Project Type:	RTD	Role:	Partner
Start Date:	23-12-2003	Finish Date:	30-06-2006
Funding:	1.499.393 €	CTS Funding:	176.968 €

Abstract:

The SEEM seed project aims to contribute significantly to the development and implementation of the future EU Policies about the Single Electronic European Market (SEEM) concept. This contribution will be based on the results of four inter-related activities:

- 1) The SEEM Concept can be defined as an e-business space where companies can do business with no technological restraints. Based on the analysis of the SEEM needs for open frameworks, the project will contribute to the SEEM concept with the definition and development of a flexible technological framework for electronic business collaborations. The definition of this framework will especially consider the linguistic, cultural and economic aspects of SME's needs.
- 2) The project will analyse the actual status of the technology, the society and the public policies in relation to SEEM. As a result of this analysis, the project will populate and maintain a dynamic, self-managed knowledge base on SEEM-related research policies throughout Europe.
- 3) The project plans to develop technology for prototyping the SEEM in a real usage scenario involving the issues within the SEEM concept and with the objective of generating a "proof of concept" in an important business sector for Europe. Therefore, a specific and complex industrial case is considered involving both SEEM technical issues (trust, discovery and negotiation, open standards required, authentication and non repudiation of transactions, services for mobile workers,...) and SEEM stakeholders (public authorities, industry, technology providers).
- 4) With the input of the results from the three tasks above, the project will launch a Discussion and Dissemination Phase with the participation of all the SEEM concept stakeholders in Europe. The results of this discussion phase will be published and submitted as key contribution to the future EC policies on the Single Electronic European Market.

Partners:

SISAQUA - Sistemas de Saneamento Básico, Lda. (Portugal); Landesumweltamt Brandenburg (Germany); Residuos Industriales de la Madera Y Afines S.A. (Spain); Conselleria de Territorio Y Vivienda (Spain); Enviro Europa S.A. (Greece); Comité Européen de Normalisation (Belgium); Antara Information Technology, S.L. (Spain); Association Européenne des Agences de Développement (Belgium); Technische Universität Hamburg-Harburg (Germany); Carl Von Ossietzky Universität Oldenburg (Germany); Universität Stuttgart (Germany); Loughborough University (United Kingdom); UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias (Portugal); Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung E.V. (Germany); Nikolaos Petrakopoulos Commercial Industrial Societe Anonyme (Greece); Büro Für Umweltplanung - Winfried Rueck (Germany); Tie Nederland B.V. (Netherlands); Schlumbergersema, Sociedad Anonima Espanola (Spain); Berleon Research GmbH (Germany); DEMOCENTER - Centro Servizi per L'Innovazione Società Consortile a Responsabilità Limitata (Italy); Telefonica Moviles Espana S.A. (Spain); Asociacion de Investigacion Y Desarrollo en la Industria Del Mueble Y Afines (Spain).

SEIS - Space Environment Information System

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	ESA	Programme:	ESTEC/
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-08-2003	Finish Date:	01-09-2005
Funding:	200.000 €	CTS Funding:	160.000 €

Abstract:

UNINOVA has been increasing its experience, with past and on-going projects at ESOC, in radiation monitoring and prediction and the usage of this information in the assessment of Solar cells degradation (details available at <http://www.gtd.es/fuzzy>). This, along with our combined expertise in Artificial Intelligence, Data Mining, Machine learning, Fuzzy Logic and Decision Support Systems (mainly data warehousing), are behind this identified opportunity (see (Ribeiro, Pires et al. 2002) for an overview of these technologies and possible future applications).

Our experience of current practices of mission operations at ESOC is that operators can benefit from systems that deliver relevant information and knowledge, usually not integrated in the mission control environment. Space weather data is definitely included. In addition, space weather data is not used in standard documented mission control processes:

This perception is also confirmed by the assessment of current practices performed in the feasibility studies of (see (Horne 2000) – page 33). Operators cannot reliably identify space weather as a cause of problems since they do not have enough expertise in space physics and information about the spacecraft environment.

The identified user need is to supplement the flight control team with space environmental information - past, current and forecast - already translated into spacecraft operational impact assessment and, in combination with spacecraft telemetry data, into suggested

preventive or corrective operational procedure(s) (as defined in the S/C Flight Operation Plan) for implementation.
 With the opportunity implicit in the previous statements in mind, UNINOVA has envisioned a solution which consists of:
 Collecting historical and real-time space weather data coming from whatever sources are deemed relevant (opportunistic usage) for a specific operations context and integrate that data with the satellite telemetry and orbit.
 Transform the Space Weather raw data into information and knowledge at higher levels of abstraction.
 Develop a prototype system capable of delivering a set of space weather services designed for mission control purposes directly in the control room.
 The user benefits include increased awareness of space weather cause & effect relationships; vis-à-vis on-board spacecraft health status; improved productivity and safety levels of satellite operations versus space weather environmental phenomena; increased science return and extended life time.

Partners:

UNINOVA; Deimos Engenharia

SESS - Space Environment Support System for Telecom and Navigation Missions

Responsible:	<u>Rita Ribeiro</u>	Group	B1
Sponsor:	ESA	Programme:	ESTEC/
Project Type:	RTD	Role:	Partner
Start Date:	01-08-2005	Finish Date:	01-12-2007
Funding:	400.000 €	CTS Funding:	123.000 €

Abstract:

The design of any system demands consideration of the environment in which it must operate, to ensure proper system function, reliability and lifetime. Space Systems are not an exception. For the present project, the 'space environment affecting Nav/Tel mission' to be considered is that of Near- Earth environment from the orbit range of LEO to GEO including all the inclinations.
 The main goal of the SESS project is to provide Telecom and Navigation Mission operators, project teams, development engineers and scientists with a completely operational prototype capable of supplying, in a structured manner, information on the space environment and its effects on the spacecraft.
 Although conceptually SESS shall be applicable for Telecom/Navigation missions in general, the system shall be implemented as a testbed in the forthcoming Galileo programme, where currently two spacecraft are foreseen as case studies: GIOVE A and GIOVE B.

Partners:

UNINOVA; Deimos Space (Prime); Deimos Engenharia; Instituto Nacional de Técnica Aeroespacial

SICAL - Cyclic CVD of Thin Films of Si and C Alloys

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	POCTI/?
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-01-2003	Finish Date:	31-12-2007
Funding:	102.012 €	CTS Funding:	0 €

Abstract:

Este projecto propõe a supressão de certos problemas, que se encontram quando se deposita filmes finos baseados em Si e C por métodos convencionais, e em vez deste se utiliza um porocesso cíclico de deposição química de vapores (CVD) onde a razão de deposição, a fracção cristalina e a densidade de defeitos são optimizadas por um processo cíclico de tratamento por plasma no crescimento dos filmes.
 O princípio da câmara fechada cíclica CVD (CC CVD) É aplicado em particular no silício microcristalino hidrogenado (mc-Si:H), no SiC estequiométrico, e no carbono parecido com o diamante (CVD diamante).
 O processo de câmara fechada que se encontra patenteada, assegura um aumento na razão de deposição quando comparada com os métodos convencionais de CVD e oferece por outro lado um alto grau de liberdade no control dos parâmetros estruturais dos filmes.

Partners:

Instituto Superior de Engenharia de Lisboa - ISEL; Universidade Técnica de Lisboa - Instituto Superior Técnico - IST; Centro de Física Molecular da Universidade Técnica de Lisboa; Universidade do Algarve

SIGAPANO - Sensor Information Gathering with PATrol NOdes

Responsible:	<u>Luís Bernardo</u>	Group	A11
Sponsor:	FCT	Programme:	POSC/?
Project Type:	RTD	Role:	Partner
Start Date:	01-06-2005	Finish Date:	31-05-2007
Funding:	81.000 €	CTS Funding:	18.000 €

Abstract:

The main goals of the SIGAPANO (Sensor Information GAThering with PATrol NOdes) research project are to contribute to a fundamental understanding of wireless sensor networks with mobile patrol nodes, provide an appropriate middleware design for this class of communication networks and develop a state-of-the-art sensor network prototype to demonstrate their applicability for tasks as critical as forest monitoring and fire detection.
 Wireless sensor networks made of tiny, low-cost devices capable of sensing the physical world and communicating over radio links, are significantly different from classical wireless networks like GSM or wireless LANs: (a) the design of a sensor network is strongly driven by its particular application, (b) sensor nodes are highly constrained in terms of power consumption and computational complexity, and (c) since the network is dense and the nodes share a common objective -- to gather and convey information -- cooperation can be used

to enhance the network's efficiency.

Previous work on the communications aspects of wireless sensor networks has focused on mostly static models, in which the sensor nodes keep their positions, and transmit the picked-up data to a central base station in a fixed location. Under this scenario, the sensor nodes are expected to store and process the data, coordinate their transmissions, organize the routing of messages within the network and relay the data to a remote receiver -- a challenging set of tasks which might prove impractical given the power constraints on the sensor nodes and the expected size of the network.

We propose to investigate an alternative approach, based on a limited set of mobile ad-hoc nodes with increased processing and communication capabilities, which are placed e.g. on a robot, a jeep or a helicopter and are thus able to move as a patrol around the wireless sensor network and, thus, relieve the sensor nodes from power-consuming networking tasks by collecting the required data in loco with less and more reliable transmissions.

The project will be divided in three complementary parts:

- (1) Fundamental performance limits of sensor networks with patrol nodes (DCC-FC, Porto): we will define adequate models for this class of wireless network and investigate the impact of the patrol nodes' mobility on the connectivity, the capacity and the average lifetime of the network using elements of information theory, graph theory and stochastic processes.
- (2) Network architecture and middleware for sensor networks with patrol Nodes (CRL, Lisbon): is to study and propose a protocol stack that provides an interface between the sensor networks and adhoc patrol nodes based on the theoretical results of part 1.
- (3) Development of a prototype sensor network for forest monitoring and fire detection. (DCC-FC + CRL): we will use two wireless sensor network kits to implement the sensor network architecture investigated in part 1 and the middleware package developed in part 2, and conclude with lab demonstrations and field tests in Portuguese forests.

Partners:

Fundação Gomes Teixeira (FGT/UP); Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL); Laboratório de Inteligência Artificial e Ciência de Computadores (LIACC/UP)

Singrar - Sistema integrado para a gestão de prioridades de reparação e afectação de recursos

Responsible:	<u>Adolfo Steiger Garção</u>	Group	B1
Sponsor:	?	Programme:	?/?
Project Type:	RTD	Role:	0
Start Date:	01-01-2004	Finish Date:	31-12-2007
Funding:	0 €	CTS Funding:	0 €

Abstract:

O SINGRAR é uma aplicação informática de apoio à decisão e destina-se a ser usada essencialmente na área da Batalha Interna em situação de combate, servindo o Comandante e os decisores das áreas técnicas de Armas e Electrónica e da Propulsão, Energia e Limitação de Avarias.

O SINGRAR concilia as funcionalidades de compilação do estado da plataforma e dos sistemas nela instalados e da sua representação em diversos formatos gráficos e tabelares, com aconselhamento de prioridades de reparação e da afectação dos recursos humanos a empregar nas reparações.

Os requisitos básicos do SINGRAR posicionam-no como um meio fiável de apoio à decisão que reaja imediatamente às alterações de cenário e aos novos dados introduzidos, devendo:

ordenar por prioridades as acções de reparação;

atribuir às acções de reparação os recursos humanos melhor habilitados e posicionados;

ser aplicável a navios com capacidade de operar em ambiente multi-ameaça;

ser escalável, isto é, ser aplicável a unidades com diferentes configurações e capacidades.

Desta forma o sistema apresenta propostas de reparação que entram em consideração factores de natureza operacional e de natureza técnica.

Além dos dados fornecidos pelos utilizadores, é utilizada uma base de conhecimento configurada para cada navio e para cada cenário.

O sistema SINGRAR funciona com computadores ligados entre si utilizando uma arquitectura em rede, o que lhe confere diversas vantagens:

a integração instantânea da informação compilada nos diversos postos, ficando as comunicações por voz reservadas a actividades de coordenação e como redundância;

a reacção automática e simultânea às alterações de dados em todos os postos;

capacidade de sobrevivência da informação, pelo recurso à recuperação de dados em caso de falha;

a possibilidade de assumir remotamente a gestão numa dada área, face à incapacidade temporária do centro de decisão afectado;

a diminuição do tempo total que medeia a tomada de conhecimento de uma avaria e a sua resolução;

a redução dos recursos humanos envolvidos em actividades de comando e controlo.

Partners:

0

SIPHASE - Design of switched-capacitor circuits in advanced CMOS technologies using a novel single-phase scheme

Responsible:	<u>João Goes</u>	Group	A1
Sponsor:	FCT	Programme:	POSC/?
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-05-2005	Finish Date:	30-10-2007
Funding:	54.000 €	CTS Funding:	54.000 €

Abstract:

Since the 70's, the analogue switches in switched-capacitor (SC) circuits are operated by non-overlapping bi-phase control signals (P1, P2). The non-overlapping of these two phases is essential for successful SC operation since, a capacitor inside an SC circuit can discharge if two switches, driven by P1 and P2, are turned on simultaneously. Hence, to avoid any chance of overlap between P1 and P2, duty cycles of 45 to 49% have been used in practice, to allow the unavoidable variations in the finite rise/fall times of P1 and P2.

Moreover, since 1983, two additional phases are generally used in many SC circuits, which consist of advanced versions of P1 and P2. These two additional phases overcome the problem of signal-dependent charge injection, by turning-off sampling switches connected to the inputs of the amplifiers slightly before the switches connecting the input signals to the bottom-plates of the sampling capacitors [1]. Since both NMOS and PMOS switches are normally employed, this four-phase scheme becomes a rather complex, six or eight phase scheme, due to the need to have complementary versions for driving the PMOS devices. An attractive solution to realize low-voltage SC circuits, overcoming the lack of the linearity of the switches, and with high power-and-area efficiency is the switched-opamp (SO) technique [2], invented in 1993. The basic idea consists of eliminating all switches in the signal path. The sampling operation in a given SC block is then obtained by switching-off the output-stage of the opamp of the previous SC block. A novel single phase scheme to be used in SC and SO circuits is proposed in this project by the Project Leader [8]. The signal integrity is preserved by exploiting the gap between the high conductance region of PMOS and NMOS switches at low power-supply voltages and the fast clock transitions that exist in advanced CMOS technologies. The main advantages are: 1. The clock-phase generator is simply implemented by a couple of CMOS inverters and the cumulative jitter noise introduced will be much smaller; 2. Duty-cycles of 50% can be achieved; 3. Only a single phase (plus its complementary version), is used for driving all switches rather than the conventional system comprising six or eight phases. Significant reductions in digital noise into the substrate as well as routing area can be achieved. The major goal of this project is to design, integrate and experimentally evaluate two practical circuits in order to demonstrate for the first time, the proposed novel single phase scheme and its advantages. The proposed circuits are: 1) A low-voltage 10-bit, 4MS/s pipeline ADC with high energy efficiency (the aim is to achieve less than 0.5 pJ of used energy per conversion, an unprecedented performance) for sensor interface applications; 2) A low-voltage and low-power second-order A/D delta-sigma modulator (PD < 1mW, DR > 80 dB, BW > 10 kHz) with high area efficiency for biomedical applications.

Partners:

Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL);

SMART-FM - A Standards compliant framework to support complete integrated product life-cycle information Management And electronic commerce for the furniture manufacturing (FM) industry, in THE advent of the smart enterprises

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP5/IST
Project Type:	RTD	Role:	Technical Coordination
Start Date:	01-06-2002	Finish Date:	31-05-2005
Funding:	1.770.854 €	CTS Funding:	295.201 €

Abstract:

Based on the number of people it employs, the furniture industry is the largest manufacturing sector in the world, and in Europe in particular. To keep its competitiveness, Europe needs to accomplish rapidly the new requirements for the furniture industrial sector in the e-global marketplace. SMART-fm project establishes a Thematic Network organised in 5 inter-coordinated Working Groups to harmonize and demonstrate to the furniture industry the state of the art and trends in Standardisation and Research in complete integrated Product Life Cycle (PLC), intelligence e-business and extended enterprise practices. Network members and furniture related companies are the major receivers of SMART - fm results. They will be the basis to stimulate companies to adopt the project results and the research community to move beyond.

Partners:

Univ. Federal do Rio Grande do Sul (Brazil); Haas + Partner Ingenieurgesellschaft Mit BeschraenKter Haftung (Germany); Cranfield Univ. (United Kingdom); Fac. de Ciências e Tec. da Univ. Nova de Lisboa (Portugal); Schweizerische Hochschule Fuer Die Holzwirtschaft Biel (Switzerland); C.L.A.C. - Centro Legno Arredo Cantu S.R.L. (Italy); Fira Inter. Limited (United Kingdom); Assoc. das Industrias de Mad. e Mobiliário de Portugal (Portugal); In. Tres _ Ingegneria Inf. Industriale - Societa a Responsabilita Limitata (Italy); École Nationale Supérieure des Technologies et Industries du Bois - Université Henri Poincaré Nancy I (France); Borm-Informatik AG (Switzerland); Architecture and Computer Aids-ACA Espana. S.L. (Spain); Permase, S.A. (Spain); Tiziana e Giuseppe Mascheroni-S.P.A. (Italy); Euroinformarket, S.A. (Spain); Univ. de Caxias do Sul (Brazil); Nikrom Trabna Mebel Ltd. (Bulgaria); P&H Jones Limited (United Kingdom); Linial Desarrollo de Software para Sectores Verticales, S.L. (Spain); Design Market Europe AB (Sweden); Global Product Channel (G.P.C.) Italia SPA (Italy); Uninova-Inst. de Desenvolvimento de Novas Tecnologias (Portugal); Tema-Téc. de Mobiliário, Lda. (Portugal); Aplicaciones de Cad, CAM y GIS S.L. (Spain); Univ. Feredral de Santa Catarina (Brazil); Univ. Politécnica de Valencia (Spain); Antara Information Technology, S.L. (Spain); Federacion Empresarial de la Madera y Mueble de la Comunidad Valenciana (Spain); Federmobili Societa di Servizi SRL (Italy); Univ. of Chemical and Metallurgy (Bulgaria).

SPEED - Low Power Ultra-High Speed Analogue-to-Digital Converter for Ultra-Wideband Wireless Communications

Responsible:	<u>João Goes</u>	Group	A1
Sponsor:	FCT	Programme:	PTDC/?
Project Type:	RTD	Role:	Partner
Start Date:	01-09-2007	Finish Date:	30-08-2009
Funding:	61.732 €	CTS Funding:	14.619 €

Abstract:

The recent advent of WPAN (Wireless Personal Area Network) standards using ultra-high bandwidths has boosted the interests on the design of high-speed moderate-resolutions low-power ADCs. These ADCs are, hence, integral components of the high-speed communication systems, such as serial links and UWB (Ultra Wide Band) receivers.

Flash ADCs generally achieve the highest sampling rates, with the comparator limiting the maximum achievable sampling speed. For resolutions up to 4 bits, solutions reaching very high energy efficiency (EE) based on this type of architecture have been reported (EE < 0.2 pJ per conversion step). However, all comparators require off-chip calibration not accounted in the total power budget. Unless offset calibration techniques are employed in the comparators, such as the one proposed in, large devices have to employed in order to reach the required accuracy, leading to a high power dissipation. Moreover, for resolutions up to 6-8 bits, the EE of the flash ADCs drops to 3.2 pJ, since there is an exponential dependence of the power and area on the resolution.

Therefore, other architectures have been successfully employed, such as time-interleaving several successive-approximation (SA)

ADCs meeting 0.34 pJ of EE for a sampling-rate of 0.6 GS/s. However, to reach sampling-rates above 1GS/s more than 2 time-interleaved channels have to be used in parallel, requiring calibration of the offset/gain/timing mismatches among channels. The hardware cost of a pipelined A/D converter is approximately proportional to the number of bits resolved. Therefore this architecture is the most cost-effective (power and area) approach to obtain higher resolutions among all the fast Nyquist A/D architectures. Sampling rates of the order of 1GS/s can easily be achieved in advanced CMOS technologies, for resolutions up to 8-bits, using only 2-channels in parallel. An ADC with an ENOB of 8.4 bits, operating at 1GS/s, but using 4-channels in parallel have recently been presented in achieving an EE of about 1 pJ per conversion step.

The major goal of this project is to design, integrate in a 90nm CMOS technology and experimentally evaluate a calibration-free 2-channel time-interleaved 6-bit 1GS/s CMOS Pipeline ADC with an EE better than 0.2-0.3 pJ per conversion step and at the same time achieving a very low die area. Many novel techniques will be addressed to reach such goal such as, intensive use of passive structures, amplifier sharing, simple amplifier topology and exhaustive circuit optimization. A second aim of the project will be to include, on-chip, an efficient solution for providing built-in self-testing capability.

Partners:

Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL); Instituto de Engenharia de Sistemas e Computadores, Investigação e Desenvolvimento em Lisboa (INESC ID/INESC/IST/UTL); Instituto de Telecomunicações Lisboa (IT Lisboa/IT)

SPIN - Manipulation of spin and charge currents in magnetic nanostructures

Responsible:	<u>Maria Manuela Vieira</u>	Group	A2
Sponsor:	FCT	Programme:	POCI/?
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2005	Finish Date:	31-12-2008
Funding:	80.000 €	CTS Funding:	0 €

Abstract:

Theory of electronic, magnetic and transport properties of mesoscopic systems and artificial structures with inhomogeneous magnetization, will be developed. The objects of our investigation include some multilayer structures with magnetic elements (nanopillars), quasi-one-dimensional systems with magnetic domain walls, magnetic nanorings and other systems with topologically nontrivial magnetic ordering. The theory includes the determination of quantum electronic states in the magnetization profile, spectrum of spin waves and gauge-field excitations associated with the curved spin space for the inhomogeneous magnetization. We also include into consideration the corresponding effect of external magnetic field on the energy spectrum and magnetization profile.

Our study of transport properties includes the calculation of charge and spin currents in nonequilibrium conditions mostly related to relatively large magnitude of the charge currents. A special attention will be paid to the development of quasi-classical description of electrons in magnetic nanostructures relating microscopic theory to the methods of computer simulation of magnetoelectronic devices. The detailed theory with parameters characterizing ferromagnetic and semiconducting materials will be presented for such applications as current-induced switching in nanopillars and nanoconstrictions with domain walls, spin injection from magnetic semiconductor, and creation of pure spin currents. Computer simulations will be performed for maximally realistic models of the nanostructures.

The main parts of the project include:

- Magnetic switching by current in nanopillars (calculation of spin torque and dynamics of magnetization)
- Dynamics of domain walls controlled by electric current (spin transfer in domain walls, nonequilibrium dynamics of domain wall motion)
- Magnetoresistance of nanoconstrictions with domain walls in ferromagnets and magnetic semiconductors (including effects of Coulomb interaction)
- Spin currents in inhomogeneous magnetic systems (related to the spin transfer in the equilibrium for magnetically metastable states, and the spin current transferred by magnons)
- Tunneling and spin currents in ferromagnet/superconductor nanostructures

Partners:

Instituto Superior Técnico (IST/UTL); Instituto Superior de Engenharia de Lisboa (ISEL/IPL); Universidade de Évora (UE); Centro de Física das Interações Fundamentais (CFIF/IST/UTL)

SPRAYNET - Technology transfer of application protocols, standards and health/safety criteria for the use of spray drying technology

Responsible:	<u>Rui Neves da Silva</u>	Group	B2
Sponsor:	EC	Programme:	FP5/GROWTH
Project Type:	RTD	Role:	Partner
Start Date:	01-02-2002	Finish Date:	31-01-2005
Funding:	967.788 €	CTS Funding:	37.680 €

Abstract:

This Concerted Action specifically addresses the spray drying industry and its applications. Spray drying is an important processing technique, widely used in a number of processing industries, including the food, pharmaceuticals, agrochemicals bulk and fine chemical industries. It is also used in the production of technical ceramics and in the control of acid rain from coal-fired power stations.

Optimisation of spray drying in these industries is often limited by a lack of basic scientific understanding. This is particularly true in the food industry, targeted by this network primarily because there is a prevalence of SME's in this industry who do not have access to the latest technologies. This network proposes to overcome this problem by identifying and transferring new technologies from the research level to the industrial field by coordinating ongoing research activities with the member organisations, funded within member states.

Partners:

UNINOVA (PT); CHALEX (IR), TTZ (DE), UNIGHENT (BE), BODEC (NL), MB Tech (UK), MERCK (DE), TEAGASC (IR)

STAND-INN - Integration of performance based building standards into business processes using IFC standards to enhance innovation and sustainable development

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
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Sponsor:	EC	Programme:	FP6/INNOVA
Project Type:	RTD	Role:	Partner
Start Date:	01-09-2006	Finish Date:	30-09-2008
Funding:	987.405 €	CTS Funding:	28.503 €

Abstract:

The strategically very important building and construction (B&C) industry is now facing a paradigm shift, from where the buildings and building products are no longer considered only as physical objects, but are rather seen as service arenas designed to facilitate management of life cycle performance and value adding services to meet changing end user needs. This paradigm shift, coupled with the drive for customer orientation, sustainability and ICT deployment is regarded as the key drivers for change and improvement in the B&C sector. New manufacturing processes based on the IFC standards will create new and more efficient business processes, thus facilitating the construction sectors great potential for cost reduction and productivity increase, consequently, improving the competitiveness of the B&C industry. Focus on improving the integration of open IFC- and performance based standards for sustainable development into business processes (A2) is thus the main objective of the project. Due to the relevance of IFC and sustainability for the other two actions in the call, the project also links with sustainable building products and services, including sustainable housing (A1), as well as standards in public procurement processes.

The suite of IFC standards for shared information exchange has the potential to change the entire B&C industry. These standards form the foundation and structure for effective e-collaboration practices, B2B and B2C exchanges, and B2A/building permit and public tendering procedures.

The project Consortium comprise 28 members from 11 European countries and with 5 European- wide networks, entailing major stakeholders from industry including SMEs, users, R&D and standardisation as well as 2 partners from China and 1 from Australia. The work plan entails developing guidance material for the three actions, carrying out a series of dissemination activities across Europe, developing handbooks on "best practise" and pilots, and policy recommendation.

Partners:

Norwegian Building Research Institute; Standards Norway; International Alliance for Interoperability, Norway; EnviChina; EPM Technology; Snøhetta Modular; Technical Research Centre of Finland; Senate Properties; Confederation of Finnish Construction Industries RT; The Building Information Foundation RTS (Rakennustietosäätiö RTS); Centre Scientifique et Technique du Bâtiment; Association Francaise de Normalisation; AEC3 Ltd.; Faithful & Gould Limited; Centre for Built Environment, University of Gävle; Ljustech Konsult AB; SIS, Swedish Standards Institute; Capitolo Italiano dell'International Alliance for Interoperability; Ente Nazionale Italiano di Unificazione; Vilnius Gediminas Technical University Lithuania; Fundación LABEIN; Asociación de Investigación de Industrias de la Construcción; Instituto de Desenvolvimento de Novas Tecnologias; MAX BÖGL Bauunternehmung GmbH & Co. KG; Ingenieurbüro Dr.-Ing. Wolfram Trinius; Belgian Building Research Institute, with subcontractors; • Council for Construction Research Development and Innovation; European Network for Building Research Institutes; International Council for Research and Innovation in Building and Construction; International Council for Research and Innovation in Building and Construction; International Alliance for Interoperability, German speaking chapter; French Speaking Chapter of the International Alliance for Interoperability/ Mediaconstruct; International Alliance for Interoperability UK chapter; China Academy of Building Research; China Institute of Building Standard Design & Research; Commonwealth Scientific and Industrial Research Organisation

SUPERMACHINES - Advanced rotating electrical machines exploiting high temperature superconducting components

Responsible:	<u>Amadeu Leão Rodrigues</u>	Group	A2
Sponsor:	EC	Programme:	??
Project Type:	RTD	Role:	Partner
Start Date:	01-08-2000	Finish Date:	31-07-2004
Funding:	0 €	CTS Funding:	0 €

Abstract:

The primary aim is to determine the best design of electrical machines that exploits high temperature superconductor (HTS) material. Specifically the objective of this project is to develop the complete design of a 100 kW machine. In order to achieve this the most appropriate and properly characterised material is needed. This material is available normally as small pucks, and so the best method to make the correct size and shape must be determined. Given the material characteristics, an optimum topology and design of motor must be found. It is proposed initially to build and test a number of smaller prototypes to verify the design calculations, before designing and manufacturing a motor of the order of 10kW, on which to base the final design. This motor will also have built-in cryogenics and superconducting bearings.

Partners:

IPHT Jena; IRC Cambridge; FCT/UNL; SUPRAS; CSIC; University of Oxford;

TeleCARE - A Multi-Agent Tele-Supervision System for Elderly Care

Responsible:	<u>Luís Camarinha Matos</u>	Group	C1
Sponsor:	EC	Programme:	FP5/IST
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-05-2001	Finish Date:	31-05-2004
Funding:	2.857.896 €	CTS Funding:	529.598 €

Abstract:

Project TeleCARE aims to design and develop a framework for tele-supervision following a multi-agent approach, including both stationary and mobile agents and applied to facilitate independent lifestyles among elderly people using remote services from health and care centres. The system will be developed around a set of Internet based "sites" designed to provide expert supervision and care facilities to improve the quality of life for the elderly person and their families. The TeleCARE elderly support system will give consideration to a number of specific issues that run horizontal across all TeleCARE services, such as, the safety of the elderly person, possible loss of sense faculties, privacy, and integrity of information held on each elderly person.

Partners:

Universiteit Van Amsterdam (Netherlands); Skill Consejeros de Gestion, S.L. (Spain); Roundroso Associates LTD (United Kingdom); Synkronix Incorporation Limited (United Kingdom); Camara Navara de Comercio e Industria (Spain); Uninova - Instituto de Novas Tecnologias (Portugal).

THEIERE-DISS - Thematic Harmonisation in Electrical and Information Engineering in Europe- DISSemination

Responsible: Luís Gomes **Group** A12
Sponsor: EC **Programme:** ERASMUS/
Project Type: Network **Role:** Partner
Start Date: 01-01-2005 **Finish Date:** 31-12-2005
Funding: 0 € **CTS Funding:** 0 €

Abstract:

The aims of this new thematic network (years 2000 to 2003) are:

a survey concerning the available curricula in EIE (Electrical and Information Engineering) throughout the whole Europe, a reflection on the best practices of high engineering education in the specific field of Electrical and Information Engineering in a European perspective,

A development of pieces of curriculum and pedagogical tools available through the internet as pre-requisites to help students for mobility exchange programmes (ex: ECTS). The aim is to allow the student to prepare him/herself before going in a foreign country by: acquiring the basic level,

Beginning to learn in the foreign language and with the foreign approach the academic content of one particular course.

To enable a curricula comparison that will facilitate the transfer of knowledge between higher education institutions.

The whole aim is to get a harmonisation of the curricula in EIE throughout Europe in order to facilitate the exchanges of knowledge, students and teachers. This harmonisation will make possible the establishment of common accreditation, crediting and certification procedures.

Partners:

89 european institutions

THINKcreative - Thinking network of experts on emerging smart organizations

Responsible: Luís Camarinha Matos **Group** C1
Sponsor: EC **Programme:** FP5/IST
Project Type: RTD **Role:** Prime Contractor
Start Date: 01-07-2001 **Finish Date:** 31-12-2003
Funding: 495.000 € **CTS Funding:** 187.470 €

Abstract:

THINKcreative aims at establishing a working group to act as a European advisory group in the area of smart and emerging organizations in the framework of the knowledge and skills economy. The main goal is to identify and characterize the emerging industrial organizational forms, the required infrastructures, modelling and application tools, and socio-organizational needs for the next 5, 10, and 20 years. A key mechanism is the organization of a set of consultation meetings and regional workshops, with the participation of the THINKcreative members and other invited international experts, which will be used as a "think tank" and a discussion / deliberation space. A Delphi survey and electronic forum complement these activities. A major result is a Green Book describing the identified visionary scenarios, the needs, and recommendations for R&D in order to enhance Europe's competitiveness in the global digital marketplace.

Partners:

CAS Software AG (Germany); RoundRose Associates Ltd. (United Kingdom); Fraunhofer Gesellschaft zur Förderung der angewandten Forsch (Germany); Universiteit van Amsterdam (Netherlands); Czech Technical University in Prague (Czech Republic); Center for Technology and Innovation Management (Germany); GMD – Forschungszentrum Informationstechnik GmbH (Germany); Cranfield University (United Kingdom); Skandia Insurance Company Ltd. (Sweden); INESC Porto (Portugal); Uninova - Instituto de Novas Tecnologias (Portugal).

TIMOC - Time Modulated CVD Process for Preparation of Advanced Thin Film Materials

Responsible: Maria Manuela Vieira **Group** A2
Sponsor: EC **Programme:** INCO-COPERNICUS/
Project Type: RTD **Role:** Prime Contractor
Start Date: **Finish Date:**
Funding: 0 € **CTS Funding:** 0 €

Abstract:

Pretende-se com este projecto desenvolver técnicas de deposição de películas e dispositivos semicondutores e fazer transferência de tecnologia entre os parceiros envolvidos.

Partners:

Instituto Superior Técnico (coordenador, Portugal), CL SENES (Bulgária), Joffe-Physico-Technical Institute (Rússia), Universidade de Giessen (Alemanha), Universidade Técnica de Munique (Alemanha), Hahn- Meitner-Institute (Alemanha) Plasma-finish GmbH (Alemanha), INESC (Portugal) e Instituto Superior de Engenharia de Lisboa (Portugal).

Transatlântico - Organização virtual Luso-Brasileira para PME

Responsible:	<u>Adolfo Steiger Garção</u>	Group	B1
Sponsor:	?	Programme:	?/?
Project Type:	RTD	Role:	Prime Contractor
Start Date:		Finish Date:	
Funding:	0 €	CTS Funding:	0 €

Abstract:

This project aims the interchange of knowledge and experience between UNINOVA and NUMA (Univ. of S. Paulo - Brazil) as a drive for the development of project proposals to be submitted to multi-lateral or EU RTD Programmes.

This project will take consider the efforts being done by both institutions towards the advances in the field of the Digital Economy.

The project will consist of bi-lateral meetings to synchronize the efforts being done by both sides, towards a common understanding platform that will be the basis for the development of further project proposals.

The results of the created synergy will be presented in international fora.

Partners:

UNINOVA; NUMA - University of S. Paulo (S. Carlos; Brazil)

U-BOAT - U-BOAT - Ultra-Wide Band Transmission for Ad Hoc Networks

Responsible:	<u>Luís Bernardo</u>	Group	A1
Sponsor:	FCT	Programme:	PTDC/?
Project Type:	RTD	Role:	Partner
Start Date:	01-10-2007	Finish Date:	10-01-2009
Funding:	97.000 €	CTS Funding:	0 €

Abstract:

The implementation choices of very high data rate ad hoc networks for short and medium ranges, covering the physical, medium access control (MAC) and network layer are broad. Several proposals exist which use crosslayering techniques for the MAC and physical layers, but so far few proposed deeper cross-layering covering the three layers, and above. However, some optimizations, essential for the network and application layer performance, can only be achieved through this deeper integration. Nodes must self-organize to control network access and reduce interference. Access can be organized into structured PANs (Personal Area Networks) composed of stable groups (scatternet), each one with one master node (e.g. 802.15.3); or it can be unstructured and decentralized (e.g. DCF (Distributed Coordination Function) of 802.11) for ad hoc medium access. Although DCF's theoretical peak rate is high, the effective throughput available per user is much lower due to MAC inefficiency on sharing the channel and on carrying broadcast traffic. Nowadays, there is a strong interest in UWB (Ultra-Wide Band) transmission schemes for ad hoc networks. The UWB signals have huge bandwidths and small power spectral densities, even below the channel noise levels. Therefore, an UWB-based system can share the spectrum with several "narrow-band" systems with minimal performance degradation for them. Moreover, since the UWB schemes use spread spectrum techniques allowing very high processing gains (even for services with moderate or high data rates), they provide strong robustness against interferences, such as those associated to the multiple "narrow-band" signals sharing its bandwidth. The impulse radio techniques are the most popular candidate for UWB transmission, typically employing selected pulse modulation schemes combined with TH-MA (Time-Hopping Multiple Access). This is especially due to the reduced implementation complexity of impulse radio, when compared with continuous-wave UWB options. However, since the spectral efficiencies achievable with impulse radio techniques are typically low, there is an increased interest on UWB systems employing continuous-wave techniques such as OFDM (Orthogonal Frequency Division Multiplexing), DS-CDMA (Direct Sequence Code Division Multiple Access) and MCDMA (MultiCarrier CDMA). This work considers transmission techniques for UWB-based ad hoc networks. Both impulse radio, combined with TH-MA, and continuous-wave schemes, namely OFDM, DS-CDMA and MC-CDMA schemes, will be considered for the UWB radio transmission. Appropriate signal processing schemes will be developed and evaluated, for both the transmitter and the receiver, so as to improve the range/bitrate tradeoffs. Improved receivers, with multipath and multiaccess interference cancellation, will be developed. The use of multiple-antenna systems to improve the performances and/or to increase the capacity will be considered. The synchronization and channel estimation requirements will be studied, as well as appropriate estimation methods, namely employing iterative detection/estimation procedures will be developed. For both transmission techniques (impulse radio and continuous-wave) we will consider DS (Direct

Sequence) spreading and CS (Code Spread)

schemes, namely employing TCH codes (Tomlinson Cercas Hughes). Since the system should be able to share the spectrum with present "narrow-band" systems, there is especial interest in the evaluation of the mutual interference levels, as well as the development of techniques to minimize these interferences. To reduce the interference levels, we will consider appropriate pulse/spectral shaping techniques, as well as interference cancellation schemes. Medium access control was traditionally implemented independently of the physical layer. Contention based models rely on CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance) access mode, enhanced with RTS (Request to Send) / CTS (Clear to Send) mechanism for reducing the hidden node collision problem for large packets. To improve throughput and quality of service, priority mechanism and frame aggregation mechanism were introduced. However, it is not possible to offer QoS guarantees without introducing effective reservation mechanisms for broadcast and point-to-point communication. This can be achieved by coordinating access on a self-organized network, or by introducing cross-layering reservation mechanisms possibly supported by the physical layer (e.g. codes, bandwidths, time slots). From the network layer point of view, the final performance is also related to the relative performance of the broadcast traffic, since most of the basic routing and service discovery services use it. Broadcast traffic is more sensible to collisions since it is not acknowledged at the MAC layer. Its performance can be improved using cross-layering approaches. In this project we intend to optimize the throughput at the network layer, through an evaluation of the study of relevant implementation choices and crosslayer implementations.

Partners:

Instituto Superior Técnico (IST/UTL); Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL); Instituto Superior de Ciências do Trabalho e da Empresa (ISCTE); Instituto de Sistemas e Robótica - Lisboa (ISR Lisboa/IST/UTL)

VET-TREND (B2) - Valorisation of an Experiment-based Training System through a Transnational Educational Network Development

Responsible:	<u>Fernando Coito</u>	Group	B2
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Sponsor:	EC	Programme:	Leonardo da Vinci/?
Project Type:	RTD	Role:	Partner
Start Date:	01-12-2006	Finish Date:	30-11-2008
Funding:	289.742 €	CTS Funding:	12.796 €

Abstract:

The project aims to create a transnational network in the domain of virtual & remote experiments for e-learning based on integration and optimisation of existing products (some of them created in the framework of the pilot project "Virtual-Electro-Lab" RO/01/B/F/PP141024), with the multilateral use of the transnational network capabilities. The network is aimed to:

- Expand and valorise the existing remotely accessed experiment-based VET system;
 - Create the appropriate tools for multiple-ways communication among different actors (project partnership, potential users and potential authors);
 - Develop the frame for the evaluation of knowledge and skills acquired during the training, involving remote experiments methodology.
- The project will promote the collaborative work and the integration of the partners' and other actors' laboratories by:
- Thematic workshops on development of criteria and methods for further training needs identification and analysis;
 - Pilot testing activities & training sequences, and experience exchange, for teachers and trainers, in the use of the expanded and optimized existent e-Learning platform, in order to integrate their multi-media courses and laboratories, their assessment schemes and evaluation systems.

Partners:

Transilvania University of Brasov, Romania (leader), Technical University Darmstadt, Alemanha, Hasso-Plattner-Institute for Software Systems Engineering at University of Potsdam, Alemanha, Institute of Communication and Computer Systems ICCS, Grécia, Laboratorio delle Idee, Italy, DIBE - University of Genoa, Italy, Politecnico di Torino, Italy, Centro de Formação Profissional da Indústria Electronica, Portugal, Universidade Nova de Lisboa, Portugal, PSE Siemens Romania SRL, Romania, Vision Systems SRL, Romania, The Swedish TelePed. Knowledge Centre, Sweden.

VET-TREND (A1) - Valorisation of an Experiment-based Training System through a Transnational Educational Network Development

Responsible:	<u>Luís Gomes</u>	Group	A12
Sponsor:	EC	Programme:	Leonardo da Vinci/?
Project Type:	RTD	Role:	Partner
Start Date:	01-12-2006	Finish Date:	30-11-2008
Funding:	289.742 €	CTS Funding:	12.796 €

Abstract:

The project aims to create a transnational network in the domain of virtual & remote experiments for e-learning based on integration and optimisation of existing products (some of them created in the framework of the pilot project "Virtual-Electro-Lab" RO/01/B/F/PP141024), with the multilateral use of the transnational network capabilities. The network is aimed to:

- Expand and valorise the existing remotely accessed experiment-based VET system;
 - Create the appropriate tools for multiple-ways communication among different actors (project partnership, potential users and potential authors);
 - Develop the frame for the evaluation of knowledge and skills acquired during the training, involving remote experiments methodology.
- The project will promote the collaborative work and the integration of the partners' and other actors' laboratories by:
- Thematic workshops on development of criteria and methods for further training needs identification and analysis;
 - Pilot testing activities & training sequences, and experience exchange, for teachers and trainers, in the use of the expanded and optimized existent e-Learning platform, in order to integrate their multi-media courses and laboratories, their assessment schemes and evaluation systems.

Partners:

Transilvania University of Brasov, Romania (leader), Technical University Darmstadt, Alemanha, Hasso-Plattner-Institute for Software Systems Engineering at University of Potsdam, Alemanha, Institute of Communication and Computer Systems ICCS, Grécia, Laboratorio delle Idee, Italy, DIBE - University of Genoa, Italy, Politecnico di Torino, Italy, Centro de Formação Profissional da Indústria Electronica, Portugal, Universidade Nova de Lisboa, Portugal, PSE Siemens Romania SRL, Romania, Vision Systems SRL, Romania, The Swedish TelePed. Knowledge Centre, Sweden.

VIRTUAL-ELECTRO-LAB - Using information & communication technologies in development of virtual & remote laboratories for initial & continuous education oriented on efficient professional (re)insertion in electrical domain

Responsible:	<u>Adolfo Steiger Garcão</u>	Group	A1
Sponsor:	EC	Programme:	Leonardo da Vinci/?
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2002	Finish Date:	30-09-2004
Funding:	600.000 €	CTS Funding:	54.411 €

Abstract:

Using information & communication technologies in development of Virtual & Remote Laboratories for initial and continuous education oriented on efficient professional (re)insertion in electrical domain.

The goal of the project consists of developing a complex training system that includes the correlation of the courses, seminars / workshops and testing systems with the virtual & remote experiment elements. This is pointed out through the following:

It proposes an innovative approach of the teaching method using a virtual & remote laboratory.

It supposes the setting up of new ICT software tools for training in order to implement this innovative approach.

Partners:

Hogeschool Gent (Belgium); EVITech (Esposo - Vantaa Institute of Technology - Finland); Laboratorio delle Idee (Italy); UNINOVA

(Institute for the Development of New Technologies - Portugal); Transilvania University of Brasov (Romania); County School Inspectorate Brasov (Romania); County Agency for Employment and Vocational Training Brasov (Romania)

VIVACE - Value Improvement through a Virtual Aeronautical Collaborative Enterprise

Responsible:	<u>Adolfo Steiger Garção</u>	Group	C2
Sponsor:	EC	Programme:	FP6/AERO
Project Type:	RTD	Role:	Partner
Start Date:	01-01-2004	Finish Date:	31-12-2007
Funding:	43.299.803 €	CTS Funding:	266.747 €
Abstract:			
<p>VIVACE is a project set-up in the framework of AECMA addressing aeronautics' Vision 2020 objectives to contribute significantly to fulfilling 3 specific targets of the aeronautics industry Strategic Research Agenda: 1/ Halve the time to market for new products with the help of advanced electronic analytical, design, manufacturing and maintenance process, methods & tools2/ Increase the integration of the supply chain into the network3/ Maintain a steady and continuous fall in travel charges through substantial cuts in operating costs. VIVACE will develop advanced capabilities (Knowledge Enabled Engineering, Multidisciplinary Design and Optimisation, Design to Decision Objectives, Engineering Data Management, Distributed Information Systems Infrastructure for Large Enterprise and Collaborative Hub for Heterogeneous Enterprises) applied on real case engineering and business scenarios from the aircraft and engine sectors. The main result will be an Aeronautical Collaborative Design Environment and associated Processes, Models and Methods to design an aircraft and engines as a whole, providing to the aeronautics supply chaining an extended enterprise, virtual products with all requested functionality and components in each phase of the product engineering life cycle. VIVACE will make its approach available to the aeronautics supply chain via existing networks, information dissemination, training and technology transfer actions. It will last 4 years and be organised into 3 technical subprojects dealing with the Aircraft, the Engine and Advanced Capabilities that will federate all developments. Fourth sub project will take care of management and innovation issues. VIVACE will start from past experiences and results gained in concurrent Engineering such as ENHANCE and will bring together 55 partners from industry, research institutes, universities and technology providers. Exploitation will take place via the design of new aircraft and engines.'</p>			
Partners:			
<p>Airbus France; Airbus Deutschland GmbH; Airbus SAS; Airbus UK Ltd; Ajilon Engineering; Alenia Aeronautica S.p.A.; ARTTIC; Assystem Ltd UK; Avio S.p.A.; BAE SYSTEMS (Operations) Ltd; CIMPA GmbH; Dassault Aviation; Dassault Systèmes; EADS CCR; EADS Deutschland GmbH; Empresarios Agrupados Internacional, S.A.; EPM Technology AS; ESOCE NET; Eurocopter SAS; Eurostep Group AB; Hewlett-Packard Limited; Hydro-Control-Steuerungstechnik GmbH; Industria de Turbopropulsores, S.A.; ISIGHT Software SARL; Leuven Measurements & Systems International N.V.; Messier-Dowty Limited; MSC Software GmbH; MTU Aero Engines GmbH; Rolls-Royce Deutschland Ltd & Co KG; Rolls-Royce plc; Samtech SA; Snecma; Techspace Aero SA; Thales Avionics; Thales Avionics Electrical Systems SA; Transcendata Europe Ltd; Turbomeca SA; Volvo Aero Corporation; Xerox Italia S.p.A.; CENAERO; Centre de Recherche et de Formation avancée en Calcul Scientifique; Deutsches Zentrum für Luft - und Raumfahrt e.V.; Office national d'Etudes et de Recherches Aéronautiques; Stichting Nationaal Lucht - en Ruimtevaartlaboratorium; Technische Universität Hamburg-Harburg represented by TUHH-Technologie GmbH; UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias; Cranfield University; Imperial College of Science, Technology and Medicine; UPS /IRIT, Université de Toulouse 3 Paul Sabatier Institut de Recherche en Informatique de Toulouse; Luleå University of Technology; National Technical University of Athens; Politecnico di Milano; Politecnico di Torino; Queen's University Belfast; The University of Nottingham; The University of Warwick; Universität Stuttgart; University of Manchester; Dassault Data Services; Ibérica del Espacio, SA; Intespace; Oktal; Teuchos;</p>			

VOMAP - Roadmap design for collaborative virtual organizations in dynamic business ecosystems

Responsible:	<u>Luís Camarinha Matos</u>	Group	C1
Sponsor:	EC	Programme:	FP5/IST
Project Type:	RTD	Role:	Prime Contractor
Start Date:	01-07-2002	Finish Date:	30-06-2003
Funding:	449.536 €	CTS Funding:	148.154 €
Abstract:			
<p>VOMap aims to identify and characterize the key challenges, required multi-disciplinary constituency, and an implementation plan for a comprehensive initiative to affirm the EU leadership on emerging collaborative virtual organizations (VO). VOMap focuses on the feasibility study and developing a roadmap to the necessary integrated research and technological development, with the aim to address the full innovation cycle of a sustainable new generation of businesses with the wide industrial impact.</p> <p>Further scientific and technical objectives include:</p> <ul style="list-style-type: none"> - Consolidate multi-disciplinary paradigms; - Establish a clear baseline and wide consensus on concepts and terminology; - Identify future scenarios; - Build a vision of future VOs; - Understand and characterize the VO nesting environments; - Plan the necessary IT and non-IT developments based on a common reference model; - Design a strategy and implementation mechanisms for a major initiative on VO. 			
Partners:			
<p>Universiteit Van Amsterdam (Netherlands); CETIM - Center for Technology and Innovation Management GMBH (Germany); Virtuelle Fabrik AG (Switzerland); Valtion Teknillinen Tutkimuskeskus (VTI) (Finland); Fraunhofer Gesellschaft Zur Förderung Der Angewandten Forschung E.V. (Germany); Cas Software AG (Germany); UNINOVA-Instituto de Desenvolvimento de Novas Tecnologias (Portugal).</p>			

VOSTER - Network of Excellence on Virtual Organizations

Responsible:	<u>Luís Camarinha Matos</u>	Group	C1
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Sponsor:	EC	Programme:	FP5/IST
Project Type:	Network	Role:	Partner
Start Date:	01-12-2001	Finish Date:	31-05-2004
Funding:	1.350.000 €	CTS Funding:	112.161 €

Abstract:

The aim of VOSTER is to collect, analyse and synthesize the results from a number of leading European research projects on Virtual Organisation (VO), i.e. geographically distributed, functionally and culturally diverse, dynamic and agile organisational entities linked through ICT.

The scientific and technological objectives of VOSTER are to:

1. Consolidate VO related concepts and their relationships, VO types, characteristics and indicators;
2. Identify and recommend useful approaches for VO modelling;
3. Identify relevant technologies and standards and assess their potential for VOs;
4. Define functions of VO infrastructures and suggest ways to implement them; and
5. Promote VO approaches in European industries.

Partners:

VTT; Fhg-IAO; CeTIM; Uninova; Aachen University of Technology; Loughborough University; INTRACOL S.A.; Dreaden University of Technology; University of Salford; Computas; CAM-I; University of Amsterdam; Concurrent Engineering Consulting; Silesian University of Technology; Virtuelle

5.4. Prototypes and Products

In terms of what's generically known as "Prototypes and Products" we further define the following:

- Proof-of-concept: Trial that allows a prospect to quickly build and try out a part of a system to show the capabilities of an idea. Delivers a realistic slice of functionality and is often used as the foundation for the first developments.
- Prototype: A less formal experimental and experiential development process for the purpose of demonstrating some or all of the functional capabilities. A prototype does not typically have the same rigorous testing, documentation, and implementation requirements as a product release.
- Demonstrator: A demonstrator model that is an example of something used in some kind of presentation or exhibit. This typically represents demonstrating the application usage of a system to a target audience.
- Product: An item that is ready to be commercialised.

5.4.1. Proof-of-concept

1. [NOMDIS - New Operators for Monitoring and Diagnostic of Intelligent Systems](#). Integration of Choquet integral as a new aggregation method in fuzzy inference systems. Case study: Rosetta thermal alarm system [proof-of-concept]
2. [EE-II Evolution and Ecology of Interacting Infohabitants](#). This project will implement in software the ERGO_X ergonomic analysis tool [proof-of-concept]

5.4.2. Prototype

1. [A 0.9 V 200 uW 0.06mm² Sigma-Delta Modulator for biomedical applications](#). First switched-capacitor circuit reported using overlapping clock-phases (single-phase technique). Smallest ADC reported for the given performance. IEEE ISSCC Conference. (Feb. 06); IEEE TCAS-I (Dec. 05) [prototype]
2. [10-b 4MS/s Parallel Pipeline ADC for fingerprint sensors](#). Very low power dissipation; no special process layers used for implementing the capacitors. [prototype]
3. [First fully integrated CMOS UWB radar transceiver for medical imaging applications](#). Novel architecture using new fully differential circuits for pulse generation and new receiver topology; experimental results will be published in a book edited by Springer. [prototype]
4. [10-b 50MS/s Parallel Pipeline ADC](#). First silicon-proved time-interleaved pipeline ADC employing low-voltage techniques! The published fastest and the most energy efficient Parallel Pipeline ADC. IEEE VLSI Circuits Conference. [prototype]
5. [Gaussian and Uniform High-amplitude Broadband Noise Generators](#). Power dissipation of the Gaussian Noise Generator reduced by one order of magnitude when compared with the state-of-the-art for increased performance; First Practical Uniform Noise Generator reported up to date. [prototype]
6. [ISO10303 Part 28 Transformation Tool from EXPRESS to XML Schema](#). EXP2XSD is a tool that converts an EXPRESS schema into XML Schema language. The EXP2XSD morphism, despite implementing the default ISO 10303-28 transformation of EXPRESS models (input) to XSD (output), also enables the configuration of the morphism according to a pre-defined structure. Thus, the user (i.e. the company implementing the STEP AP) can configure the tool to choose among certain mapping parameters and obtain a schema more adapted to the manner that its own internal system handles XML information. The EXP2XSD is a tool that is part of the UniSTEP-toolbox. [prototype]
7. [ISO 10303 Part 28 XML Schema Transformation Tool to Relational Database](#). The main goal of this work is to provide an addition to STEP's part 28 and to persist any of the application protocols described in STEP, that can be expressed through part 28 in XSD, into a relational model in the form of SQL scripts for different dialects of different relational database vendors. The application can automatically generate the SQL scripts for some relational databases, given as input part 28 conforming XML Schemas that represent any application protocol. This functionality will permit a widening of possibilities in the use of STEP applications because it will be possible for users of these technologies to become free from the details and implementation of the relational model that supports the application protocol. [prototype]

8. [UNINOVA STEP-EXPRESS Toolbox](#). In the demand of the global market, organizations have been searching for flexible integrated environments to better manage their services and product life cycle, where their software applications could be easily integrated independently of the platform in use. However, with so many different modeling and implementation standards being used, interoperability problems arise when the chosen product model is described using one particular technology (e.g. EXPRESS) and is required to be integrated with systems that use totally different technologies with different degrees of expressiveness. This way, it would be an added value if the original model could be described in more than one language/technology depending of the environment where it is being used. UniSTEP is a toolbox that gathers different model transformation tools able to parse STEP models represented in the EXPRESS language, and apply to them model morphisms capable of modifying the original model. In the case of UniSTEP toolbox the modifications implemented by the different tools are only at the representation language level. UniSTEP, and its constituting tools relies on a framework that applies the OMG MDA principles, handling of information at different meta-levels for integration purposes. At that level, the effort to define valid transformation morphisms from the EXPRESS modeling language to others is heavily reduced since there is more information available about both the operand model languages (input and output). Hence, for the UniSTEP framework development, an EXPRESS metamodel has been defined specifying all the possible variations that a STEP data model can have. [prototype]
9. [AP236 Front End](#). Front-end to act with AP236 data model, with an innovative graphical interface, allowing easy navigation and comprehension of the model. Among its features, there is the capability to work directly with the model database, import/export xml catalogues according to Step Part 28. [prototype]
10. [EXPRESS 2 XML converter](#). This tool converts an ISO10303-11 (EXPRESS) schema in to XML format. The transformation process is based on the ISO10303-25 specification, which regulates the mapping between an EXPRESS schema and a UML model. [prototype]
11. [Enterprise Ontology Interoperability](#). Enterprise Ontology Interoperability (EOI) is a methodology that establishes guidelines for a reference ontology building process, based on the UPON methodology. The process summary is to build an ontology from the enterprise knowledge concepts to the glossary, and then to build the reference ontology by harmonization processes taking as input the glossary and the enterprise ontologies. In the glossary creation it is gathered the semantic mismatches information in order to be used for the mapping processes which will establish the relations between the enterprise sources ontologies and the new built one, the enterprise organisation reference ontology. This mapping will enable the possibility of remain in use the old ontologies for intra-enterprises business processes and the reference ontology for the inter-enterprises business processes. [prototype]
12. [Tool4Glossary](#). The Tool4Glossary is a Glossary viewer that is able to extract taxonomic structures and concept definitions from a specific table structure in excel text format. The future functionalities will be a glossary building tool that will be able to record semantic mismatches. [prototype]
13. [Ontology Mapping Tool](#). The Ontology Mapping (OnMa) tool is a GUI that helps the users establishing the mapping relations between ontologies represented in a RDF-schema format. A specific class from a specific ontology could be mapped to other ontology classes. This tool records this relations in a new auto built ontology prepared for this purpose. The actual stage of the tool only enables mapping between "literal" class elements. In the near future it is expected to establish mappings between other ontology elements as properties, instances and a mix of elements. [prototype]
14. [SEIS - Space Environment Information System](#). Integration of Space Weather information, S/C orbital positions and Telemetry data. The system includes a monitoring module, a reporting analysis tool and a meta-data repository [prototype]
15. [Conformance Testing services for XML data](#). With the increase of the competition caused by the globalization of market, companies need to establish new partnership and show that its products are the best. Conformance testing can help the companies to reach these objectives. Using conformance testing as support to its data systems or in data exchange, companies can ensure the conformance of XML data with models or standards, improving facilities to be interoperability and certifying its data conformance. Conformance Testing (CT) services for XML data, analyse data in two ways, semantically and syntactically. Using XSD models to analyse the XML data syntactically and complementing it with Schematron schemas to semantic analyses, CT provides a full exam to XML data. CT allows only one of the tests, syntactic or semantic, but is the full test that guaranty data conformance. Using CT with standards as input for knowledge base (ex.: AP236), CT can help to certify XML data by international organizations of standards like ISO. [prototype]
16. [Flat linear induction motor to drive a robot for steel ships inspection](#). Prototype resulted from a national project (POSI/33994/SRI/2000, "Climber Robot" project) and was classified as good. This prototype was designed and constructed within the Superconducting Machines Group in 2003 and consists of a flat linear induction motor to drive a robot for steel ships inspection. [prototype]

17. [Superconducting flat linear synchronous linear motor](#). The high diamagnetism observed in HTS materials lead to applications involving levitation such as the linear synchronous motor (LSM). An all superconducting motor (without copper or iron elements), with BSCCO tapes in the armature and trapped-flux YBCO in the moving part, is being developed in the Group. [prototype]
18. [Disc electronic pole changing motor](#). This motor is of axial flux type and the control system is based on electronic pole changing. It has 24 windings, two semi-stators and an YBCO plate as rotor, for it behaves as a hysteresis disc motor. The prototype was recently constructed by the group (the patent is still pending). [prototype]

5.4.3. Demonstrator

1. [E-Procurement Document Exchange Tool](#). This tool permits the various stakeholders involved in the e-procurement scenario to exchange correspondent documents. It allows the edition and validation of the correspondent documents. It's integrated with an external conformance testing service that validates the correctness of the documents, both structurally and semantically. [demonstrator]
2. [SMART-grid eMarketplace](#). The prototype intends to present the potential behind enhanced management of re-sources in collaborative engineering environments on furniture industry by clustering manufacturer's resources. The prototype is based on an architecture that will enable manufacturers to share online services in a pool of resources managed by grid technology. This approach offers an added value to all the participants in two major vectors: first they can join efforts and services to provide major output that alone could never be possible and with that explore new business opportunities, once only reachable by big companies; secondly, all together can provide a front-end with homogenized business methods and services, rich in resources that will make possible an improved customer service. [demonstrator]
3. [EOKES - Earth Observation Domain Specific Knowledge Enabled Service](#). Information system with an ontology to provide EO Knowledge Enabled Services through powerful, customized, and adaptive search capabilities [demonstrator]
4. [CESADS - Centralised ESTRACK Status And Diagnostic System](#). Monitoring and diagnostic of health status of components involved in linking a satellite and the control centre (space link). [demonstrator]
5. [MODI - Simulation of Knowledge Enabled Monitoring and Diagnosis Tool for Mars Lander Payloads](#). Prototype for intelligent monitoring of the drill device for the ExoMars Rover also capable of recognizing Mars terrain hardness [demonstrator]

5.4.4. Product

1. [ISO 10303-236 "Application protocol: Furniture catalog and interior design"](#). The International Organization for Standardization (ISO) has been pushing forward the development of standards and models. Efforts like STEP, "Standard for the Exchange of Product model data", have tried to deal with integration and interoperability issues. The ISO 10303-236 standard defines a formalized structure for catalogue and product data under industrial domains of the furniture sector. The catalogue part of AP236 standard embraces: Product Decomposition: The management of each part of any product. Product Composition: The management of a set of pieces of furniture that makes a Composition, as a pre-defined offer in their catalogues. Documentation assignment: Allows the assignment of all kind of documentation, both digital and non-digital to any product in the catalogue. Properties and independent properties definition: Enabling to define all kind of properties such as material, dimensions, prices, etc. Technical and non-technical information relationship: the relationship between all kind of technical and non-technical information, e.g. commercial information or the period of time in which this information is valid. Multilanguage: the feature of the internalization of the product data information in such a way that the product data information could be retrieved in the selected language. AP236 also has the capability of managing CAD files and representations including the aspectual model characteristics without information loss. All the information related to the geometry could be defined in base of variable properties of associated parts. As an example: It is possible to define a relationship between the height, length and width in such way that when one value is modified, others will be modified proportionally as a result of the defined relationship rule. And finally, AP236 also comprises the capability of placing the CAD modelled pieces of furniture in a room space, thus enabling interior design projects. [product]
2. [Interoperability Training](#). The ATHENA Training Curriculum offers specialised training and aims to generate an extensive impact in the field of Interoperability for Enterprise Software and Applications. The objective is to facilitate students' understanding, the whys and hows of today's common problems at the application and business levels, which are directly or indirectly caused by interoperability difficulties. A further goal is to provide academia and industry with the necessary skills to develop research and

technical solutions for interoperability problems. The curriculum courses and its training programmes are designed to meet the specific interests of different participants' profiles. Each training programme has its own target audience, and students can choose from a variety of courses addressing different interoperability application areas, and levels of expertise. The curriculum addresses an international perspective, intending to soften the impact of international competition and growing globalisation, helping the organizations involved in all areas of global business.

<http://moodle.fct.unl.pt/course/view.php?id=1127> [product]

3. [FunStep reference ontology for furniture products classification](#). The funStep reference ontology it was built following an harmonization procedure. In a summary description the process was to make a furniture existing ontologies and taxonomies analysis in order to gather in a new ontology the best characteristics from the old ones. The harmonisation procedure was made in a total agreement of the involved experts and actors in the furniture area. The result it was an ontology with 512 classes for furniture products classification. [product]
4. [EICASLAB](#). EICASLAB is a professional software suite for automatic control design and forecasting – represents an innovative approach to the design of automatic controls. (<http://www.eicaslab.com>) The prototype of this tool has been developed in the scope of ACODUASIS project. <http://www.eicaslab.com> [product]
5. [Set of STEP Application and Implementation Models used in AP236 and other STEP Application Protocols](#). Set of modular components to be used as resources in the development of ISO 10303 Application Protocols. They are standards by themselves but are only to be used when integrated in the Application Protocols. The published modules are: - ISO 10303-1109 "Alternative_solution" - ISO 10303-1111 "Classification_with_attributes" - ISO 10303-1129 "External_properties" - ISO 10303-1349 "Incomplete_data_reference_mechanism" - ISO 10303-1350 "Inertia_characteristics" - ISO 10303-1345 "Item_definition_structure" - ISO 10303-1147 "Manufacturing_configuration_effectivity" - ISO 10303-1116 "Pdm_material_aspects" - ISO 10303-1344 "Numerical_interface" - ISO 10303-1115 "Part_collection" - ISO 10303-1103 "Product_class" - ISO 10303-1063 "Product_occurrence" - ISO 10303-1343 "Product_placement" - ISO 10303-1108 "Specification_based_configuration" - ISO 10303-1112 "Specification_control" - ISO 10303-1104 "Specified_product" - ISO 10303-1110 "Surface_conditions" - ISO 10303-1347 "Wireframe_2d" - ISO 10303-1143 "Building_component" - ISO 10303-1144 "Building_item" - ISO 10303-1145 "Building_structure" - ISO 10303-1146 "Location_in_building" - ISO 10303-1114 "Classification_assignment" - ISO 10303-1113 "Group" - ISO 10303-1342 "Expression" - ISO 10303-1341 "Generic_expression" - ISO 10303-1346 "Numeric_function" - ISO 10303-1133 "Single_part_representation" - ISO 10303-1351 "catalog_data_information" - ISO 10303-1352 "catalog_data_information_and_shape_representation" - ISO 10303-1353 "parameterized_catalog_data_information" - ISO 10303-1354 "furniture_interior_decoration" - ISO 10303-1355 "parameterized_catalog_data_and_shape_representation" - ISO 10303-436 "ap236_furniture_catalog_and_interior_design" [product]
6. [European Master Degree in Construction IT](#). A new postgraduate programme developed by a consortium of seven European universities supported by the Socrates Erasmus of the European Commission. The accepted degrees are Civil Engineering, Architecture, Built Environment and related disciplines with a duration of 2 years and 120 ECTS credit points. The curriculum consists of 12 taught units (subjects) and a dissertation element. The taught units have been developed and are delivered jointly by leading European experts in Construction IT. The courses will be taught through a combination of face-to-face teaching and Internet based distance learning teaching methods. <http://euromaster.itcedu.net/> [product]

5.5. Cooperation List

5.5.1. Worldwide-level Cooperation

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2. Ricardo Jardim-Gonçalves, Jianzhong Cha, Adolfo Steiger-Garção, eds. 2003. [Enhanced Interoperable Systems](#). Beijing Jiaotong University (China).

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Joint publications in International Scientific Periodicals @ Worldwide-level Cooperation

1. Manuela Vieira, A. Fantoni, P. Louro, M. Fernandes, J. Martins, R. Schwarz, G. Lavareda, C. N. Carvalho. 2006. [Colour filtering in a-SiC:H based p-i-n-p-i-n cells: A trade-off between bias polarity and absorption regions](#).
2. A. Fantoni, M. Fernandes, P. Louro, C. N. Carvalho, Manuela Vieira. 2006. [Photocurrent profile in a-SiC:H monolithic tandem photodiode](#).
3. A. Fantoni, M. Fernandes, P. Louro, Manuela Vieira. 2006. [a-SiC:H/a-Si:H tandem structure analysis for RGB color recognition in LSP devices](#).
4. M. Fernandes, Manuela Vieira, R. Martins. 2006. [The laser scanned photodiode: Theoretical and electrical models of the image sensor](#).
5. P. Louro, M. Fernandes, A. Fantoni, G. Lavareda, C. Nunes de Carvalho, R. Schwarz, Manuela Vieira. 2006. [An amorphous SiC/Si image photodetector with voltage-selectable spectral response](#).
6. P. Louro, M. Fernandes, A. Fantoni, Manuela Vieira. 2006. [Bias sensitive spectral sensitivity in double aa-SiC:H pin structures](#).
7. P. Louro, M. Fernandes, Manuela Vieira. 2006. [Thin film sensors produced at low temperatures: a trade-off between carbon composition and spectral response](#).
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9. E. Morgado, R. Schwarz, T. Braz, C. Casteleiro, A. Maçarico, Manuela Vieira, E. Alves. 2006. [Radiation-induced defects in a-Si:H by 1.5 MeV He⁴ particles studied by photoconductivity and photothermal deflection spectroscopy](#).
10. Manuela Vieira, A. Fantoni, P. Louro, M. Fernandes, G. Lavareda, C. N. Carvalho. 2006. [Light filtering in a-SiC:H multilayers stacked devices using the LSP technique](#).
11. Manuela Vieira, M. Fernandes, P. Louro, A. Fantoni, G. Lavareda, C. N. Carvalho, Yu Vygranenko. 2006. [A real time colour and image processing pin-pin device with optical readout](#).
12. Manuela Vieira, P. Louro, M. Fernandes, R. Schwarz. 2006. [Large area P-I-N flexible image sensitive devices deposited on plastic substrates](#).
13. Yu Vygranenko, P. Louro, Manuela Vieira, J. H. Chang, A. Nathan. 2006. [Low leakage current a-Si:H/a-SiC:H n-i-p photodiode with Cr/a-SiNx front contact](#).
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15. Manuela Vieira, M. Fernandes, P. Louro, C. Mendes, R. Schwarz, Yu Vigranenko. 2005. [Optical signal and image processing device optimized for optical readout](#).
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22. P. Louro, A. Fantoni, M. Fernandes, A. Maçarico, R. Schwarz, Manuela Vieira. 2004. [Optoelectronic characterization of a-Si:C-H stacked devices](#).
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29. Luís Camarinha-Matos, Hamideh Afsarmanesh, R. Rabelo. 2003. [Infrastructure developments for agile virtual enterprises](#). **UNINOVA, Univ. Amsterdam (Netherlands), Federal Univ. Santa Catarina (Brazil)**.
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