UNINOVA

Institute for the Development of New Technologies

CtS

Centre of Technology and Systems

Activity Report 2007-2010

INDEX

Centre of Technology and Systems

Research areas:

A - Microelectronics and telecommunications

B - Energy Efficiency, Industrial and Intelligent control and Decision Support Systems

C - Computer Engineering

Introduction

CTS pursues its progress of consistent scientific production and increase of PhDs critical mass (now beyond 50%). The main research domains have been maintained while the architecture of the research lines was slightly adjusted according to the evolution of former "hosted activities". The overall center strategy was tuned and major improvements made. CTS decided to strengthen its body of MSc and PhD students as an important tool to achieve better research results and visibility. Special attention paid to MSc theses reflects a more efficient way of attracting more students to follow our PhD program. At the same time, a publication reference model was created to categorize and privilege major journals and a limited number of conferences (ranked A & A+) in our research areas (externally refereed). Additionally, individual assessment of performance was improved based on a record of indicators (Publications A and A+, WoS, citations, PhD supervision, research project coordination/collaboration, prizes and patents). Some results are already visible as we attained more than 150 MSc theses concluded and have more than 80 registered PhD students.

Summarizing the evolution concerning 2003/06 and 2007/10 terms, we notice:

Publication in Journals (globally)   rose from 78 to 178 and Journals A & A from + 51 to 110 for; in Conferences rose from 388 to 484, in conferences A and A+ rose from 135 to 253; MSc theses rose from 34 to 152; PhD theses rose from 10 to 29 and PhD students from 32 to 80. Next term we expect 49 PhD theses to be concluded.

Meanwhile the PhD staff increased from 22 to 33 members (50% increase).

Hosted activities namely Telecommunications, Energy and Embedded Systems (ES) developed according to our expectations and some rearrangement (including Signal Processing) was made.

The research line on Microelectronics is now Microelectronics and Telecommunications, SP split and joined Telecommunications, ES merged with Microelectronics design.

A research line on Computer Engineering was reshaped, comprising former Intelligent Processing, Interoperability and Complex Systems and Collaborative Organizations. Finally Energy split from Microelectronics materials as an independent and successful

activity and together with Industrial Systems and Intelligent Control materialize the other research line.

Summarizing, we still have nine activities cooperating in agreement with natural developments and interdisciplinarian research needs. The major group or "critical mass" still is more concentrated on Microelectronics and Telecommunications (17 PhDs) and 9 and 8 PhDs on the other research lines. PhD students and finalized PhD theses are also distributed across the research lines according to the following numbers: Line A-(32; 12); Line B-(27;8); Line C-(21;9).

Finally, publications follow a similar pattern and comparing the former and present quadrennial the evolution in terms of publications Journals and communications in conferences rated A & A+ was, for the same three research lines: A (35 to 59; 47 to 102); B (6 to 12; 28 to 68);C (10 to 39; 60 to 83).

The following maps and graphics give an overall and analytical vision of the research line and group activity. With the exception of 3 items all the indicators for the global production display a rise superior to 100%, also coherent with A & A+ increment on quality.

Data & Graphics

	Global data		Global data by PhDs	
	2003-2006	2007-2010	2003-2006	2007-2010
Journals	78	178	3,7	5,4
Journals A/A+	51	110	2,4	3,4
Conferences	388	484	18,3	14,7
Conferences A/A+	135	253	6,4	7,7
MSc Theses	34	152	1,6	4,6
PhD Students	32	80	1,5	2,4
PhD Theses	10	29	0,5	0,9
Teams PhD	21	33		
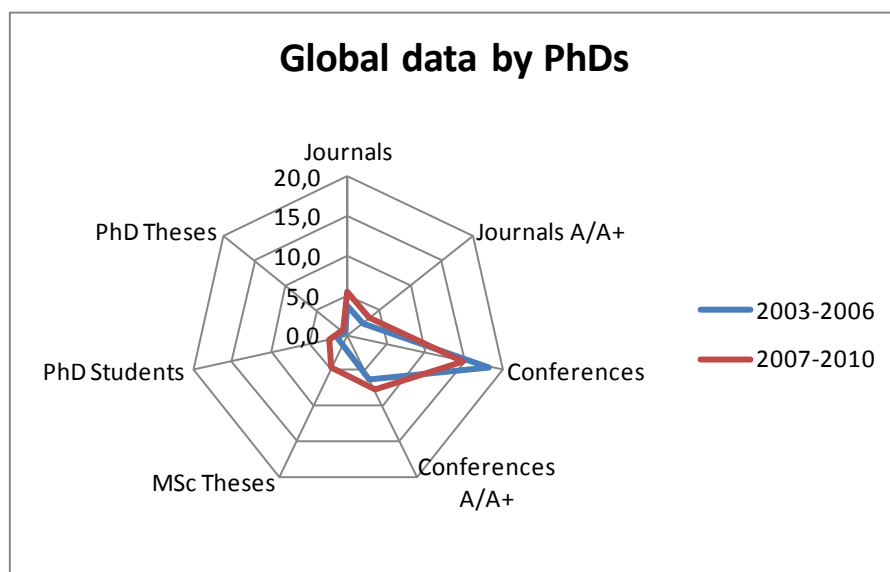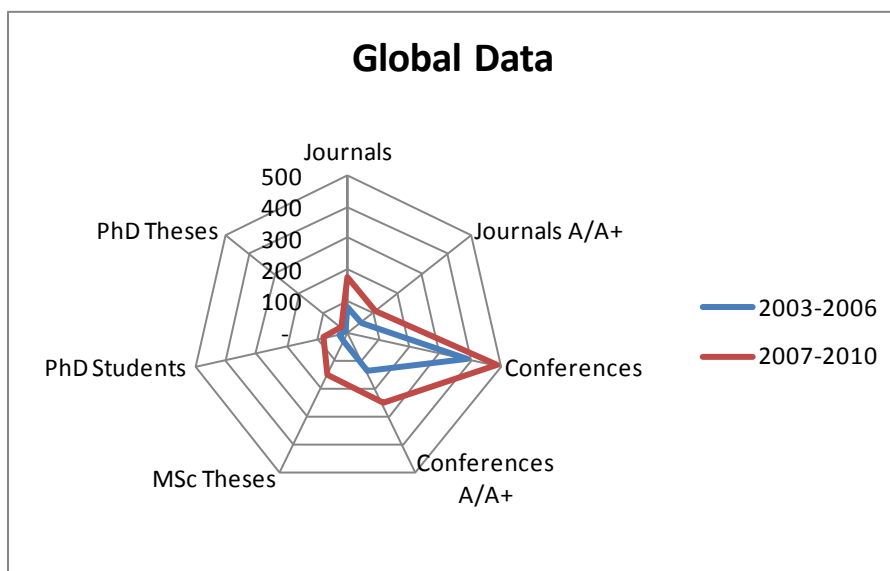
	Research Line A				Research Line B				Research Line C			
	Global data		Global data by PhDs		Global data		Global data by PhDs		Global data		Global data by PhDs	
	2003-2006	2007-2010	2003-2006	2007-2010	2003-2006	2007-2010	2003-2006	2007-2010	2003-2006	2007-2010	2003-2006	2007-2010
Journals	45	86	5,0	5,1	9	29	2,3	3,4	24	63	2,9	8,5
Journals A/A+	35	59	3,9	3,5	6	12	1,5	1,4	10	39	1,2	5,2
Conferences	132	199	14,7	11,9	124	143	31,0	16,6	132	142	16,0	19,1
Conferences A/A+	47	102	5,2	6,1	28	68	7,0	7,9	60	83	7,3	11,1
MSc Theses	11	71	1,2	4,2	13	49	3,3	5,7	10	32	1,2	4,3
PhD Students	13	32	1,4	1,9	7	27	1,8	3,1	12	21	1,5	2,8
PhD Theses	5	12	0,6	0,7	0	8	0,0	0,9	5	9	0,6	1,2
Teams PhD	9	16,75			4	8,63			8,25	7,45		

Additional comments: scientific productivity is not a linear function of number of PhD researchers but some dependency is expected to exist. For short terms, insertion of newcomers causes an important trade off and we also know how scientific results depend on the existence of PhD students. So it is wise to gradually increment or decrement the number of researchers, otherwise major over or under shoots can occur in scientific production.

The situation can become more cumbersome if researchers come from an environment where PhD programs are not allowed (Polytechnic Institutions), creating a larger dependency on universities (FCT/UNL) where those programs are quite usual. Such source of recruitment means that additional time will be needed to bring those researchers to the main stream of the Center productivity.

That was scenario within Microelectronics Materials and Processes, where a rise from 2 PhDs to 5,3 happened during the last term. Even with a massive increase of publications (still the CTS highest rate/PhD) and MSc theses it was impossible to compensate, in the short term, a more than 150% researchers rise. Still the figure of 5 PhD students could not be increased. So without surprise the detailed graphics illustrate that temporary situation. The full research line results, truly compensate this transient.

LINE A

- Microelectronics and Telecomunications –

Group A1.1: Microelectronics

Research Group Coordinator

- João Goes,   email: jg@uninova.pt

Doctoral Research Team (staff)

- João Goes, Associate Professor,   email: jg@uninova.pt
- Nuno Paulino, Assistant Professor,   email: nunop@uninova.pt
- Luís Bica de Oliveira, Assistant Professor,   email: l.oliveira@fct.unl.pt
- Luís Gomes, Associate Professor,   email: lugo@uninova.pt
- João Paulo Barros, Adjunt Professor at I. P. Beja,   email: jpb@uninova.pt
- Anikó Costa, Assistant Professor (Ph. D. in Nov. 2010), email: akc@uninova.pt
- Rui Santos-Tavares, Teaching Assistant (Ph. D. in Dec. 2010), email: rmt@uninova.pt
- João Pedro Oliveira, Teaching Assistant (Ph. D. in Dec. 2010) email: jpao@fct.unl.pt

PhD students

- Acácio Galhardo Baptista (Ph. D. in Nov. 2009),   galhardo@deea.isel.ipl.pt
- José Rui Custódio,   jrui.custodio@gmail.com
- Michael Figueiredo,   mf@uninova.pt
- Edinei Santin   e.santin@fct.unl.pt
- Rui Pais   ruipais@uninova.pt
- José Rocha   jose.rocha@estsetubal.ips.pt
- José Ribeiro   jribeiro@deea.isel.ipl.pt
- Filipe Moutinho   fcm@uninova.pt
- Blazej Nowacky   blazej.nowacki@gmail.com
- João Ferreira   jmferreira@netcabo.pt
- João Casaleiro   joao.casaleiro@cedet.isel.ipl.pt
- Carlos Carvalho   cfc@cedet.isel.ipl.pt
- Fernando Pereira   fjp@deea.isel.ipl.pt
- José Pedro Lucas   jose.lucas@estsetubal.ips.pt
- Rogério Rebelo (started in 2011)   rogeriorebelo@gmail.com

- Somayeh Abdollahvand (started in 2011)   s.abdollahvand@yahoo.com
- Ivan Iuri Bastos (started in 2011)   bastos356@gmail.com
- João Melo (started in 2011)   melo@fct.unl.pt

MSc students (scholar year 2009/2010)

- Blazej Nowacki
- Bruno Alexandre Simões Esperança
- Bruno Miguel Lopes
- Carlos Emanuel Martins Gimenez Dias
- Erik Thomas Snelling
- Hélio Alexandre Malão Martins
- Henrique Joao Alves Afonso Carvalho Ferreira Higino
- Pedro Miguel Xavier Faleiro
- Hugo Filipe Rocha Lopes

- Hugo Miguel Palma do Amaral
- Ivan Iuri Alves Bastos
- João António Sereno de Oliveira
- Joao Luis Alvernaz de Melo
- Joao Manuel Graça Ferreira
- João Nunes Águas
- Joao Pedro Gouveia Lourenço
- João Ricardo Pereira Valente Gustavo
- José Filipe Gonçalves
- José Henriques Patrício
- Marco Filipe Ribeiro Rodrigues
- Nuno Filipe Nogueira Penetra
- Paulo Luis Gonçalves Lima
- Pawel Pankiewicz
- Pedro Filipe Santos Faria
- Piotr Makosa
- Ricardo Filipe Pires Nunes
- Ricardo Wolffensperger Ferreira
- Rogério Alexandre Botelho Campos Rebelo
- Tiago Miguel Correia Reis
- Tomasz Michalak
  .

Summary

Four years have passed since our last evaluation by FCT/MCTES of our group (unit A1, Microelectronics-Design). We have been granted with the grade of "Very Good". Meanwhile, a wide range of activities in key technology areas have been carried out. Microelectronics Design is now one of the two merging driving forces of A1 unit (telecommunications is the second one) and it clearly represents now a gravity center of the envisage activities. In particular, during the 4-year (2007-2010) period, there was an excellent publication record.

An important achievement of the group was the growth in research staff, with the graduation (PhD) of five of the members, and the inclusion of many new PhD students (a total of 17 PhD students are registered by the end of 2010, that represents a growth of 425% when compared with the corresponding accumulated number at the end of 2006).

Some prospective work has also been developed has also been developed during 2009 and 2010 in order to establish future multidisciplinary projects and mature effective cross synergy among the involved groups. The new multidisciplinary areas which have been surfaced in the past year, and where significant joint efforts are expected to be developed in the years ahead include self-powered smart wireless sensors for biomedical applications.

Looking at the productivity indicators achieved it should be emphasized that, the 2007-2010 4-year period was excellent (especially when compared with the previous and similar 4-year of 2003-2006), as it can be observed in the graphic shown in Fig. 1 (and the Table below):

– the number of papers, normalized to the number of PhDs in the team and in high quality review journals (A and A+) has improved by over 2.4 times. An average record of 0.61 journal papers *per* Ph.D. and *per* year has been reached in 2009;

– the number of papers in A/A+ international conferences (most of them IEEE conferences and recognized by the ISI Web-of-knowledge) has increased from 14 to 25 papers. After normalizing it shows that the number of publications in A and A+ conferences has decreased slightly, since there most significant effort was put in increasing the number of papers in leading journals;

– the number of under-graduated students granted with a M. Sc. degree was boosted from 5 to 31 (the number of M. Sc. Theses when normalized to the number of researchers with PhD has increased by 275%) and the number of concluded Ph.D. theses was increased from 3 (in 2003-2006 period) to 5 (in 2007-2010 period).

For the next 4-year period (2011-2014) our main goal will be to maintain all previous indicators and improve some of them. In particular, our group will try at least, to increase further the journal papers *per* Ph.D. and *per* year from 0.61 to 0.8 (30% increase) and to double the number of completed Ph.D. Theses when comparing with the previous 4-year period.

Summary Figures

Table I: Productivity Data in the periods of 2003-2006 and 2007-2010.

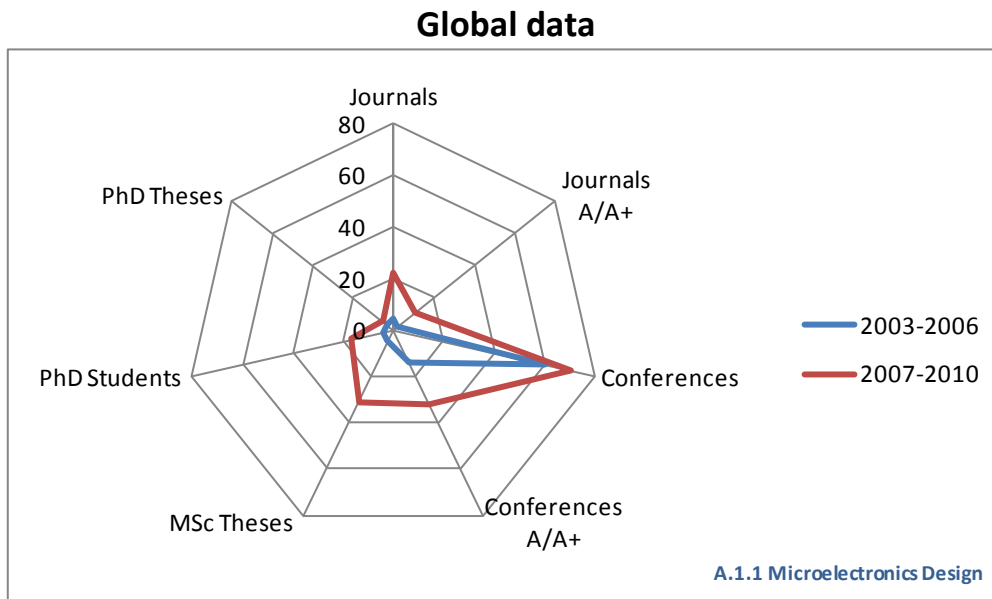|	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	4	22	2	4,89
Journals A/A+	2	11	1	2,44
Conferences	60	70	30	15,56
Conferences A/A+	14	32	7	7,11
MSc Theses	5	31	2,5	6,89
PhD Students	4	17	2	3,78
PhD Theses	3	5	1,5	1,11
Teams PhD	2	4,5		

Global data

Fig. 1 (a): Performance comparison of A1 unit in two 4-years periods (Global data, i.e., NOT normalized to the number of Ph. D. students).

Introduction

The Group of Microelectronics-Design was founded in 2000 by Dr. Steiger-Garção, full Professor at FCT/UNL, Dr. Manuel D. Ortigueira, Associate Professor at FCT/UNL, Dr. João Goes, a former Project Manager from Chipidea SA. (PT) and also an Associate Professor at FCT/UNL and M. Sc. Nuno Paulino (Ph. D. granted in Jan. 2008) a former Project Leader at Rockwell Semiconductor Inc. (USA) (also an Assistant Professor at FCT/UNL since 1999) and M. Sc. Rui Tavares, a former student at FCT/UNL in the area of Electrical and Computer Engineering (also a Research Trainee at FCT/UNL since 2000). This group was originally named as Microelectronics a Signal Processing Group (MESP) and its activities focused mainly in the data-converters, low-voltage and low-power analog and mixed-signal circuits, CAD-tools targeting optimization of analog and mixed-signal circuits and UWB signal-processing areas.

In parallel with these activities, Dr. Luis Gomes (PhD 1997, Associate Professor at FCT/UNL since 2008) has founded in late 90's the Reconfigurable and Embedded Systems Group (GRES) together with two of his former Ph. D. Students (Dr. João Paulo Barros, Adjunct Professor at I. P. Beja since 2006, and Dr. Anikó Costa, Assistant Professor at FCT/UNL since November 2010). This group was then integrated, in 2003, as a hosted activity of MESP group. The activities of the group were focused mainly in model-based development, where Petri nets play the central role, and reconfigurable computing platforms.

In 2007, the Signal-Processing group has been moved into the telecommunications sub-unit within the same research line (A1) and, consequently, Prof. M. D. Ortigueira together with Prof. Arnaldo Baptista have both joined this new unit. The MESP group was then re-baptised with the name of Microelectronics-Design (MD).

Also in 2007, Prof. Luis B. Oliveira (Ph. D. granted in Jan. 2007) and M. Sc. João P. Oliveira (Ph. D. granted in Dec. 2010) strongly enhanced the group in the area of RF CMOS circuits design and transceivers architectures (currently both are Assistant Professors at FCT/UNL).

Since 2003, three other researchers have been granted with a Ph. D. degree, namely Dr. Bruno Vaz (now with S3group), Dr. Guiomar Evans (an Assistant Professor at FC/UL) and Dr. Acácio Galhardo (an Assistant Professor at ISEL). Presently the MD group reaches its critical mass by having eight new Ph. D. Students as main collaborators namely, M. Sc. Michael Figueiredo, M. Sc. José Custódio, Eng. Edinei Santin, M. Sc. João Casaleiro, M. Sc. Carlos Carvalho, M. Sc. João Ferreira, M. Sc. Somayeh Abd., M. Sc. Blazej Nowacky, complemented by seven other Ph. D. Students from the GRES sub-group, namely, M. Sc. Rui Pais, M. Sc. José Rocha, M. Sc. José Ribeiro, M. Sc. Filipe Moutinho, M. Sc. Fernando Pereira, M. Sc. José Pedro Lucas and M. Sc. Rogério Rebelo.

The mission of the MD group is mainly (but not exclusively) focused on the design low-power SoC (analog, digital and mixed-signal) solutions in advanced CMOS and FPGA technologies oriented for the wireless/wireline communications, consumer-electronics and biomedical industries.

Research

The research objectives of MD group in the analog and mixed-signal design focuses on the design, simulation, fabrication and measurement of analog and radio-frequency integrated circuits in advanced IC technologies. Particular areas of interest are:

Video and base-band communications circuits:
- Nyquist-Rate ADCs, mostly Pipeline and Algorithmic ADCs (and current-steering DACs); Ph.D. Theses of Bruno Vaz (2004), João Oliveira (2010) and Michael Figueiredo (to be concluded in 2011).
- Built-in self-calibration (BISC) and BIST techniques for ADCs; Ph.D. Thesis of Edinei Santin (to be concluded in 2012);
- PLLs/DLLs using Self-Biased Circuitry and SC and Digital Decimation Filters; Ph.D. Thesis of Somayeh Abd. (to be concluded in 2014);
- Class-D Audio Amplifiers; Ph.D. Thesis of João Melo (to be concluded in 2014);

RF circuits:
- RF Quadrature oscillators (LC and RC topologies); Ph.D. Thesis of Joao Casaleiro (to be concluded in 2013);
- LNA/Mixers/IIR filters co-design; Ph.D. Thesis of José Custódio (to be concluded in 2011);
- UWB CMOS radar transceivers; Ph.D. Thesis of Nuno Paulino (2008);
- MOSFET-only circuits and noise cancellation techniques;
- Trans-impedance amplifiers (for optical communication); Ph.D. Thesis of Ivan Iuri Bastos (to be concluded in 2014);

CAD Tools:
- Analog Circuit Optimizers (hybrid equation-based/simulation-based for time-domain optimization of amplifiers); Ph.D. Thesis of Rui Tavares (2010);

Biomedical Circuits:
- Sigma-Delta ADCs for Biomedical applications; Ph.D. Thesis of José Custódio (to be concluded in 2011);
- Trans-impedance amplifiers (for medical imaging);
- MOSFET-only Low-IF (SC) integrated receiver solutions for WMTS: 608 - 614 MHz band; Ph.D. Thesis of José Custódio (to be concluded in 2011);

Other Circuits:
- DC-DC Power Converter for Solar Energy Harvesting Applications. Ph.D. Thesis of Carlos Carvalho (to be concluded in 2013);
- Analog Front-ends for Software Radios supporting 4G; Ph.D. Thesis of João Ferreira (to be concluded in 2013);

On the digital design side, the main objective of the GRES sub-group has been to contribute for the validation 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 composition of sub-models, partitioning into components, and automatic code generation, ready for deployment into specific implementation platforms (which means covering the whole development flow). This objective has been mainly pursued through participation in national and international projects and preparation of MSc and PhD thesis. Current main research topics include:

- Petri nets modeling issues emphasizing structuring mechanisms, model composability and model partitioning issues.
- Hardware-software co-design of embedded systems using Petri nets and other models of concurrency (namely hierarchical and concurrent finite state machines based formalisms).
- Distributed execution of models (using Petri nets and other models of concurrency), emphasis on GALS (Globally-Asynchronous-Locally-Synchronous) and NoCs (Network-on-Chip) paradigms.
- Reconfigurable computing platforms.
- Embedded systems design considering Model-Based Development techniques and Model-Driven Architecture as a reference.

Projects

Besides some EU funded projects comprising many partners, the MD group has periodically (annually) submitted scientific R&D project proposals to obtain funding mainly from the National Foundation for Science and Technology (FCT) of the Ministry of Science and Technology and Higher Education (MCTES). This funding allowed providing scholarships to research trainees and support all costs related with equipment acquisition, fabrication and evaluation of silicon prototypes. Table I presents a summary of all participation and coordination of the different projects within the period from 2001 to 2010 (last decade). Notice that, up to date, 95 % of the project proposals that have been submitted have been granted and funded reaching an average grade of "very-good" after rigorous evaluation by international panels of experts in the field of electronics and design of integrated circuits. Notice also that the accumulated budget exceeds 1 Million Euro.

Table I: Summary of all R&D projects within the period from 2003 to 2010 (8 years period). In white color is the 2007-2010 period.

Project Name and Involved Partners	Funding Entity	Amount of Funding (EURO)	Evaluation	Covered Period	Type of Participation
SAMBA (CTS-UNINOVA)	FCT/ MCTES	53000	Very Good	2002/05	Primary Investigator and Coordinator
S2A (ISEL/ CTS-UNINOVA)	FCT/ MCTES	~ 18000	Excellent	2002/05	Participant
Virtual Electro-LAB (CTS-UNINOVA)	European Union	54411	Approved	2002/04	Participant
SECA (CTS-UNINOVA /INESC)	FCT/ MCTES	~ 20000	Excellent	2003/06	Primary Investigator and Coordinator
SIPHASE (CTS-UNINOVA)	FCT/ MCTES	54000	Very Good	2005/08	Primary Investigator and Coordinator
LEADER (CTS-UNINOVA/INESC-ID)	FCT/ MCTES	44994	Very Good	2007/10	Primary Investigator and Coordinator
SPEED (IT/CTS-UNINOVA/INESC-ID)	FCT/ MCTES	61732	Very Good	2007/10	Participant
ESA (ESA/ACACIA Semi.)	ESA	> 550000	N. A.[1]	2007/09	Scientific Coordinator
CAPES/FCT (CTS-UNINOVA, UFRJ, Brazil)	FCT	> 10000	N. A.[1]	2009/10	Primary Investigator and Coordinator
CAPES/FCT (UNINOVA-CTS, UFCG, Brazil)	FCT	10000	N. A.[1]	2009/10	Coordinator of Portuguese participation
IMPACT (CTS-UNINOVA/INESC)	FCT/ MCTES	108101	Excellent (*rank #4/89*)	2009/12	Primary Investigator and Coordinator
FORDESIGN (CTS-UNINOVA)	FCT/ MCTES	90000	Very Good	2005/08	Coordinator
AMADEUS (CTS-UNINOVA/INESC, FEUP, Univ. Minho)	FCT/ MCTES	18200	N. A.[1]	2007/11	Participant

OPTO-ESTÉTICA (UNINOVA-CTS, B&M, Equip. Médicos Estéticos)	Industry funded	20000	N. A.[1]	2004/07	Scientific coordinator
Leonardo da Vinci – COMPLETE RO/04/B/F/PP–175016	European Union	64093	Approved	2005/07	Participant
MINERVA - IDENTITY 229930-CP-1-2006-1-RO-MINERVA-M	European Union	27960	Approved	2006/08	Participant
Leonardo da Vinci VET-TREND - RO/06/B/F/NT175014 –	European Union	51182	Approved	2006/08	Participant
RESTmonitoring 3738/2009 (Fatrónica, UNINOVA, ISEL)	IAPMEI	35520	N. A.[1]	2010/11	Participant

[1] – *Not Applicable or not subject to quantitative evaluation.*

Short abstracts and the main highlights of the most relevant R&D projects are given below in order to clarify their main scientific objectives.

SAMBA – POCTI/ESE/41804/2001 – Design and evaluation of a 0.9 V 200 uW 0.06mm^2 Sigma-Delta Modulator ($\Sigma\Delta$M) 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. Results published in IEEE ISSCC Conference (Feb. 06) and in IEEE TCAS-I (Dec. 05).

SECA – POCTI/ESE/47061/2002 – The main goal of this project was to demonstrate in silicon a new digital-domain self-calibration technique for video-rate ADCs. It consists on applying a Gaussian noise stimulus to 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 high-speed ADCs. An European Patent has been granted in 2006 under this subject (EP 1 473 836). This patent is a clear and successful demonstration of the efficient interdisciplinary cooperation between researchers from microelectronics and signal processing areas.

SIPHASE – POSI/EEA-ESE/61863/2004 –.A novel single-phase scheme to be used in switched-capacitor circuits was early 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 technique demonstrates that 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. Papers published in ISSCC'06 and in TCAS-I in Dec. 2005.

LEADER – PTDC/EEA-ELC/69791/2006 (on going) - A new mismatch-insensitive amplifier with an accurate gain of two and with compensated parasitic effects is proposed for silicon demonstration. The new circuit 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 TCAS – II in Jan. 2007.

ESA Project – AO/1-4686/04/NL/HE – High-Speed High-Resolution Radiation-Hardened ADC Technology. High-performance analogue-to-digital converters (ADC) are a critical

building block in a growing number of applications for interfacing real-world analogue signals with digital data. Moreover, emerging applications in the fields of communications, space, defence, physics experiments and medical imaging are setting new demands in terms of power dissipation, robustness, circuit area and costs, which are beyond the present capability of commercial discrete components and IP (intellectual property) solutions. This project consists in developing and implementing in silicon a new, radiation-hardened, high-speed high-resolution ADC technology that improves linearity, energy-efficiency, cost and reliability in these target applications.

IMPACT – PTDC/EEA-ELC/101421/2008 (on going) – (*Innovations in MOS Parametric Amplification Circuit Technology*): To demonstrate in integrated circuit and using a deep-submicron CMOS technology (e.g., 130 nm), the feasibility of a complex switched-capacitor circuit. As a silicon demonstrator, an 8-bit 120 MS/s interleaved pipeline ADC fully based on PA will be designed, fabricated, and experimentally evaluated. The targeted power-and-area figure-of-merit of the ADC should be better than 220 fJ*mm^2. To achieve low cost and low area, the circuit should be made with transistors only using a standard logic CMOS process (no analog options should be employed, such as MiM capacitors, low-VT devices, and resistors). A paper has been published in IEEE TCAS – II in Feb. 2010.

FORDESIGN – Formal methods for Embedded Systems Co-Design; May 2005- June 2008; Consortium: UNINOVA; Ref.: POSI/EIA/61364/2004 (http://www.uninova.pt/fordesign); A set of tools were 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 developed in this project and other computational tools already available. Overall, the project allowed an effective use of Petri nets as the system-level specification language within the co-design of embedded systems.

AMADEUS – Aspects and Compiler Optimizations for MATLAB System Development; December 2007 October 2011; Consortium: INESC ID, FEUP, Univ. Minho, UNINOVA, FFCT; Ref.: PTDC/EIA/70271/2006.

Leonardo da Vinci RO/04/B/F/PP–175016 – COMPLETE - "New Strategies of COMPetence Acquisition for Lifelong Learning in Energy – Transport - Environment Engineering"; January 2005 - December 2007; Consortium: Gent University, Belgium; Paris 7 – Denis Diderot University, França, Laboratorio delle Idee s.a.s., Italy; UNINOVA, Portugal; Transilvania University of Brasov, Romania (promoter & leader); ARCE-Brasov - Romania Agency for Energy Conservation, Romania; ASTEC-Bucuresti - TEMPUS Association for Continuing education, Romania; SC INAR SA - Road Vehicle Institut, Romania. Global budget: 511168 €; Local budget: 64093 €;

MINERVA 229930-CP-1-2006-1-RO-MINERVA-M – IDENTITY - "INDIVIDUALIZED LEARNING ENHANCED BY VIRTUAL REALITY"; October 2006 - September 2008; Consortium: Transilvania University of Brasov, Romania (promotor e leader), Noema-CMI Oy, Finland, The Technical University of Ilmenau, Germany, DIBE - University of Genoa, Italy, Laboratorio delle Idee, Italy, Universidade Nova de Lisboa, Portugal, SIEMENS PSE, Romania, Technical University of Kosice, Slovak Republic, The Swedish TelePed. Knowledge Centre, Sweden, EMMERCE EEIG, Sweden

(http://iesc.unitbv.ro/identity/). Global budget: 332 639 €; Local budget: 27 960 €; Maximum financed: 20970 €

Leonardo da Vinci 2006 RO/06/B/F/NT175014 – VET-TREND – "Valorisation of an Experiment-based Training System through a Transnational Educational Network Development"; 1 December 2006 - 30 November 2008; Consortium: Transilvania University of Brasov, Romania (promotor e 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 Prefessional da Indústria Electronica, Portugal, Universidade Nova de Lisboa, Portugal, PSE Siemens Romania SRL, Romania, Vision Systems SRL, Romania, The Swedish TelePed. Knowledge Centre, Sweden. Global budget: 579 484 €; Local budget: 51182 €; Maximum financed: 25591 €

Recognition

- Invited Talk by João Goes about "Digital-Domain *versus* Mixed-Signal Calibration Techniques in Pipeline ADCs" given at NORCHIP'10, Tampere, Finland, November 2010.

- Two "Outstanding Paper Awards" won at IEEE MIXDES'10 Conference in Poland. June 2010.

- Invited Seminar by João Goes about: "*Digitally Enhancing Dynamic Linearity in High-Resolution A/D Converters*" given at: The National Microelectronics Institute (NMI) (http://www.nmi.org.uk/), Dublin, Ireland. October 2009.

- "Outstanding Paper Award" won by "J. P. Oliveira, et al", entitled: "LNA, Oscillator and Mixer Co-Design for Compact RF-CMOS ISM Receivers" at IEEE MIXDES'09 Conference in Poland. June 2009.

- Invited Talk by Luís Gomes at Workshop sobre Laboratórios Virtuais e Remotos; 25 March 2009, Org. ISEP – I. P. Porto about "Remote and Virtual Laboratories"

- Vice President for Workshops and Small Conferences of the IEEE Industrial Electronics Society (Institute of Electrical and Electronics Engineers), Luís Gomes elected for 2007, 2008, 2009, and 2010 (yearly basis)

- Directive Board of IEEE Education Society Chapter – Portugal Section, Luís Gomes elected as member for 2009 a 2010

- (1st) Directive Board of SPEE - Sociedade Portuguesa de Ensino em Engenharia (Portuguese Society for Engineering Teaching), Luís Gomes elected as member for 2010, 2011

- Associate Editor of IEEE Transactions on Industrial Informatics, Luís Gomes served between 2005 and 2008

- Associate Editor of IEEE Transactions on Industrial Electronics, Luís Gomes served starting 2009.

- Editorial Board member of ToPNoC - Transactions on Petri Nets and Other Models of Concurrency; (LNCS), Springer, Luís Gomes served starting 2006.

Collaboration

Internationally:

1. TU-Denmark (joint Ph.D. Student since 2007 up to now and several joint publications with Prof. Erik Bruun)
2. TU-Delft, The Netherlands (several joint publications with Prof. C. Verhoeven)
3. University of Alberta, Canada (several joint publications with Prof. I. Filanovsky)
4. TU-Poznan (M. Sc. Theses, several scholarships, several joint publications and an "outstanding paper award" at MIXDES'09);
5. University Santa Maria, Brazil (2 research trainees exchange in 2008);
6. Federal University of Rio de Janeiro (UFRJ), Brazil (project and several joint publications under preparation for 2010 with Prof. A Petraglia, Prof. Baruqui and Prof. M. Petraglia);
7. EIT-ITH, Sweden, (joint publications with Prof. P. Andreani);
8. Universidade Federal de Campina Grande, Brazil (project and several joint publications during 2009, 2010, and 2011);
9. Transylvania University of Brasov, Romania (projects and several joint publications).

Nationally:

1. INESC – ID, Portugal: Analog and mixed-signal circuits group (several joint publications with Prof. Jorge Fernandes and Prof. M. Medeiros Silva).
2. Universidade do Minho, Braga, Portugal"; Co-Editor of the book "Actas das IV Jornadas sobre Sistemas Reconfiguráveis - REC'2008"; 7-8 February 2008; António Esteves, Luís Gomes (Eds.); ISBN 978-989-20-1041-0

Outreach

Acacia Semiconductor (www.acaciasemi.com) company was founded in September 2003 as a spin-off from CTS (before named CRI) Microelectronics R&D line from UNINOVA. Acacia Semiconductor was an analog intellectual property (IP) company designing low-power, high-performance analog CMOS solutions required in wireless and wireline communications, consumer imaging and video, portable instrumentation and medical imaging and biomedical devices. The company was acquired by Silicon and Software Systems LTD (S3) from Ireland in October 2007 (press release in: www.s3group.com).

Consultancy Agreements with Industry

Through a Protocol established between FCT/UNL and Silicon and Software Systems, since Nov. 2007 and up to date, Prof. João Goes and Prof. Nuno Paulino accumulate their Lecturer work at DEE/FCT/UNL with part-time (regular) consultancy work at Silicon and Software Systems LTD (S3).

Highlights of achievements during the 2003 – 2006 period:

1. A 10b 50MS/s Time-interleaved Pipeline CMOS ADC : First silicon-proved time-interleaved pipeline ADC employing low-voltage techniques; 2.5 times more energy-efficient than any other low-voltage implementation and 7 times more energy-efficient than any other time-interleaved ADC. (VLSI'04) (PhD Thesis of Bruno Vaz).

2. A low-voltage, low-power analog CMOS Gaussian Noise Generators for on-chip BISC and BIST of ADCs: When compared with the state of the art, these GNGs dissipate 1/10 of the power for enhanced performance. (EP 1 473 836) (PhD Thesis of Guiomar Evans).

3. A second-order 83dB DR SC SD Modulator operating at 0.9V, dissipating 200 uW with an area of 0.06mm2: World's first SC circuit driven by overlapping-phases (single-phase technique). (ISSCC'06, TCAS-II, Dec. 2005).

4. An UWB RADAR transceiver for "measurement/imaging" applications: World's first UWB RADAR transceiver fully integrated in a standard CMOS technology (180nm). (Springer book in 2008 and PhD Thesis of Nuno Paulino).

Highlights of achievements during the 2007 – 2010 period:

1. ADOPT (EDA-Tool): The analog circuit design is traditionally undertaken following a bottom-up approach that makes extensive use of human resources, technical expertise and computing power. This methodology has the following disadvantages: 1) the process design is inherently time consuming, 2) involves a series of manual adjustments, and subject to repetitive error, 3) require user fees tool very expensive, such as electrical simulators (e.g. HSPICE or SPECTRE),

4) knowledge of the project performed by experienced engineers is not captured efficiently for later use, 5) entire process must be repeated from scratch when carrying out the "retargeting" analog circuits for a technology or a set of different specifications. The answer to the problems described above, was development of a project tool analog circuits (ADOPT) capable of accelerating its scaling by an order of magnitude and increases the probability of obtaining "first-silicon-right". The ADOPT kernel uses a tool developed in C and based on genetic algorithms to improve sizing accuracy, the optimization process based on analytical equations for simplified and can be calibrated in real time, through an automatic link to a simulator electrical "open source " (NG SPICE). This tool has undergone an evolution and improvement permanent during the last decade with contributions different researchers, including Prof. Nuno Paulino (2000), Dr. Bruno Vaz (2004) and Prof. Rui Tavares (2010).

2. A 13b 40MS/s self-calibrated pipelined ADC (S3/ESA/CTS-A1 Project) employing an histogram-based calibration technique using on-chip thermal noise is fabricated in a 90nm CMOS logic process. The ADC occupies less than 0.9mm2 and consumes only 38 mW at 1.2V supply. After calibration, SFDR is improved by over 14 dB and THD is improved by over 10 dB, (submitted for publication in Dec. 2010).

3. A MOSFET-Only 1.2V 8-bit 120MS/s Time-Interleaved CMOS Pipeline ADC Fully Based on MOS Parametric Amplification (TCAS-II, Feb. 2010). (PhD Thesis of João Pedro Oliveira)

4. A Wideband (3 - 10 GHz) Quadrature RC Oscillator with the best Figure of Merit in RC class of oscillators (to appear in J. of Circuit Theory and Applications, 2010).

5. A 1.2 V <156 uW 92 dB DR second-order multi-bit SDM using non-linear DACs for Hearing-Aid applications (full performance already measured; Paper submitted to IEEE JSSC, and PhD Thesis of José Custódio);

6. A 1.2 V 7-bit 640 MS/s, 15 mW, 5.4-bit ENOB 2-channel pipeline ADC based on a mismatch-insensitive MDAC (new MDAC type II) and on self-biased amplifiers and quantizers (Paper submitted to IEEE VLSI'11 and PhD Thesis of Michael Figueiredo);

7. Design of a ultra-low-power SDM (2nd. order) using novel quasi-passive integrators operating with ultra-incomplete settling (Chip fully functional; Paper submitted to IEEE VLSI'11 and PhD Thesis of Blazej Nowacky);

8. A 1.2 V Receiver for Biomedical Communications (WMTS: 608 - 614 MHz) using a new self-biased LNA and a new passive SC Mixer-IIR filter topology employing parametric amplification (taped-out in Nov. 2010 and PhD Thesis of José Custódio);

9. New Mixed-Signal techniques for BIST of medium-resolution I&Q ADCs and for BISC of high-resolution (>=12b) multi-channel interleaved ADCs using an RC-

Oscillator (theoretical work being done; to be demonstrated in silicon in 2011; paper to appear in TCAS-I, May 2011 and PhD Thesis of Edinei Santin).

10. The development of an integrated framework based on low-level Petri nets for supporting embedded systems design using hardware-software co-design techniques emphasizing reconfigurable platforms as implementation platforms. The set of develop tools is being used as a proof-of-concept and integrates tools such as graphical editor, operations on nets namely composition through net addition and splitting of models, automatic code generators for C and VHDL, configurator tool for generation of implementation code to be deployed into specific platforms, animator tools allowing generation of controllers integrating graphical user interfaces running in general purpose PCs as well as FPGA-based specific platform. Support for Network-on-Chip (NoC) solutions as well for Globally-Asynchronous Locally-Synchronous (GALS) systems has been integrated. The novelty of the framework is the capability to automatically generate implementation code to be deployed in the final platform from initial Petri net model, where the implementation platform can accommodate centralized or distributed execution of the model.

11. The group sustained presence within the Petri nets community, where the PhD members have been serving several times as program committee members for the "main" Petri nets conference and/or for several workshops sponsored by the Petri nets community, Program Co-Chair for ACSD'2010, as well being involved in preparation of IEC/ISO standard on Petri nets representation; Dr. João Paulo Barros and Rui Pais were also members of the Organizing Committee for the Petri Nets 2010 and ACSD 2010 conferences that took place in Braga, Portugal, in June 21-25 (http://acsd-petrinets2010.di.uminho.pt).

12. The group sustained presence within the Industrial Electronics Society of the IEEE, where Luís Gomes served in several committees of events (including General Co-Chair, Program Co-Chair, Special Session Co-Chair, among others), four times elected for one-year period as Vice-President for Workshops, and invited to serve as Associate Editor and Guest Co-Editor for three Special Sections for IEEE Transactions on Industrial Electronics, as well as Associate Editor for IEEE Transactions on Industrial Informatics..

Education & Training

Concluded Ph. D Theses (period 2003-2010):

Bruno Vaz, 2004.
João Paulo Barros, 2006.
Guiomar Evans, 2006.
Luis Oliveira, 2007.
Nuno Paulino, 2008.
Acácio Baptista, 2009.
Anikó Costa, 2010.
Rui Tavares, 2010.
João Pedro Oliveira, 2010.

On-going Ph. D Theses (to be concluded and defended):

José Custódio, in 2011.
Michael Figueiredo, in 2011.
Edinei Santin, in 2012.
Rui Pais, in 2012.
José Rocha, in 2012.
José Ribeiro, in 2012.
Filipe Moutinho, in 2012.
Blazej, Nowacky, in 2013.
Joao Ferreira, in 2013.
João Casaleiro, in 2013.
Carlos Carvalho, in 2013.
Fernando Pereira, 2013.
José Pedro Lucas, 2013.
Rogério Rebelo, 2013.
Somayeh Abd., in 2014.
Ivan Iuri Bastos, in 2014.
João Melo, in 2014.

Concluded M. Sc. degrees:

Over 32 M. Sc. degrees have successfully been concluded since 2001.

Facilities

The IC prototypes required for validation of the novel techniques and new circuits proposed by the MD group are fabricated in the scope of the agreement between the Faculdade de Ciências e Tecnologia (FCT) from Universidade Nova de Lisboa, the UMC foundry, and the IMEC Institute, in the scope of the European program EUROPRACTICE (FCT is a member #A12310 since 1998), providing the access for the advanced CMOS, BiCMOS and SiGe technologies (130nm, 90nm and 65nm).

Researchers use a full set of industrial grade design tools for our IC designs. This includes tools suites from Cadence and other EDA Vendors. Designers use PC desktops running Linux as well as servers running SunOS and Linux.

In order to support this research project the resources of the microelectronics and signal processing group laboratory at CTS-UNINOVA (FCT/UNL) will be used. This laboratory was partially funded by several National FCT/MCTES projects and comprised the most advanced testing equipments either for baseband or for RF chips evaluation. Our instruments allow a full characterization in the frequency domain and time domain.

Strategy

1. Develop the activities and increase the productivity always improving quality and merge all the knowledge and different expertise from all the four sub research-areas of group A1 targeting the design of complete SoC solutions;
2. Intensify international and interdisciplinary cooperation;
3. Encourage all staff and Ph. D. students to disseminate their research results priory in journals with major 5-Years impact factors (e.g. IEEE *JSSC*, *T-CAS* I and II, *T-CAD*, *Electronics Letters, T-IE*) and in leading international conferences (e.g. *ISSCC*, *CICC*, *VLSI*, *ESSCIRC*, *DAC*, *DATE*);
4. Submit, on a regular basis (every year), silicon results to ISSCC, VLSI and to JSSC. This aim has been already achieved since 2004;
5. Using the trilogy composed by Theory, Tools, and Practical Use as the leitmotif for continuing research on model-based development (emphasizing Petri nets) of distributed embedded system using co-design techniques and reconfigurable computing platforms.

Production

Concluded Ph. D. Theses (2007 – 2010):

1. Anikó Katalin Horváth da Costa, PhD Thesis; FCT-UNL, "Petri net model decomposition – A model based approach supporting distributed execution", FCT/UNL, Monte da Caparica, Nov. 2010.

2. João Pedro de Abreu Oliveira, "Parametric Analog Signal Amplification applied to Nanoscale CMOS Wireless Digital Transceivers", FCT/UNL, Monte da Caparica, Dec. 2010.

3. Rui Manuel Leitão Santos Tavares, "Time-domain optimization of CMOS amplifiers based on Distributed Genetic Algorithms", FCT/UNL, Monte da Caparica, Dec. 2010.

4. Acácio João Galhardo Baptista, *Advanced Techniques for the Design and Implementation of Switched-Capacitor Circuits in Deep-submicron CMOS Technologies*", FCT/UNL, Monte da Caparica, Oct. 2009.

5. Nuno Filipe Silva Veríssimo Paulino, "Low Power UWB CMOS Radar Sensors", FCT/UNL, Monte da Caparica, Jan. 2008.

Books and Book Chapters:

1. Luís Gomes, João M. Fernandes (Eds.); "Behavioral Modeling for Embedded Systems and Technologies: Applications for Design and Implementation"; Publisher: IGI Global; ISBN: 978-1-60566-750-8; 449 pgs., July 2009.

2. Nuno Paulino, João Goes, Adolfo Steiger Garção, "Low Power UWB CMOS Radar Sensors", Springer, ISBN 978-1-4020-8409-6, 2008.

3. João Goes, "VLSI Circuits for Biomedical Applications", (Chapter 14 about ADCs for Biomedical Circuits), ISBN 13:978-1-59693-317-0, Artech House, INC., 2008.

4. Luis B. Oliveira, et. al., "Analysis and Design of Quadrature Oscillators", Springer, ISBN 978-1402085154, 2008.

5. "Teaching, Learning, and Remote Laboratories"; Luís Gomes, Fernando Coito, Anikó Costa, Luís Brito Palma; in "Advances on remote laboratories and e-learning experiences"; Luis Gomes, Javier Garcia-Zubia (Eds.); Publisher: University of Deusto, Bilbao; ISBN 978-84-9830-077-2; pp. 189-204; June 2007.

Journal Papers:

2010:

1. Ricardo Gama, Antonio Galhardo, João Goes, Nuno Paulino, Rui Neves, Nuno Horta, "Design of a Low-power, Open Loop, Multiply-by-two Amplifier with Gain-accuracy Improved by Local-feedback", *International Journal of Microelectronics and Computer Science*, Mar. 2010.

2. M. Figueiredo, J. Goes, L. B. Oliveira, A. Steiger-Garção, "Low-Voltage Low-Power Fully-Differential Self-biased 1.5-bit Quantizer with Built-in Thresholds", *International Journal of Circuit Theory and Applications* da *Wiley Interscience*, May 2010 (on-line). **A/A+**

3. J. Oliveira, J. Goes, M. Figueiredo, et. al., "An 8-bit 120 MS/s Interleaved CMOS Pipeline ADC Based on MOS Parametric Amplification", *IEEE Transactions on Circuits and Systems – II*, pp. 105-109, Feb. 2010. **A/A+**

4. Oliveira, Luís B. and Snelling, Erik and Fernandes, J. and Silva, Manuel M., "An Inductorless CMOS Quadrature Oscillator Continuously Tunable from 3.1 to 10.6 GHz*.",* *International Journal on Circuit Theory and Applications*, Wiley InterScience. (In Press), 2010. **A/A+**

5. L. B. Oliveira, A. Allam, I. M. Filanovsky, J. Fernandes, C. J. M. Verhoeven, and Manuel Silva, "Experimental Comparison of Phase Noise in Cross-Coupled RC- and LC-Oscillators", *International Journal on Circuit Theory and Applications*, *Wiley InterScience*, vol. 38, nº 7, pp. 681 – 688, Sep. 2010. **A/A+**

6. V. Silva, J. R. Fernandes, L. B. Oliveira, H. C. Neto, R. Ferreira, S. Freitas, P. P. Freitas "Thermal Assisted Switching Magnetic Tunnel Junctions as FPGA Memory Elements", *International Journal of Microelectronics and Computer Science*, vol. 1, nº 1, 2010.

7. I. Bastos, L. B. Oliveira, J. Goes, and M. N. Silva, "MOSFET-only Wideband LNA with Noise Cancelling and Gain Optimization", *International Journal of Microelectronics and Computer Science*, vol. 1, nº3, pp. 241 – 248, 2010.

8. João Casaleiro, Hugo F. Lopes, L. B. Oliveira, and I. M. Filanovsky "CMOS Coupled Multivibrators for WMTS Applications", *International Journal of Microelectronics and Computer Science*, vol. 1, nº3, pp. 249 – 255, 2010.

9. "Rapid Prototyping of Graphical User Interfaces for Petri Net-Based Controllers"; Luís Gomes, João Lourenço; *IEEE Transactions on Industrial Electronics*, Vol. 57, no. 5, May 2010; pp. 1806 – 1813, ISSN: 0278-0046, DOI 10.1109/TIE.2009.2031188. **A/A+**

10. "Current Trends in Industrial Electronics Education"; Juan J. Rodriguez-Andina, Luís Gomes, Seta Bogosyan; *IEEE Transactions on Industrial Electronics*, Vol. 57, no. 10, October 2010; pp. 3245-3252; ISSN: 0278-0046, DOI 10.1109/TIE.2010.2057235. **A/A+**

11. Melo, Joao; Paulino, Nuno; , "A 3rd order 1.5-bit continuous-time (CT) Sigma-Delta (ΣΔ) modulator optimized for Class D audio power amplifier," *International Journal of Microelectronics and Computer Science*, vol. 1, nº3, 2010.

2009:

12. A. Galhardo, J. Goes and N. Paulino, "Design of Improved Rail-to-Rail Low Distortion and Low-Stress Switches in Advanced CMOS Technologies", *Analog Integrated Circuits and Signal Processing Journal*, Springer, 2009.

13. L. B. Oliveira, A. Allam, I. M. Filanovsky, J. Fernandes, C. J. M. Verhoeven, and Manuel Silva, "Experimental Comparison of Phase Noise in Cross-Coupled RC- and LC-Oscillators", accepted for publication, International Journal on Circuit Theory and Applications, Wiley InterScience, published online April 2009. **A/A+**

14. J. P. Oliveira, J. Ferreira, I. Bastos, L. B. Oliveira, T. Michalak, P. Pankiewicz, B. Nowacki, P. Makosa, and A. Rybarczyk, "LNA, Oscillator and Mixer Co-Design Strategy Approach for RF-CMOS", Electronics and Telecommunications Quartely, vol. 55, nº 4, pp.37-51, 2009. (Invited Paper).

15. Igor M. Filanovsky, Luis B. Oliveira, and Jorge Fernandes, "Wide Tuning Range Quadrature VCO Using Coupled Multivibrators", Electronics and Telecommunications Quartely, vol. 55, nº 4, pp. 53-68, 2009. (Invited Paper).

16. "Checking Semantics Equivalence of MDA Transformations in Concurrent Systems"; Paulo Barbosa, Franklin Ramalho, Jorge Figueiredo, Antônio Junior, Anikó Costa, Luís Gomes; Journal of Universal Computer Science, vol. 15, no. 11 (2009), pp. 2196-2224. **C**

17. "Current Trends in Remote Laboratories"; Luís Gomes, Seta Bogosyan; *IEEE Transactions on Industrial Electronics*, Vol. 56, no. 12, December 2009; pp. 4744-4756; DOI 10.1109/TIE.2009.2033293. **A/A+**

2008:

18. Fernandes, J.R.; Goncalves, H.B.; Oliveira, L.B.; Silva, M.M.; "A Pulse Generator for UWB-IR Based on a Relaxation Oscillator", *IEEE Trans. on Circuits and Systems II*, pp. 239-243, March 2008. **A/A+**

19. Filanovsky, I. M.; Oliveira, et. al., "Switching Time in Relaxation Oscillations of Emitter-Coupled Multivibrators", *IEEE Trans. on Circuits and Systems II*, pp. 892-896, Sep. 2008. **A/A+**

20. Oliveira, L. and van den Bos, Chris and Fernandes, Jorge R. and Verhoeven, Chris J. M. and Silva, Manuel M., "A 5 GHz quadrature relaxation oscillator with mixing for improved testability or compact front-end implementation" , *International Journal of Circuit Theory and Applications*, 2008. **A/A+**

2007:

21. "On the Use of Programming Languages for Textual Specification of Petri Net Models"; João Paulo Barros, Luís Gomes; Petri Net Newsletter 73 (Newsletter of the Special Interest Group on Petri Nets and Related System Models); pp. 11-25, ISSN 0931-1084, October 2007.

22. J. Fernandes, M. Kouwenhoven, C. van den Bos, L. B. Oliveira, C. J. M. Verhoeven, "The Effect of Mismatches and Delay on the Quadrature Error of a Cross-Coupled Relaxation Oscillator", IEEE Transactions on Circuits and Systems I – Regular Papers, vol. 54, pp. 2592-2598, December 2007. **A/A+**

Conference Papers:

2010:

1. J. R. Custódio, L. B. Oliveira, J. Goes, Erik Bruun, Erik Bruun, "A Small-Area Self-Biased Wideband CMOS Balun LNA with Noise Cancelling and Gain Enhancement", NORCHIP 2010, Tampere, Finland, Nov. 2010. **A/A+**

2. J. Goes, N. Paulino, M. Figueiredo, E. Santin, M. Rodrigues, P. Faria, B. Vaz, R. Monteiro, "Purely-Digital *versus* Mixed-Signal Self-Calibration Techniques in High-Resolution Pipeline ADCs", NORCHIP 2010, Tampere, Finland, Nov. 2010. **A/A+**

3. E. Santin, M. Figueiredo, R. Tavares, J. Goes, L. B. Oliveira, "Fast-Settling Low-Power Two-Stage Self-Biased CMOS Amplifier Using Feedforward-Regulated Cascode Devices", *IEEE International Conference on Electronics Circuits and Systems*, Greece, Dez. 2010.

4. Ivan Bastos, Luis B. Oliveira, João Goes, "MOSFET-Only Wideband LNA with Noise Cancelling and Gain Optimization", *IEEE 16th. International Conference on Mixed Design of Integrated Circuits and Systems*, Poland, Jun. 2010.

5. Bruno Lopes, Nuno Paulino, João Goes, A. Steiger-Garção, "Digitally Programmable Delay-Locked-Loop with Variable Charge Pump Current", *IEEE 16th. International Conference on Mixed Design of Integrated Circuits and Systems*, Poland, Jun. 2010.

6. M. Figueiredo, E. Santin, J. Goes, R. Santos-Tavares, G. Evans, "Two-Stage Fully-Differential Inverter-based Self-Biased CMOS Amplifier with High Efficiency"*, IEEE International Symposium on Circuits and Systems*, pp. 2828-2831, France, May 2010. **A/A+**

7. E. Santin, L. B. Oliveira, B. Nowacki, J. Goes, "Fully Integrated and Reconfigurable Architecture for Coherent Self-Testing of IQ ADCs"*, IEEE International Symposium on Circuits and Systems*, pp. 1927-1930, France, May 2010. **A/A+**

8. J. R. Custódio, J. Oliveira, L. B. Oliveira, J. Goes, E. Bruun, "MOSFET-Only Mixer/IIR Filter with Gain using Parametric Amplification"*, IEEE International Symposium on Circuits and Systems*, pp. 1209-1212, France, May 2010. **A/A+**

9. J. R. Custódio, M. Figueiredo, E. Santin, J. Goes, "A CMOS Inverter-Based Self-Biased Fully Differential Amplifier", Doctoral Conference on Computing, Electrical and Industrial Systems, DoCEIS 2010, Portugal, Feb. 2010.

10. Melo, Joao; Paulino, Nuno; , "A 3rd order 1.5-bit continuous-time (CT) Sigma-Delta (ΣΔ) modulator optimized for Class D audio power amplifier," Mixed Design of Integrated Circuits and Systems (MIXDES), 2010 Proceedings of the 17th International Conference, vol., no., pp.531-535, 24-26 June 2010.

11. Carvalho, Carlos; Paulino, Nuno; , "A MOSFET only, step-up DC-DC micro power converter, for solar energy harvesting applications," *Mixed Design of Integrated Circuits and Systems (MIXDES), 2010 Proceedings of the 17th International Conference* , vol., no., pp.499-504, 24-26 June 2010.

12. Casaleiro, J., Lopes, H., Oliveira, Luís B., Filanovsky, I. M., "CMOS Coupled Multivibrators for WMTS Applications", IEEE International Conference on Mixed Design of Integrated Circuits and Systems, Poland, 24-26 June 2010.

13. Anikó Costa, Paulo Barbosa, Luís Gomes, Franklin Ramalho, Jorge Figueiredo, Antônio Junior; "Properties preservation in distributed execution of Petri nets models"; DoCEIS'10 – Doctoral Conference on Computing, Electrical and Industrial Systems; Caparica, Lisbon, Portugal; February 22-24, 2010;

14. Paulo Barbosa, Franklin Ramalho, Jorge Figueiredo, Anikó Costa, Luís Gomes, Antônio Junior; "Semantic Equations for Formal Models in the Model-Driven Architecture"; DoCEIS'10 – Doctoral Conference on Computing, Electrical and Industrial Systems; Caparica, Lisbon, Portugal; February 22-24, 2010;

15. André Jorge, João Guerreiro, Pedro Pereira, João Martins, Luís Gomes; "Energy Consumption Monitoring System for Large Complexes"; DoCEIS'10 – Doctoral Conference on Computing, Electrical and Industrial Systems; Caparica, Lisbon, Portugal; February 22-24, 2010;

16. Luís Gomes, Rogério Rebelo, João Paulo Barros, Anikó Costa, Rui Pais; "From Petri net models to C implementation of digital controllers"; ISIE'2010 - IEEE International Symposium on Industrial Electronics; Bari, Italy; 4-7 July 2010. **A/A+**

17. Paulo E. S. Barbosa, Anikó Costa, Luís Gomes, Franklin Ramalho, Jorge C. A. de Figueiredo, Antonio Junior; "A MDA-based contribution for integrating web services within embedded system's design"; INDIN'2010 - 8th IEEE International Conference on Industrial Informatics, 13-16 July 2010; Osaka, Japan. **A/A+**

18. Ricardo J. Machado, João M. Fernandes, João P. Barros, Luís Gomes; "Scenario-based Modeling in Industrial Information Systems"; DIPES'2010 - IFIP Conference on

Distributed and Parallel Embedded Systems; September 20th - 23rd, 2010, Brisbane, Australia, 2010.

19. Filipe Moutinho, Luis Gomes, Franklin Ramalho, Jorge Figueiredo, João Paulo Barros, Paulo Barbosa, Rui Pais, Anikó Costa; "Ecore Representation for Extending PNML for Input-Output Place-Transition Nets"; IECON'2010 - 36th Annual Conference of the IEEE Industrial Electronics Society, November 7-10, 2010; Glendale, AZ, USA. **A/A+**

20. Ricardo Ferreira, Anikó Costa, Luís Gomes; "Interligação intra- e inter-circuito de componentes especificados com Redes de Petri"; REC'2010 – VI Jornadas sobre Sistemas Reconfiguráveis; 4-5 Fevereiro 2010, IEETA, Universidade de Aveiro, Aveiro, Portugal.

2009:

21. M. Figueiredo, T. Michalak, J. Goes, L. Gomes, P. Sniatala, "Improved Clock-Phase Generator based on Self-biased CMOS Logic for Time-Interleaved SC circuits", *IEEE International Conference on Electronics, Circuits and Systems*, Tunisia, Dec. 2009.

22. R. Gama, A. Galhardo, J. Goes, N. Paulino, R. Neves, N. Horta, "Design of a Low-power, Open Loop, Multiply-by-two Amplifier with Gain-accuracy Improved by Local-feedback", *IEEE 16th. International Conference on Mixed Design of Integrated Circuits and Systems*, Lodz, Poland, Jun. 2009.

23. Miguel Martins, L. B. Oliveira and Jorge Fernandes, Combined LNA and Mixer Circuits for 2.4 GHz ISM Band, *IEEE Int. Symp. Circuits and Systems (ISCAS'09)*, May 2009. **A/A+**

24. V. Silva, J. Fernandes, L. B. Oliveira, H. Neto, R. Ferreira, S. Freitas, P. Freitas, "Thermal Assisted Switching Magnetic Tunnel Junctions as FPGA Memory Elements", *16th International Conference on Mixed Design of Integrated Circuits and Systems (MIXDES'09)*, pp. 332-336, June 2009.

25. J. Ferreira, I. Bastos, L. B. Oliveira, J. Oliveira, T. Michalak, P. Pankiewicz, P. Makoza, B. Nowacki and A. Rybarczyk, "LNA, Oscillator, and Mixer, Co-Design for Compact RF-CMOS ISM Receivers, *16th International Conference on Mixed Design of Integrated Circuits and Systems (MIXDES'09)*, pp. 291-295, June 2009.

26. Igor Filanovsky, L. B. Oliveira, Jorge Fernandes, "Wide Tuning Range Quadrature VCO Using Coupled Multivibrators", *16th International Conference on Mixed Design of Integrated Circuits and Systems (MIXDES'09)*, pp. 341-344, June 2009.

27. Victor Silva, L. B. Oliveira, Jorge R. Fernandes, Mário P. Véstias, Horácio C. Neto, "Run-Time Reconfigurable Array using Magnetic RAM", *12th EUROMICRO Conference on Digital System Design (DSD 2009)*, August 2009.

28. M. Medeiros Silva, Carlos M. Leitão, L. B. Oliveira, "Noise Performance of Transimpedance Amplifiers for Radiation Detectors", *Design of Circuits and Integrated Systems (DCIS'09)*, November 2009.

29. J. F. Martins, V. Fernão Pires, Luís Gomes, O. Páscoa Dias; "Plug-in electric vehicles integration with renewable energy building facility – building/vehicle interface POWERENG'09 – 2nd International Conference on Power Engineering, Energy and Electrical Drives, Lisbon, Portugal; 18-20 March 2009; DOI 10.1109/POWERENG.2009.4915258.

30. Gustavo Patrício, Luís Gomes; "Smart House monitoring and actuating system development using automatic code generation"; INDIN'2009 - 7th IEEE International Conference on Industrial Informatics, 24-26 June 2009, Cardiff, UK; DOI 10.1109/INDIN.2009.5195813. **A/A+**

31. Anikó Costa, Luís Gomes; "Petri net partitioning using net splitting operation"; INDIN'2009 - 7th IEEE International Conference on Industrial Informatics, 24-26 June 2009, Cardiff, UK; DOI 10.1109/INDIN.2009.5195804. **A/A+**

32. Filipe Moutinho, Luís Gomes; "From Models to Controllers Integrating Graphical Animation in FPGA through Automatic Code Generation"; ISIE-2009 – 2009 IEEE International Symposium on Industrial Electronics, Seoul, Korea, 5-8 July 2009; DOI 10.1109/ISIE.2009.5218315. **A/A+**

33. Arkadiusz Bukowiec, Luís Gomes; "Partitioning of Mealy Finite State Machines"; DESDes'09 – 4th IFAC Workshop on Discrete-Event System Design; Gandia, Beach, Valencia, Spain; 6-8 October 2009.

34. Luís Gomes, Gustavo Patrício, Ricardo Ferreira, Anikó Costa; "Remote experimentation for introductory digital logic course"; ICELIE'2009 – 3rd IEEE International Conference on e-Learning in Industrial Electronics; Alfandega Congress Center, Porto, Portugal; 3-5 November, 2009; ISBN: 978-1-4244-4654-4; DOI: 10.1109/ICELIE.2009.5413204.

35. Gheorghe Scutaru, Elena Cocorada, Luis Gomes, Anna Marina Scapolla, Massimo Mustica, Mariela Pavalache, Dominic Kristaly, Sorin Cocorada; "Enhanced Individualized Learning Environment's Impact on the Learning Process"; ICELIE'2009 – 3rd IEEE International Conference on e-Learning in Industrial Electronics; Alfandega Congress Center, Porto, Portugal; 3-5 November, 2009; ISBN: 978-1-4244-4654-4; DOI: 10.1109/ICELIE.2009.5413212.

36. Márcio Ngolo, Luis Brito Palma, Fernando Coito, Luís Gomes, Anikó Costa; "Architecture for Remote Laboratories based on REST Web Services"; ICELIE'2009 – 3rd IEEE International Conference on e-Learning in Industrial Electronics; Alfandega Congress Center, Porto, Portugal; 3-5 November, 2009; ISBN: 978-1-4244-4654-4; DOI: 10.1109/ICELIE.2009.5413216.

37. Luís Gomes, João Paulo Barros; "PNML Based Composition in Non-autonomous Petri Net Models"; IECON'2009 – 35th Annual Conference of the IEEE Industrial

Electronics Society; Alfandega Congress Center, Porto, Portugal; 3-5 November, 2009; ISBN: 978-1-4244-4649-0; ISSN: 1553-572X; DOI: 10.1109/IECON.2009.5414908. **A/A+**

38. Paulo Barbosa, Anikó Costa, Jorge Figueiredo, Frankilin Ramalho, Luís Gomes, Antônio Junior; "Modeling Complex Petri Nets Operations in the Model-Driven Architecture"; IECON'2009 – 35th Annual Conference of the IEEE Industrial Electronics Society; Alfandega Congress Center, Porto, Portugal; 3-5 November, 2009 ISBN: 978-1-4244-4649-0; ISSN: 1553-572X; DOI: 10.1109/IECON.2009.5414909. **A/A+**

39. Filipe Moutinho, Luís Gomes; "Geração Automática de Controladores em FPGA Integrando Animação Gráfica"; REC'2009 – V Jornadas sobre Sistemas Reconfiguráveis; 5-6 Fevereiro 2009, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, Monte de Caparica, Portugal

40. João Oliveira, Anikó Costa, Luís Gomes; "Configurador de plataformas específicas em Co-design de Sistemas Embutidos"; REC'2009 – V Jornadas sobre Sistemas Reconfiguráveis; 5-6 Fevereiro 2009, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, Monte de Caparica, Portugal

2008:

41. Esperanca, B.; et. al., "Power-and-area efficient 14-bit 1.5 MS/s two-stage algorithmic ADC based on a mismatch-insensitive MDAC", *IEEE ISCAS'08*, 2008. **A/A+**

42. Figueiredo, M.; et. al., "New simple digital self-calibration technique for pipeline ADCs using the internal thermal noise", *IEEE ISCAS'08*, pp. 232 – 235, 2008. **A/A+**

43. Galhardo, A.; et. al., "Low-power 6-bit 1-GS/s two-channel pipeline ADC with open-loop amplification using amplifiers with local-feedback", *IEEE ISCAS'08*, 2008. **A/A+**

44. Paulino, et. al., "A CMOS variable width short-pulse generator circuit for UWB RADAR applications", *IEEE ISCAS'08*, 2008. **A/A+**

45. Santos-Tavares, et. al.,"Optimization of multi-stage amplifiers in deep-submicron CMOS using a distributed/parallel genetic algorithm", *IEEE ISCAS'08*, 2008. **A/A+**

46. J. R. Custódio, et. al., "Multi-Bit Sigma-Delta Modulators with Enhanced Dynamic-Range using Non-Linear DAC for Hearing Aids", IEEE ICECS'08. 2008.

47. J.P. Oliveira, et. al., "New Low-Power 1.5-bit Time-Interleaved MDAC based on MOS Capacitor Amplification", IEEE ICECS'08, 2008.

48. B. Vaz, et. al., "Design and Testing of a Radiation Hardened 13-bit 80 MS/s Pipeline ADC Implemented in a 90nm Standard CMOS Process", 2nd. AMICSA, 2008.

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50. Oliveira, L.B.; et. al., "Synchronization of two LC- oscillators using capacitive coupling", *IEEE ISCAS'08*, 2008. **A/A+**

51. Luís Gomes, Anikó Costa, João Paulo Barros, Paulo Lima; Redes de Petri e geração de código VHDL"; REC'2008 – IV Jornadas sobre Sistemas Reconfiguráveis; 7-8 Fevereiro 2008, Universidade do Minho, Braga, Portugal

52. L. Gomes, J. Lourenço "Petri nets-based automatic generation GUI tools for embedded systems"; Conference on Human System Interaction, 2008.

53. L. Gomes, A. Costa, "Co-design techniques within digital system design curricula"; 7th European Workshop on Microelectronics Education, 2008.

54. J. Lourenço, L. Gomes, "Animated Graphical User Interface Generator Framework for Input-Output Place-Transition Petri Net Models", 29th Int. Conf. on Application and Theory of Petri Nets, 2008. **A/A+**

55. G. Martins, M. Barata, L. Gomes, "Low Cost Method to Reproduce Sound with FPGA"; ISIE'2008 - IEEE Int. Symp. on Industrial Electronics, 2008. **A/A+**

56. Fernando Coito, Luís Gomes, Anikó Costa, Luís Brito Palma; "The Use of Remote Laboratory Activities within the Learning Process"; CONTROLO'2008; 8th Portuguese Conference on Automatic Control; UTAD, Vila Real, Portugal, July 21-23, 2008

57. A. Costa, L. Gomes, J.P. Barros, J. Oliveira, T. Reis, "Petri nets tools framework supporting FPGA-based controller implementations", IECON'2008 - 34th Conf. of the IEEE Industrial Electronics Society, 2008. **A/A+**

2007:

58. J. P. Oliveira, J. Goes, B. Esperança, N. Paulino and J. Fernandes, "Low-Power CMOS Comparator with Embedded Amplification for Ultra-high-speed ADCs", *IEEE International Symposium on Circuits and Systems*, New Orleans, USA, pp. 3602-3605, May 2007. **A/A+**

59. Galhardo, A.; Goes, J.; Paulino, N.;, "Design of Improved Rail-to-Rail Low-Distortion and Low-Stress Switches in Advanced CMOS Technologies", *14th IEEE International Conference on Electronics, Circuits and Systems*, pp. 218 – 221, Morocco, Dec. 2007.

60. Oliveira, J. P.; Goes, J.; Paulino, N.; Fernandes, J., "Improved Low-Power Low-Voltage CMOS Comparator for 4-Bit Flash ADCS for UWB Applications**"**, *14th International Conference on Mixed Design of Integrated Circuits and Systems*, pp. 293 – 296, Poland, Jun. 2007.

61. Luís Gomes, Anikó Costa; "Partição de redes de Petri integrada em metodologia de co-design de sistemas embutidos"; REC'2007 – III Jornadas sobre Sistemas Reconfiguráveis; 8-9 Fevereiro 2007, Instituto Superior Técnico, Lisboa, Portugal.

62. Luís Gomes, João Paulo Barros, Anikó Costa; "Petri Nets Tools and Embedded Systems Design"; PNSE'07 - International Workshop on Petri Nets and Software Engineering, Siedlce, Poland, June 25-26, 2007.

63. João Paulo Barros, Luís Gomes; "Towards a Human-Usable Textual Language for Petri Nets"; Workshop on Petri Net Standards 2007; 26 June 2007, Siedlce, Poland.

64. Luis Gomes, Fernando Coito, Anikó Costa, Luis Brito Palma, Paulo Almeida; "Remote Laboratories support within Teaching and Learning Activities"; REV'2007 - International Conference on Remote Engineering and Virtual Instrumentation; 25-27 June 2007, University of Porto (FEUP), Portugal.

65. Anikó Costa, Luís Gomes; "Module Composition within Petri Nets Model-based Development"; SIES'2007 – 2nd IEEE International Symposium on Industrial Embedded Systems; 4-6 July 2007; Hotel Costa da Caparica, Lisbon, Portugal. **B**

66. Anikó Costa, Luís Gomes; "Petri net Splitting Operation within Embedded Systems Co-design"; INDIN'2007 - 5th IEEE International Conference on Industrial Informatics, 23-26 Julho 2007, Vienna, Austria. **A/A+**

67. Luís Gomes, João Paulo Barros, Anikó Costa, Ricardo Nunes; "The Input-Output Place-Transition Petri Net Class and Associated Tools"; INDIN'2007 - 5th IEEE International Conference on Industrial Informatics, 23-26 Jul. 2007, Vienna, Austria. **A/A+**

68. Luís Gomes, Anikó Costa, João Paulo Barros, Rui Pais, Tiago Rodrigues, Richard Ferreira; "Petri Net based Building Automation and Monitoring System"; INDIN'2007 - 5th IEEE International Conference on Industrial Informatics, 23-26 Jul. 2007, Vienna, Austria. **A/A+**

69. Ricardo Nunes, Luís Gomes, João Paulo Barros; "A Graphical Editor for the Input-Output Place-Transition Petri Net Class"; ETFA'2007 - 12th IEEE Conference on Emerging Technologies and Factory Automation, September 25-28, 2007; Patras, Greece.

70. Luís Gomes, Anikó Costa, João Paulo Barros, Paulo Lima; "From Petri net models to VHDL implementation of digital controllers"; IECON'2007 - The 33rd Annual Conference of the IEEE Industrial Electronics Society, November 5-8, 2007, The Grand Hotel, Taipei, Taiwan.

Awards:

1. Lopes, Bruno and Paulino, Nuno and Goes, João and Steiger-Garção, Adolfo (2010) *Outstanding Paper Award for the paper entitled "Digitally Programmable Delay-Locked-Loop with Variable Charge Pump current".* [Award].

2. Casaleiro, Joao and Lopes, Hugo and Oliveira, Luís B. and Filanovsky, Igor (2010) *CMOS Coupled Multivibrators for WMTS Applications.* [Award].

3. Ferreira, J. and Bastos, I. and Oliveira, Luís B. and Oliveira, J.P. and Michalak, T. and Pankiewicz, P. and Makosa, P. and Nowacki, B. and Rybarczyk, A. (2009) *Outstanding Paper Award: LNA, Oscillator, and Mixer, Co-Design for Compact RF-CMOS ISM Receivers.* [Award].

4. Certificate of Excellence given to "E. Santin" for the paper entitled: "Fast-Settling Low-Power Two-Stage Self-Biased CMOS Amplifier Using Feedforward-Regulated Cascode Devices" at the *IEEE International Conference on Electronics, Circuits and Systems*, Greece, Dez. 2010.

GROUP A.1.2: Microelectronics Materials And Process

Research Group Coordinator

- Manuela Vieira,　　　　email: mv@isel.ipl.pt

Doctoral Research Team (staff)

- Manuela Vieira, Professora coordenadora c/ agregação mv@isel.ipl.pt
- Alessandro Fantoni, Professor coordenador,　　　　afantoni@deetc.isel.ipl.pt
- Manuel Barata, Professor coordenador　　　　mmb@isel.ipl.pt
- Paula Louro Antunes, Professora adjunta,　　　　plouro@deetc.isel.ipl.pt
- Yuriy Vygranenko, Investigador,　　　　yvygranenko@deetc.isel.ipl.pt
- Guilherme Lavareda, Professor Auxiliar,　　　　gal@fct.unl.pt
- João Costa, Professor adjunto　　　　jcosta@deetc.isel.ipl.pt
- Miguel Fernandes, Professor adjunto　　　　mfernandes@deetc.isel.ipl.pt

PhD Members

PhD students (staff)

- Filipe Maçarico　　　　afmacarico@deetc.isel.ipl.pt
- João Martins　　　　jfmartins@deetc.isel.ipl.pt
- Manuel Vieira　　　　mvieira@deetc.isel.ipl.pt
- Vitor Fialho　　　　vfialho@deetc.isel.ipl.pt

PhD students

- João Paulo Machado Mendes

Collaborators (with a small percentage of their time)

MSc students (scholar year 2009/2010)

- Nuno Neves
- Susana Amaral
- Gonçalo Pacheco

Summary

For the last years the group developed considerable experience in materials and semiconductors, namely on optoelectronics transducers and micro/micro electronics. The main developments were done in semiconductors materials, optoelectronics, micro electronics and energy conversion. Sixteen research projects were successfully accomplished and two additional ones are presently going on. Five more were submitted to the FCT for funding. Three PhD thesis were developed and four are currently going on. The publication record refers to 160 articles in journals (SCI or Index to Scientific & Technical Proceedings), 70 publications in peered conferences (Proceedings) and 200 publications in International Congresses (Abstracts) and Seminars and finally 40 in national journals and conferences.

Summary Tables

	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	33	28	16,5	5,3
Journals A/A+	27	27	13,5	5,1
Conferences	50	30	25,0	5,7
Conferences A/A+	27	28	13,5	5,3
MSc Theses	3	11	1,5	2,1
PhD Students	5	5	2,5	1,0
PhD Theses	2	3	1,0	0,6
Teams PhD	2	5,3		

Global data

A.1.2 Materials and Process
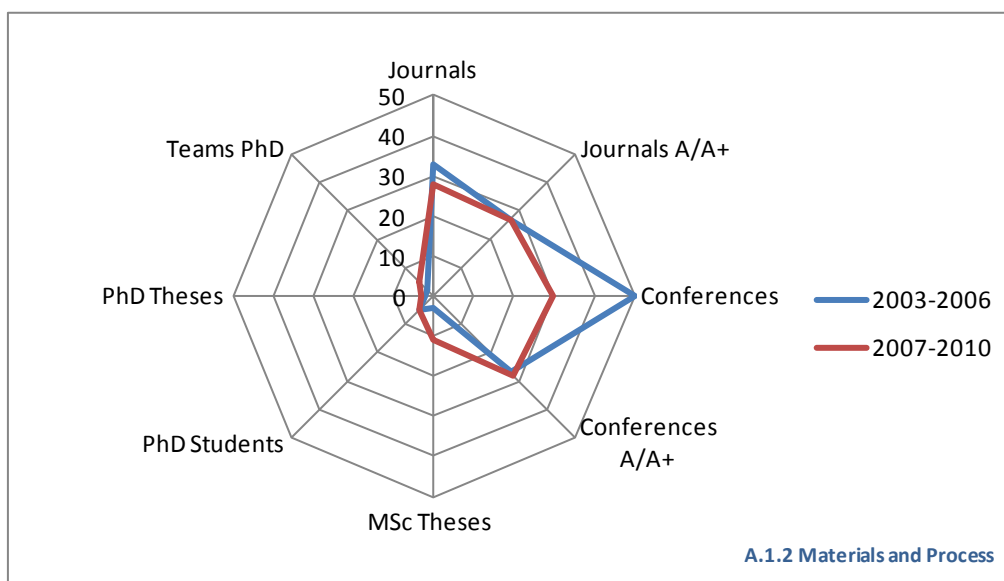
Introduction

The M^{2}P 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 8 PhD thesis.

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

Research

Our research focuses on the following topics:

- Development of a monochromatic large area image sensor using an optically addressed readout technique (LSP).

- Optimisation of a large area image sensor using an optically addressed readout technique for the acquisition of colour images.

- Large area a-SiC:H tandem optical sensors.

- Development of a monochromatic large area image sensor using an optically addressed readout technique (LSP).

- Optimisation of a large area image sensor using an optically addressed readout technique for the acquisition of colour images.

- Large area a-SiC:H tandem optical sensors.

- Large area X-ray detector based on the use of the LSP technique.

- Development of an optical tester to evaluate the diffuse and specular reflectivity of paper used in peage tickets.

- Development of wavelength division multiplexing devices in the visible spectrum for short range communications.

- Development of biosensors for FRET detection

- Modelling and simulation of BioFETs

Projects

Participação em projectos de I&D já concluídos e a decorrer

Projectos financiados pela FCT - Fundação para a Ciência e Tecnologia:

- **LAXOR - Detectores de raios X de grande área com leitura óptica**
Ref.: POCI/CTM/56078/2004
Instituição coordenadora: Instituto Superior de Engenharia de Lisboa
Instituições participantes: ISEL, IST, ESTSLFCUL, ISEL, INETI.
Investigador responsável: Manuela Vieira
Duração: 2004-2007

- **Transporte electrónico e dinâmica magnética em sistemas magnéticos de baixa dimensionalidade e em nano-estruturas**
Ref.: PTDC/FIS/70843/2006
Instituição coordenadora: Instituto Superior Técnico
Instituições participantes: IST-UTL, ISEL, Un. Évora, CFIF/IST/UTL.
Investigador responsável: Vitalii Dugaev
Duração: 2006-2010

- **Um novo processo para células solares de baixo custo (SDS)/SDS silicon ribbons: a new path lo low cost photovoltaics**
Ref.: PTDC/FIS/70843/2006
Instituição coordenadora: Faculdade de Ciências – Universidade de Lisboa
Instituições participantes: INETI, ISEL, CFMC/UL
Investigador responsável: António Vallera
Duração: 2006-2010

- **Desenvolvimento de um biossensor baseado no sistema de ISFET para doseamento de amidas tóxicas**
Ref.: PTDC/AGRAAM/73460/2006
Instituição coordenadora: Instituto Superior de Engenharia de Lisboa
Instituições participantes: Univ. Évora, Centro de Investigação de Engenharia Biotecnológica (CIEB/ISEL/IPL)
Investigador responsável: Amin Karmali
Duração: 2006-2010

- **Detector de raios-X plano para aplicações em medicina (MARx) X-Ray flat-panel detector for Medical Applications (MARx)**
Ref.: PTDC/EEA-ELC/115577/2009
Instituição coordenadora: Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL)
Instituições participantes: Instituto Superior de Engenharia de Lisboa
Investigador responsável: Luis Miguel Tavares Fernandes
Duração: 2010-2013

- **Biossensor de Glucose baseado em FRET (OBIOS) Optical Biosensor based on FRET (OBIOS)**
  Ref.: PTDC/EEA-ELC/111854/2009
  Instituição coordenadora: Instituto Superior de Engenharia de Lisboa
  Instituições participantes: Instituto de Desenvolvimento de Novas Tecnologias (UNINOVA/FCT/UNL)
  Investigador responsável: Maria Manuela de Almeida Carvalho Vieira
  Duração: 2010-2013

Projectos financiados pelo Instituto Politécnico de Lisboa (IPL)
- **ASCA 2D - Software de Simulação Numérica de Dispositivos de Películas Finas Semicondutoras para aplicações na Opto e Microelectrónica**
  Ref.: IPL/46/2003
  Instituição coordenadora: Instituto Superior de Engenharia de Lisboa.
  Instituições participantes: ISEL.
  Investigador responsável: Alessandro Fantoni.
  Duração: 2006-2008.
- **CLSP - Sensores de cor e imagem com endereçamento e leitura óptica**
  Ref.: IPL/5847/2004.
  Instituição coordenadora: Instituto Superior de Engenharia de Lisboa.
  Instituições participantes: ISEL.
  Investigador responsável: Manuela Vieira.
  Duração: 2006-2008.
- **DRX2D - Detector digital de raios X para radiografia digital**
  Ref.: IPL/5820/2004.
  Instituição coordenadora: Instituto Superior de Engenharia de Lisboa.
  Instituições participantes: ISEL.
  Investigador responsável: Manuela Vieira.
  Duração: 2006-2008.

Recognition

Invited talk by Maria Manuela Vieira about: "Reviewing Photo-sensing Devices Using a-Si Based Materials" given at the MRS Spring Meeting Conference 2010, San Francisco, USA, April 2010.

Invitation to write/edit a book about the topic of "Photo-sensing Devices Using a-Si Based Materials" by the Pan Stanford Publishing.

Invitation to write a chapter for the book "Advances in Photodiodes" InTech - Open Access Publisher InTech. The chapter "Three transducers embedded into one single SiC photodetector" LSP direct image sensor, optical amplifier and demux", by M. Vieira, P. Louro, M. A. Vieira, J. Costa, M. Fernandes is in print.

Invitation to write a chapter for the book "Advances in Photodiodes" InTech - Open Access Publisher InTech. The chapter "Use of a-SiC:H photodiodes in optical communications applications", by P. Louro, M. Vieira, M. A. Vieira, M. Fernandes, J. Costa, A. Fantoni is in print.

Best paper student award to the manuscript "Monolithic a-SiC:H architectures as tunable optical filters for spectral analysis", by M. Vieira, P. Louro, M. A. Vieira, J. Costa, M. Fernandes, Y. Vygranenko, M. Barata, presented at The First International Conference on Sensor Device Technologies and Applications, SENSORDEVICES 2010, July 18 - 25, 2010 - Venice/Mestre, Italy.

Collaboration

International

- University of Waterloo – GigatoNanoElectronics group
  Production of semiconductor devices.
  Characterisation of materials and devices.
  Joint publications (2006-2010)

National

- Universidade Técnica de Lisboa – Instituto Superior Técnico
  Production of semiconductor devices.
  Characterisation of materials and devices.
  Joint publications (2001-2010)

Outreach

Organisation of the JETC 2008 (Fourth Workshop in Electronics, Telecommunications, and Computer Engineering (http://www.cc.isel.ipl.pt/JETC08/) that took place in ISEL, Lisbon, November 2008.

Organisation of the 10º Encontro da Associação Portuguesa de Engenharia de Áudio, APEA - Secção Portuguesa da Audio Engineering Society, AES , that took place in ISEL, Lisbon, December 2008

Organisation of the 7th Ibero-American Conference on Sensors, IBERSENSORS 2010 (http://portugal2010.ibersensor.org/index.html), 9-11 November 2010, ISEL-Lisbon 2010, Portugal.

Education & Training

Post-Doc

Scientific coordinator of Yuriy Vygranenko (FCT fellowship BPD/20264/2004).

Concluded PhDs

- **Paula Maria Garcia Louro Antunes**
  "Colour and Image sensors with addressed optical readout"
  Doutoramento em: Engª Electrotécnica
  Especialidade: Electrónica.
  Grau Concedido por: Universidade Nova de Lisboa
  Orientadores: Adolfo Steiger Garção e Maria Manuela Vieira
  Provas concluídas em: Outubro de 2007

- **João Barrigana Costa**
  Tema da dissertação: "Infinitesimal and combinatorial rigidity approaches for coarse-graining"
  João Barrigana Costa
  Doutoramento em: *Biofísica*
  Grau Concedido por: *Imperial College, London, UK*
  Orientadores: *M. Barahona, S. Yalirak*
  Provas concluídas em: Junho de 2008

- **Luís Miguel Tavares Fernandes**
  Tema da dissertação: "Sensores de imagem de grande área em tecnologia de silício amorfo"
  Doutoramento em: Engª Materias
  Grau Concedido por: Universidade Nova de Lisboa,
  Especialidade: Microelectrónica e Optoelectrónica
  Orientadores: Rodrigo Martins e Maria Manuela Vieira
  Provas concluídas em: Abril de 2009

On-going PhDs

- **Manuel Augusto Vieira**
  Tema da dissertação: "Three transducers for One Photodetector: essays for optical communications"
  Doutoramento em: Engª Electrotécnica
  Grau Concedido por: Universidade Nova de Lisboa
  Orientadores: Adolfo Steiger Garção e Paula Louro Antunes
  Previsão de conclusão de provas: 2013

- **João Paulo Machado Mendes**
  Tema da dissertação: "Hybrid Pulsed Power Modulator for Biomedical Applications"

Doutoramento em: Engª Electrotécnica
Grau Concedido por: Universidade Nova de Lisboa
Orientadores: Maria Manuela Vieira e Luís Redondo
Previsão de conclusão de provas: 2013

- **João Martins**
  Tema da dissertação
  Doutoramento em: Engª Electrotécnica
  Grau Concedido por: Universidade Nova de Lisboa
  Orientadores: Mário Véstias e Maria Manuela Vieira
  Previsão de conclusão de provas: 2013

- **Vitor Manuel de Oliveira Fialho**
  Tema da dissertação: "Oscillator phase noise study, prediction and shaping, optimized for wireless communications"
  Doutoramento em: Engª Electrotécnica
  Grau Concedido por: Universidade Nova de Lisboa
  Orientadores: Fernando Fortes e Maria Manuela Vieira
  Previsão de conclusão de provas: 2013

- **António Filipe Ruas da Trindade Maçarico**
  Tema da dissertação: "O balanço energético do planeta terra através da medição do seu albedo"
  Doutoramento em: Física
  Grau Concedido por: Universidade de Lisboa, Universidade Técnica de Lisboa, Universidade Nova de Lisboa
  Orientadores: Filipe Duarte Santos
  Previsão de conclusão de provas: 2013

Concluded MsSc

- **Cátia Francisco**
  Tema da dissertação: "Demultiplexagem óptica controlada por tensão"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Paula Louro Antunes e Manuel Martins Barata
  Provas concluídas em: Março de 2009

- **António Parreira**
  Tema da dissertação: "Novas tecnologias de Semáforos Rodoviários. (SEMÁFORO)".
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Manuel Augusto Vieira
  Provas concluídas em: Fevereiro de 2009

- **Helder Sintra**
  Tema da dissertação: "Gestão Integrada de um Túnel em Meio Urbano (TUNEL)".

Mestrado em: Engª Electrotécnica e Telecomunicações
Grau Concedido por: Instituto Superior de Engenharia de Lisboa
Orientadores: Manuel Augusto Vieira
Provas concluídas em: Fevereiro de 2009

- **Bruno Mendes**
  Tema da dissertação: "Coordenação semafórica (ONDAVERDE)".
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Manuel Augusto Vieira
  Provas concluídas em: Dezembro de 2009

- **Filipe Gomes**
  Tema da dissertação: "A Passadeira de Peões Inteligente (SMART CROSS)".
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Manuel Augusto Vieira
  Provas concluídas em: Dezembro de 2009

- **José Manuel Espadinha Caeiro**
  Tema da dissertação: "Dispositivos semicondutores em sistemas de multiplexagem por divisão em comprimento de onda"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Paula Louro Antunes e Manuel Martins Barata
  Provas concluídas em: Dezembro de 2009

- **Carlos Mendes**
  Tema da dissertação: "Estudo e desenvolvimento de bases de fotomultiplicador activas para espectroscopia nuclear"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Luís Miguel Fernandes e Luís Redondo
  Provas concluídas em: Dezembro de 2009

- **Nuno Ferrão**
  Tema da dissertação: "Desenvolvimento de discriminador rápido para marca de tempo em correlações angulares perturbadas"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Luís Miguel Fernandes e Luís Redondo
  Provas concluídas em: Dezembro de 2009

- **Nuno Neves**
  Tema da dissertação: "Desmultiplexagem óptica no domínio do visível"
  Mestrado em: Engª Naval, ramo de Armas e Electrónica
  Grau Concedido por: Escola Naval
  Orientadores: Paula Louro Antunes e Vítor Lobo
  Provas concluídas em: 2010

- **Susana Amaral**
  Tema da dissertação: "Óptica Transparente: Wavelength Division Multiplexer"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Maria Manuela Vieira e Paula Louro Antunes
  Provas concluídas em: 2010

- **Gonçalo Pacheco**
  Tema da dissertação: "Radares em meio urbano (RADAR)"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Manuel Augusto Vieira
  Provas concluídas em: 2010

On-going MsSs

- **José Euclides Junior**
  Tema da dissertação: "Cidade Digital"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Manuel Augusto Vieira
  Previsão de conclusão de provas: 2011

- **João Oliveirinha**
  Tema da dissertação: "Traffic control (Modernização da gestão dos transportes urbanos)"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Manuel Augusto Vieira
  Previsão de conclusão de provas: 2011

- **Tiago Silva**
  Tema da dissertação: "Dispositivos MUX/DEMUX para implementação de WDM em POF"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Paula Louro Antunes e Manuela Vieira
  Previsão de conclusão de provas: 2011

- **Óscar Silva**
  Tema da dissertação: "Sensor de Fluorescência Sem Fios"
  Mestrado em: Engª Electrotécnica e Telecomunicações
  Grau Concedido por: Instituto Superior de Engenharia de Lisboa
  Orientadores: Paula Louro Antunes e João Barrigana Costa
  Previsão de conclusão de provas: 2011

Facilities

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, VIR, NIR, IR) and
- Optical Characterization Systems (I-V, C-V),
- Electric Characterization Systems,
- Material Testing Bench.

Strategy

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 on-going activities followed by incrementing the number of graduation students. All the activities are aimed to produce state of the art prototypes. Concerning the 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.

The fundamental research directions stand up on the continuation of research on new image sensors including acquisition and processing, new optoelectronic devices, UV and IV detectors, color sensors, WDM devices, ISFET devices for biological applications and optical amplifiers. 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 modeling and simulation, mainly for p-n-i materials or systems either simple or pilled up.

Production

JOURNALS A/A+

1. P. Louro, Y. Vygranenko, J. Martins[a], M. Fernandes[a] and **M. Vieira** *"Colour sensitive devices based on double pinip stacked photodiodes"* Thin Solid Films Vol. 515, Issue 19, 16 July 2007, pp 7526-7529 http://dx.doi.org/10.1016/j.tsf.2006.11.132..

2. C. Casteleiro, R. Schwarz, U. Mardolcar, A. Maçarico, J. Martins, **M. Vieira**, F. Wuensch, M. Kunst, E. Morgado, P. Stallinga, H.L. Gomes, *Spatially-resolved photocapacitance measurements to study defects in a-Si:H based p–i–n particle detectors,* Thin Solid Films, Volume 516, Issue 15, 2 June 2008, Pages 5118-5121 http://dx.doi.org/10.1016/j.tsf.2008.01.012.

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4. M. Vieira, A. Fantoni, P. Louro, M. Fernandes, R. Schwarz, G. Lavareda, C.N. Carvalho *"Self-biasing effect in colour sensitive photodiodes based on double p-i-n a-SiC:H heterojunctions"* Vacuum, Volume 82, Issue 12, 8 August 2008, pp: 1512-1516. http://dx.doi.org/10.1016/j.vacuum.2008.03.056.

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9. A. Fantoni; J. Martins, M.Fernandes, P. Louro, Y. Vygranenko, **M. Vieira**." *"Modeling a-SiC:H Tandem Pinpin and Pinip Photodiodes for Color Sensor Application"* Journal of Nanoscience and Nanotechnology, Volume 9, Number 7, July 2009, pp. 4028-4033(6) http://dx.doi.org/10.1166/jnn.2009.M06.

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16. **M. Vieira,** P. Louro M. A. Vieira, J. Costa, M. Fernandes, and A. Fantoni, *"Wavelength Selective a-SiC:H p-i-n/p-i-n Heterostructure for Fluorescent Proteins Detection",* Sensor Letters, Vol. 8, 413-418 (2010).

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22. Y. Vygranenko, E.Fathi, A.Sazonov, **M.Vieira**, A.Nathan, *"Nanocrystalline p-layer for a-Si:H p–i–n solar cells and photodiodes"* Solar Energy Materials & Solar Cells 94 (2010) 1860–1863, http://dx.doi.org/10.1016/j.solmat.2010.06.044

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24. M. Vieira, P. Louro, M. A. Vieira, J. Costa, M. Fernandes, "Direct Color Sensor, Optical Amplifier and Demux Device Integrated on a Single Monolithic SiC Photodetector" in print in Sensors & Actuators: A. Physical (2010)

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28. P. M, Gorley, O. M. Mysliuk, M. Vieira, P.P. Horley , V. K. Dugaev, J. Barnas, "Spin polarization of dilute magnetic semiconductors under optical excitation of impurity levels**"** Ukr. J. Phys. Opt. 9 60-71 http://dx.doi.org/10.3116/16091833/9/1/60/2008

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2. M. Vieira.; A. Fantoni; M. Fernandes.; P. Louro "Multispectral Structures for Imaging Applications" Sensor Technologies and Applications, 2007. SensorComm 2007. International Conference on 14-20 Oct. 2007 Page(s):36 – 41.

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5.   A.Fantoni, J. Martins, M. Fernandes, P. Louro, Y. Vygranenko, M. Vieira, "Photocurrent profile in a-SiC:H monolithic tandem pinpin and pinip photodiodes" in *Amorphous and Polycrystalline Thin-Film Silicon Science and Technology—2007*, edited by Virginia Chu, Seiichi Miyazaki, Arokia Nathan, Jeffrey Yang, Hsiao-Wen Zan (Mater. Res. Soc. Symp. Proc. **Volume 989**, Warrendale, PA, 2007) A18-12

6.   Yu. Vygranenko, P. Louro, M. Vieira, J. Chang, and A. Nathan, "Two-dimensional array of a-Si:H/a-SiC:H n-i-p photodiodes with Cr/a-SiNx front electrodes" in *Amorphous and Polycrystalline Thin-Film Silicon Science and Technology—2007*, edited by Virginia Chu, Seiichi Miyazaki, Arokia Nathan, Jeffrey Yang, Hsiao-Wen Zan (Mater. Res. Soc. Symp. Proc. **Volume 989**, Warrendale, PA, 2007) A18-13

7.   M. Fernandes, R. Martins, M. Vieira "Modeling the Laser Scanned Photodiode S-shaped J-V Characteristic". in *Amorphous and Polycrystalline Thin-Film Silicon Science and Technology—2007*, *edited by Virginia Chu, Seiichi Miyazaki, Arokia Nathan, Jeffrey Yang, Hsiao-Wen Zan (Mater. Res. Soc. Symp. Proc. Volume 989, Warrendale, PA, 2007) A19-03*

8.   P. Louro, M.Vieira, A. Steiger Garcao, Yu Vygranenko, M. Fernandes, "Optical Image and Color Recognition Using Monolithic Tandem Pinip and Pinpin Heterojunctions: A Comparison" International Conference on Sensor Technologies and Applications, 2007. SensorComm 2007. 14-20 Oct. 2007 pp. 361 – 365. http://dx.doi.org/10.1109/SENSORCOMM.2007.4394948.

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18. J. Costa, M. Fernandes, M. Vieira, G. Lavareda, C. N. Carvalho, A. Karmali "Electronic detection and quantification of toxic amides by using a-Si:H field-effect devices" *Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009, MRS Proceedings Volume 1153, A19-06.* http://dx.doi.org/10.1557/PROC-1153-A19-06.

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Technology — 2010, MRS Proceedings, *Editors: Q. Wang, B. Yan, S. Higashi, C.C. Tsai, A. Flewitt Volume* 1245-A18-01 DOI: 10.1557/PROC-1245-A18-01

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28. João Costa, Miguel Fernandes, Manuela Vieira, Alessandro Fantoni, Guilherme Lavareda, Amin Karmali "An Amorphous Silicon Device With an Immobilized Membrane for Acrylamide Sensing" in Functional Materials and Nanostructures for Chemical and Biochemical Sensing, edited by E. Comini, P. Gouma, G. Malliaras, L. Torsi (Mater. Res. Soc. Symp. Proc. Volume 1253, Warrendale, PA, 2010), K10-19.

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Group A2: Telecommunications and Signal Processing

Research Group Coordinator

- Paulo Pinto,   email: pfp@fct.unl.pt

Doctoral Research Team (staff)

- Paulo Pinto, Associate Professor,   email: pfp@fct.unl.pt
- Manuel Ortigueira, Associate Professor,   email: mdo@fct.unl.pt
- Luis Bernardo, Assistant Professor,   email: lflb@fct.unl.pt
- Arnaldo Batista, Assistant Professor,   email: agb@fct.unl.pt
- Paulo Montezuma, Assistant Professor,   email: pmc@fct.unl.pt
- Rodolfo Oliveira, Assistant Professor,   email: rado@fct.unl.pt

PhD Members

- Marko Beko, Assistant Professor at Universidade Lusófona,
                                    email: beko.marko@gmail.com

PhD students (staff)

- Pedro Amaral, Teaching Assistant,   pfa@fct.unl.pt

PhD students

- Miguel Pereira,   miguelpereira.pro@gmail.com
- Francisco Ganhão,   fjs.ganhao@gmail.com
- José Luzio,   sepheron@gmail.com
- Miguel Luis   nml17338@fct.unl.pt
- Fábio Amaral   fja18393@fct.unl.pt
- Raul Rato   rtrato@yahoo.com
- Carlos Matos   cmatos@est.ips.pt
- João Costa   jcosta@est.ips.pt
- Nuno Cardoso   nvcardoso@deea.isel.ipl.pt
- Miguel Carneiro   miguel.bacelar@estsetubal.ips.pt

Collaborators (with a small percentage of their time)

- Rui Dinis, Assistant Professor,   email: rdinis@fct.unl.pt
- Isabel Ventim Neves, Assistant Prof.,   email: ivn@uninova.pt

MSc students (scholar year 2009/2010)

- Sérgio Vieira
- Luis Sousa
- André Garrido
- Edgar Silva
- Rui Jacinto
- Pedro Pereira
- Cláudio Assunção

- Mónica Martins
- Diogo Silva
- Fábio Amaral
- Gonçalo Rodrigues
- Rui Pedro de Almeida Gomes
- Rute Nídia Neves de Almeida

Summary

The Telecommunication Group is performing research in the Telecommunications area with four main subareas: signal processing modulation, Medium Access Control, and network layer aspects.

The Group is characterized by having a reasonable synergy amongst its members achieving some critical mass that would otherwise be reduced given the current size. It is on a path to establish itself nationally and internationally as a producer of high quality research.

The Group is especially proud of its work on the following three scientific areas and a study for the European Commission:
- Frequency-domain receiver and MAC-layer designs for different broadband wireless systems
- Nonlinear effects in multicarrier signals
- After several invitations to publish a book on fractional calculus, a book by Springer will appear very soon.
- EU Study on the specific policy needs for ICT standardization

Several papers in leading conferences and journals were published. Some of these papers have many citations, demonstrating the international recognition of our work.

There have been concrete contacts with the micro-electronics group of CTS in order to produce devices incorporating the new technologies. It is a promising relationship, but it is still too soon to have results.

In terms of the finished theses in the period, there were 4 PhD theses (3 completed and 1 submitted), and 29 MSc theses (27 are Bologna 2nd cycles and 2 are pre-Bologna theses).

As a self-assessment statement it can be said that over the last years the Group succeeded to have its work published at a high level. This is the outcome of an increasing rigor of the work produced and a focalization in a small set of journals and conferences (the ones with major impact factors). In certain areas the work has been already cited by peers and in other areas it is expected that this stage will happen shortly. It is fair to say that the Group has established itself already in national terms. This is visible in the number of invitations for PhD assessment (both final and as external members of PhD advisory committees). In international terms the recognition is appearing as well, and the members participate in technical program committees of relevant conferences and participate regularly in manuscript review for journals, as well as evaluation of European Project proposals and periodical reviews of the projects.

Summary Figures

Finished PhD theses – 4	PhD students – 11
Finished MSc theses – 29	MSC students – 18
Books – 1	Book chapter – 6
Journals – 37 (21 A+/A)	Conferences – 98 (42 A+/A)
Projects – 4 (4 national)	Funding – 369.353 €

PhD		MSc		Projects		
Finalized	OnGoing	Finalized	OnGoing	Responsible	Collaboration	Patents/Prize/Stds
4	11	29	18	2	2	

Journals		Conferences		Books		Cites
Total	A+/A	Total	A/A+	Author	Chapter	Total
37	21	98	42	3	6	

Journal papers

Journals

Rank	Journal	(2003-2006)	(2007-2010)	Total (2003-2006)	Total (2007-2010)
A+	IEEE proceedings		1	0	13
	IEEE Trans. on Communications		3		
	IEEE Trans. on Wireless Communications		1		
	IEEE Transactions on Signal Processing		3		
	Mechanical Systems and Signal Processing		1		
	Journal of Neuroscience Methods		5		
A	IEEE Trans. Vehicular Technology		2	6	8
	Computer Communications	1	1		
	Physics Letters A		1		
	IET Control Theory and Applications		1		
	IEEE Circuits and Systems Magazine		1		
	Signal Processing	4			
	Nonlinear Dynamics	1			
	IEEE Transactions on Broadcasting		1		
	Computers and Mathematics with Applications		1		
Total		6	21		
Total Others		0	16		
Grand Total		6	37		
Cites		10	22		

Conference papers

Conferences

Rank	Conference	(2003-2006)	(2007-2010)	Total (2003-2006)	Total (2007-2010)
A	IEEE ICC		1	6	42
	IEEE WCNC		9		
	IEEE ICCCN		7		
	IEEE Globecom		3		
	IEEE PIMRC	1	2		
	IEEE SPAWC		2		
	IEEE ICASSP		1		
	IEEE VTC		9		
	FDA - IFAC Workshop on Fractional Differentiation and	1	4		
	ENOC – EUROMECH Nonlinear Dynamics Conference	2	1		
	ISCAS - IEEE International Symposium on Circuits and Systems	2			
B	Int'l Conf. on Multibody Systems, Nonlinear Dynamics and Control (MSNDC)		3	1	33
	IEEE MILCOM	1	3		
	IEEE ISWCS		8		
	IEEE PACRIM		1		
	European Wireless		2		
	Sarnoff		5		
	IEEE Engineering in Medicine and Biology Society, Sciences and Technologies for Health		1		
	CIMED Int'l Conf. on Computational Intelligence in Medicine and Healthcare		1		
	Nonlinear Science and Complexity, NSC		4		
	Symposium on Fractional Signals and Systems		1		
	Symposium on Applied Fractional Calculus		2		
	Portuguese Conference on Automatic Control		1		
	Workshop on New Trends in Science and Technology		1		
	Int'l Conf. on Informatics in Control, Automation and Robotics, ICINCO		1		
C	Mathematical Methods in Engineering International Symposium		2		6
ISI WoS	IEEE ICSPCS		6		
	Other ISI WoS	4	13		
	Total	11	94		
Other	Other non-ISI WoS	6	4		
	Grand Total	17	98		

Evolution from previous period

	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	8	36	1,6	5,1
Journals A/A+	6	21	1,2	3,0
Conferences	22	99	4,4	14,1
Conferences A/A+	6	42	1,2	6,0
MSc Theses	3	29	0,6	4,1
PhD Students	4	10	0,8	1,4
PhD Theses	0	4	0	0,6
Teams PhD	5	7	1	1,0

Global data

Group A2: Telecommunications and Signal Processing
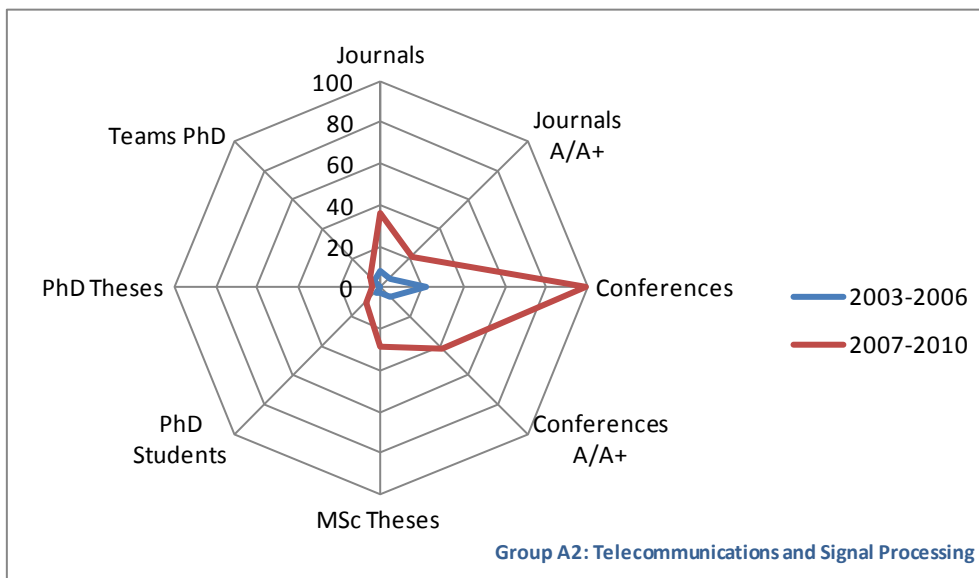
Introduction

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.

The members of the Group are mainly *staff* of the Science and Technology Faculty (meaning that they lecture at the Faculty in the Telecommunication and Signal Processing Sector). The Group has succeeded to attract external persons (e.g., lecturers in other universities) and this is an aspect that is being cherished in the present and for the near future. Some collaborators still have a weak link to the Group for various reasons (new-entrants in the Telecommunication Group, re-launching their carrier, etc.).

The mission of the Telecommunication Group is to be able to perform research at a world-leading level in terms of originality, significance and rigor for specific short-range areas where the activity of its senior members is focused. A second mission aim is to transfer our working attitude and knowledge to the students at various levels (undergraduate and graduate).

The main "umbrella" subject of the Group is, obviously, telecommunications and signal processing. The research themes can be described along the stack of the OSI Reference Model: they start at the physical level (modulation and signal processing) and cover the MAC layer, the Network layer, and small activities at Transport layer. The organization of the Group is such that for each topic more than one PhD is involved. This provides a fruitful synergy amongst the members and a certain critical mass for the production of the work.

The Signal Processing area is quite important in engineering. It is what we can call Mathematical Engineering and it can be applied to a lot of areas in our daily life (from Telecommunications to Music, from Control to Medicine, from Meteorology to Economy, from Statistics to Finance, and so on). With a so wide degree of applicability and theoretical aspects to be developed it is difficult to get acknowledgment of all the areas. So, our sub-group had to restrict its actuation areas to two specific topics: fractional signals and systems; and biomedical signal processing. In the near future a closer cooperation with the modulation sub-area of the Group is foreseen.

The concrete activities at each layer have been smoothly changing along the time to address the current discussions at international level. As an assessment of the quality of the Group's activities the objective is to publish the work in conferences and periodicals with a high impact.

Research

An observation that might be common to all research areas of the Group is the continuity of the activities with time. Each activity in the Group is strongly based on the past experience of the researchers involved and the international evolution. The point to stress here is that it is not a practice in the Group to "jump" from one area to a new one just because of some kind of "research fashion". By evolving smoothly and by having more than one PhD researcher in every area there is an attempt to deepen the quality of the work, and to provide support to the younger researchers by exposing them to different attitudes toward research.

In terms of overall performance of the research, the Group is establishing itself during the last years and especially during this period. Some conferences were chosen due to their quality and impact, and the researchers of the Group are publishing regularly on them. There are already some publications in high quality periodicals and the work has already gathered citations. A greater number of citations is expected in the future.

The main research areas of the Group are:

- **Physical Layer (*1 PhD finished, 2 PhD ongoing*):**
  Equalization techniques at the receiver side are necessary to compensate the signal distortion introduced by the channel, leading to an improvement on system performance. It was given emphasis to block transmission techniques with cycle prefix over severely frequency selective fading channels, as single carrier and multi-carrier systems employing frequency domain equalization. Other crucial aspects taken into account were:
  - Multipath propagation and diversity techniques
  - Channel estimation methods (pilots, training sequences, decision directed channel estimates)
  - Coding techniques
  Besides these subjects, the research also included nonlinear effects due power amplification. Power efficiency is very important in modern communication systems, especially in mobile devices where due energy constrains the power amplification is done with resort to nonlinear amplifiers. The research was about analytical methods for the characterization of nonlinear effects, signal design and pulse optimization to cope nonlinear effects and the design of coded signals resulting from nonlinear distortion effects.
  Other complementary aspects covered by research activities were MIMO systems and interference cancelation, based on iterative or non-iterative equalization.

- **Packet detection techniques (*2 PhD ongoing*)**
  New packet detection approaches for wireless systems also bring new opportunities to design new optimized MAC protocols. MultiPacket Reception mechanisms combine the parallel multiple access with a very

flexible datarate allocation and significant error correction properties, which can be maximized using specially tuned access protocols. We have applied such approach for Multi-Packet Reception systems and to Hybrid ARQ TDMA systems, where new physical layer's protocols were proposed. The MAC and LLC layer's protocols were designed to optimize the overall performance considering a LAN scenario, and we seek to extend the models to LEO satellite and High Platform Networks where round trip time is a relevant parameter.

- **Cross-layer design for Mobile Wireless Networks with applications in Ad hoc, Vehicular, Cognitive and Sensor networks (*1 PhD ongoing*):**

  Cross-layer design is a common solution for resource-constrained scenarios, where energy (WSN) and/or bandwidth are scarce. We envision a model-based cross-layered protocol design approach, where each protocol level is designed and parameterized based on system level performance models that take into consideration the full protocol stack. We have applied such approach to MANET and VANET routing protocol designed using 802.11 models; to WSN using specific energy models and different packet receiving schemes; and we are planning to continue to apply it to new scenarios including cognitive networks, with teams that combine elements with specific knowledge on the physical layer, MAC layer and routing layer.

- **Network Layer (*1 PhD ongoing*):**
  - Routing at Interdomain level in the Internet

  This research can be integrated in an international effort that has being made to answer the IAB (Internet Architecture Board) concern on the growth of the routing tables in the Internet. Our research defined a system that inherently addresses multhoming of Autonomous Systems and features multipath routing.

- **Fractional Signals and Systems (*1 PhD ongoing*)**

  It is intended to give contributions and solutions to the problems of the identification/modelling and to the realization of fractional linear systems.

  Characterization of the Fractional Signals and Systems

  The fractional systems are based on differential equations involving fractional derivatives. Since 1990, they have been applied to an increasing number of applications, namely by physicians and control engineers. The underlying theory constitutes what is known by Fractional Calculus (FC). This is a generalization of the traditional calculus that leads to similar concepts and tools, but with a much wider applicability. By allowing derivative and integral operations of arbitrary order, it is to traditional calculus what the real number line is to the set of integers. There is a long and growing list of practical applications for the increased power of the fractional calculus. Several published special issues of important international showed

relevant contributions to increment the knowledge on this field and to demonstrate the increasing interest in this area. Of particular interest to the signal processing community, as well as to the control systems and many others, is the fact the fractional systems have both short and long term memory. While the first corresponds to the "distribution of time constants" associated with the distribution of poles and zeroes in the complex plane, the second corresponds to infinitely many interlaced close to each other poles and zeros that in the limit originate a branch cut line. This translates to a lack specific time scale and, therefore, no new resonance or other instability effects and incorporates the power law behaviour found in natural systems that show the greatest robustness to variation of environmental parameters. The presence of fractional behaviour is very common in biomedical signals. It is easy to find this behaviour in the spectrum of the ECG signals.

1- **Fractional derivative definition** – We presented several derivative definitions. We will continue with the study of a unified framework for the main derivatives

2- **Implementation of fractional systems** – We intend to implement fractional systems both in continuous and discrete time, as well as a bridge between both classes of systems.

- **Biomedical Signal Processing (*3 PhD ongoing*)**

    EEG analysis for automated sleep classification, EEG spindle structure analysis, High-Resolution Electrocardiography for Atrial and Ventricular Fibrillation Detection.

    1- **Sleep Classification, Sleep spindle detection, modelling and characterization** - Research on automatic sleep staging based on the spectral properties of the Electroencephalogram. Sleep spindle detection and modeling as ancillary tools for the automatic sleep scoring. These works are based on the Hospital Pulido Valente apnea patient data-base.

    2- **Fibrillation detection using High Resolution Electrocardiography -** An acquisition system based on the Biosemi implementation is providing High-resolution ECG´s which are off-line processed by MicroECG, a software tool developed in our Department for the frequency characterization of the fibrillation micro-potentials using Wavelets

- **Others:**
  - Interconnection of Wireless Networks (*1 PhD finished*)

    The research was about the integration of an access network (WiFi) into the cellular network, solving problems such as synchronization of data between two data paths, user authentication in the two systems keeping both systems independent in security terms, etc. This research was part of an international effort in this area of interconnection with several publications at various levels. Its importance has diminished and so it happened in the Group

- Medium Access Control for Wireless Mobile Systems (*1 PhD finished, work at MSc level*)

    Medium access control is a central issue in modern communications. The recent advances in the physical layer demand for novel MAC design. We have proposed high-throughput MAC designs that are backward compatible to the legacy IEEE 802.11. Future work includes the application of modern stochastic control techniques taking into account the misbehaviors of the physical layer and the classical objectives of the MAC: high throughput and controlled fairness.

- Network Modeling and Performance Analysis (*work at MSc level*)

    Network modeling is essential for optimal protocol design. The research group is actively using high power computational resources for numerical, symbolic and technological simulation. The group has string skills in theoretical modeling techniques, such as queuing theory, optimization, estimation, …

Projects

Project Name and Involved Partners	Funding Entity	Amount of Funding (EURO)	Covered Period	Type of Participation
U-BOAT (ISR, IT, CTS)	FCT/MCTES	97 000	2007/10	Participant
MPSat (CTS, IT, INESC)	FCT/MCTES	109 000	2010/13	Primary Investigator and Coordinator
ADCOD[1] (ISR, IT)	FCT/MCTES	121 000	2010/13	Primary Investigator and Coordinator
OPPORTUNISTIC-CR (IT, CTS)	FCT/MCTES	42 353	2010/13	Participant

[1] – *This project moved together with its Principal Investigator.*

Short abstracts and the main highlights of the most relevant R&D projects are given below in order to clarify their main scientific objectives.

U-BOAT: Ultra-wide Band transmission for ad hoc Networks
    Funding: FCT project PTDC/EEA-TEL/67066/2006
    Description: Cross-layer design and optimization for ad hoc networks, involving physical, MAC and LLC layers.
    Partners: ISR, IT, CTS
    Coordinator: Rui Dinis

MPSat: Multi-Packet Detection Techniques for Satellite Networks
    Funding: FCT project MPSat PTDC/EEA-TEL/099074/2008
    Description: Cross-layer design and optimization for ad hoc networks, involving physical, MAC and LLC layers.
    Partners: CTS, IT, INESC
    Coordinator: Luís Bernardo

ADCOD: Advanced Code and Receiver Designs for Transmission over Selective Radio Channels
    Funding: FCT project PTDC/EEA-TEL/099973/2008
    Description: Design of codes and receivers for selective radio channels.
    Partners: ISR, IT
    Coordinator: Marko Beko

OPPORTUNISTIC-CR: Opportunistic Aggregation of Spectrum and Cognitive Radios for LTE-Advanced: Consequences on Public Policies
Funding: FCT project PTDC/EEA-TEL/115981/2009
Description: Optimization of spectrum usage for cognitive radio systems.
Partners: IT, CTS
Coordinator: Fernando Velez

Recognition

1. Member of **TC FODSC** (Fractional Order Dynamic Systems and Controls) of the IEEE Control Systems Society.
2. Member of **IPACS (**International Physics and Control Society).
3. Permanent invitations for revision of papers for the main conferences and journals, mainly: IEEE Transactions on Signal Processing, IEEE Transactions on Circuits and Systems, Signal Processing (EURASIP), Nonlinear Dynamics, Digital Signal Processing, Mechanical Systems and Signal Processing, IEEE Transactions on Industrial Electronics, IET Proceedings Control Theory and Applications, IET Signal Processing, Signal, Image and Video Processing.
4. Chair of the Symposium on Fractional Signals and Systems, FSS09, Lisbon, FCT, Monte da Caparica, Portugal, November 4-6, 2009. Co-Chair of the Mathematical Methods in Engineering International Symposium, Coimbra, Portugal, October 21-24, 2010. Co-Chair of the Symposium on Fractional Signals and Systems, FSS2011, Coimbra, Portugal, November 4-7, 2011.
5. Member of the scientific committee of conferences.
6. Guest editor in Signal Processing special issue.

Collaboration

Internationally:
- Carleton University, Ottawa, BWCS group (Prof. David Falconer)
- University of Thessaly, Greece, with Prof. Leandros Tassiulas' group -
- University of Campinas, Brazil
- Prof. Juan Trujillo, University La Laguna, Tenerife, Spain.
- Prof. Richard Magin, Univ. of Illinois at Chicago, Chicago, Illinois, USA.
- Prof. Igor Podlubny, Technical Univ. of Kosice, Slovak Republic.
- Prof. Periklis Ktonas, University of Athens, Greece.
- Prof. Atila Yilmaz, Hacettepe University, Turkey

Nationally:
- IT Lisboa – (Prof. Fernando Nunes, Prof. Francisco Cercas, Prof. Nuno Souto, Prof. João Silva, Prof. Américo Correia)
- INESC – ID, Portugal (Prof. António Grilo, Prof. Paulo Pereira, Prof. Mário Macedo).
- Thematic Network – RTCM (Mobile Communications Thematic Network) – integrating several Portuguese universities and enterprises.

Outreach

The Telecommunications and Signal Processing puts more emphasis on the scientific outreach of its work instead of consultancy or industrial projects. Therefore, there is not any spin-off made by the elements of the Group. The area of Telecommunications is quite global and some specializations are hard to achieve from scientific work.

The Group has been heavily involved in review processes of European projects (Paulo Pinto, 40 reviews of 17 projects: IP, STREP, SSA, and NoE) and evaluation of European project proposals (Paulo Pinto, 7 Calls). It has also been involved in project proposal evaluation for Scientific Council in Bulgaria (Luis Bernardo, 1 Call), Cyprus (Luis Bernardo, 1 Call) and for the Portuguese program QREN (Paulo Pinto and Luis Bernardo, 2 Calls each).

Given the current small size of the Group the organizations of large events have never been aimed yet. The Group has simply organized meetings of the Portuguese Thematic network - RTCM (Thematic Network on Mobile Communications).

Education & Training

The researcher Rafael Pasquini, of the University of Campinas, Brazil, was a visiting research in the Group.

Naturally, the Group teaches courses in some graduation and post-graduation programs of the Science and Technology Faculty, of the Universidade Nova de Lisboa.

Particularly relevant was the invitation by the Instituto Superior Técnico, of the Technical University of Lisbon, to teach a course in a post-graduation degree called POSTIT (Pós-graduação em Telecomunicações e Tecnologias de Informação). The course is entitled "*Integrated Networks*" and among the ones having an engineering nature (excluding policies and regulations) is the only one taught by external lecturers (to the Instituto Superior Técnico).

Facilities

The bulk of the scientific outcomes of the Group is either simulation results or analytical models. This is quite common at international level for the research areas covered by the Group.

Therefore, the facilities the Group holds are laboratories that house most of the post-graduate researchers and the servers that are used for simulations. Currently, the Group uses two large laboratories for research activities (and three more for graduation and post-graduation lectures).

The Signal Processing sub-group holds one lab, with computational infrastructure and a shielded room for High Resolution Biomedical Signal Acquisition: EEG and ECG.

Strategy

In strategic terms the Group aims at performing rigorous scientific research. To achieve this objective the Group tries to define its work in ways that are targeted to publication in high ranked journals and periodicals and in a small set of conferences (in opposition to high number of research manuscripts in medium or medium-low quality events). This is a difficult exercise that needs time (both calendar time and time from the researchers) but is being pursued.

One aspect that will have more attention in the future is the area of projects. Given the scope of the research, the Group has given more emphasis to small, highly focused projects. Cooperation with external members has been established in a personal basis as a joint work activity for research.

Furthermore, this assessment period has witness a large increment of the Group. It has passed from 2 PhD at 2006 to 9 PhD in 2010 (two of them with partial time, and other two belonging to the Signal Processing subgroup). It is envisaged that in the medium term the Group will increase its number of researchers even more and other kinds of projects will naturally start with the proper supporting structure. It has been a policy not to engage in projects with only junior researchers. The kinds of projects that will be aimed in the near future are European projects and projects managed by the European Space Agency (ESA).

The Group's strategy towards PhD students is to obtain scholarships from research funding bodies instead of form their participation in implementation oriented projects. Given the current small number of PhD students this has been achieved quite well. However, in the future, this might not be possible entirely (also due to the world crisis and shortage of this type of funding) but should remain as an objective.

In research terms the Group will pursue its current path of focusing the activity in simulations, analytical models, and discrete mathematical models. This is in contrast to activity more based on configuration issues that are very dependent on the power of concerned industries. For instance, the focus will be on new ideas for routing protocols, or the analytical study of a MAC protocol to assess its performance, than the design of a new routing protocol, or a new procedural method for medium access, in terms of messages, packets, and procedures.

In terms of new areas of research for the medium term the strategy stays the same as the existing one: enter gradually in new areas with all the background achieved until the current stage, and always with the participation of more than one PhD senior member.

Regarding the Signal Processing area, the objective is to pursue theoretical challenges. More concretely we intend to give contributions and solutions to the problems of the identification/modeling and to the realization of fractional linear systems. We are going to face the problem from both the analytic-computational and electronic

implementation points of view. We will continue with the formulation and study of the properties of the fractional linear systems. The main properties of the fractional linear systems will be studied and reported. Comparisons with the classic systems will be done. Design rules for designing fractional linear systems suitable for general applications will be formulated. These will be used for doing implementations both analogical and digital. The analogical implementations will be based on the "constant phase elements" and on microelectronics implementations. The digital ones will be based on suitable fractional derivative implementations. Applications of the theory to practical signals and systems will be done, by developing suitable modeling and identification algorithms. With these implementations we expect to obtain new tools for analysis and modeling of signals obtained in our daily life as it is the case of biomedical signals like ECG or EEG.

The above referred research aimed to

a) Increase the knowledge on fractional linear systems;
b) Study and design fractional filters by revising the usual design rules;
c) Develop modeling and identification techniques;
d) Study the effect of inserting fractional elements in well known useful circuits and structures.

Production

Books (with ISBN)

• EU Study on the specific policy needs for ICT standardization: Executive summary of the final report, by P. Van Eecke, P. Pinto, T. Egyedi, Luxembourg: Office for Official Publications of the European Communities, ISBN 978-92-79-07338-0, 2008.

Forthcoming, 2011

• Fractional Calculus for Scientists and Engineers, Springer.

Guest Editor (International Journals)

Forthcoming, 2011

• Signal Processing, special issue on Fractional Signals and Systems, Manuel Ortigueira, March 2011, (ISI WoS IF: 1.135)

Refereed Book Chapters

NOTE: _articles and addresses presented at conferences, published only in the conference's proceedings/minutes, even when these are published in book form (with ISBN) are **_not included here_**._

Total 2007-2010: 6, annual average: 1.5

2007

1. Searching for Resources in MANETs - A Cluster Based Flooding Approach, by Rodolfo Oliveira, Luis Bernardo, Paulo Pinto, in e-Business and Telecommunication Networks, ICETE 2005 Selected Papers Eds.: Joaquim Filipe; Helder Coelhas; Monica Saramago Springer, ISBN: 978-3-540-75992-8, pp. 236-245, 2007.

2008

2. A Telephony Application for MANETs: Voice over a MANET-extended JXTA Virtual Overlay Network, by Luis Bernardo, Rodolfo Oliveira, Sérgio Gaspar, David Paulino, Paulo Pinto, in e-Business and Telecommunication Networks, CCIS 9, ICETE 2006 Selected Papers, Eds.: Joaquim Filipe; Mohammad S. Obaidat, Springer, ISBN: 978-3-540-70759-2, pp. 347-358, 2008.

2009

3. The Empirical Mode Decomposition an Useful Tool for Signal Analysis, Rato, R. T. Ortigueira M. D., and A. G. Batista, in: New Signal Processing Research, Editor: Takumi Maeda, Nova Science Publishers, Inc., 2009.

4. Fractional Derivatives and Linear Systems, Ortigueira M. D, in: Mobile Computing Research and Applications, Editors: Kevin Y. Chen and H.K. Lee, Nova Science Publishers, Inc., 2009.

2010

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Refereed Articles in Journals

NOTE: This section does not include editorial articles.

Total 2007-2010: 36, annual average: 5,1

2007

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2. Pseudo-Fractional ARMA modelling using a double Levinson recursion, Ortigueira, M. D. and Serralheiro, A. J., IET (ex IEE) Control Theory and Applications, vol.1, No. 1, pp. 173-178, Jan. 2007.

3. New Quasi-orthogonal BCH-derived Sequences for CDMA Applications, Ricardo C. N. E., Ortigueira, M. D. and Gerald, J. A. B., European Transactions on Telecommunications, 2007; 18:803–810.

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5. On the relation between the fractional Brownian motion and the fractional derivatives, Ortigueira, M.D. and Batista, AG., Physics Letters A, 372 (2008) 958–968 (6 cites).

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11. Nonlinear Signal Processing Schemes for OFDM Modulations within Conventional or LINC Transmitter Structures, R.Dinis and A.Gusmão, European Trans. on Telecomm., 2008.

12. A Turbo SDMA Receiver for Strongly Nonlinearly Distorted MC-CDMA Signals, P.Silva and R.Dinis, Canadian Journal of Electrical and Computer Engineering, 2008.

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17. Time-frequency analysis methods to quantify the time-varying microstructure of sleep EEG spindles: Possibility for dementia biomarkers, Ktonas, P.Y., Golemati, S., Xanthopoulos, P., Sakkalis, V., Ortigueira, M.D., Tsekou, H., Zervakis, M., Paparrigopoulos, T., Bonakis, A., Economou, N. T., Theodoropoulos, P., Papageorgiou, S. G., Vassilopoulos, D., and Soldatos, C. R,. Journal of Neuroscience Methods. 185 (2009) 133–142.

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29. System Initial Conditions vs Derivative Initial Conditions, Ortigueira, M. D. and Coito, F.J., Computers and Mathematics with Applications, special issue on Fractional Differentiation and Its Applications, Volume 59, Issue 5, March 2010, Pages 1782-1789 (1 cite).

30. On the Fractional Linear Scale Invariant Systems, Ortigueira, M. D., IEEE Trans. On Signal Processing, Vol.58, No. 12, December 2010.

31. State-Space Estimation for OFDM and SC-FDE Schemes with Strongly Varying Carrier Frequency Offset, P.Pedrosa, R.Dinis and F.Nunes, ECTI Transactions on Computer and Information Technology, Vol. 4, No. 1, pp. 21 - 29, May 2010.

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- On the Fractional Signals and Systems, Magin, R., Ortigueira, M. D., Podlubny, I., and Trujillo, J., (invited paper), Signal Processing, 91(2011) 350–371.

Refereed International Conferences

Total 2007-2010: 99, annual average: 14.1

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1. Modelling Delay on IEEE 802.11 MAC Protocol for Unicast and Broadcast Non-saturated Traffic, Rodolfo Oliveira, Luis Bernardo, Paulo Pinto, IEEE Wireless Communications and Networking Conference (WCNC'07), Hong Kong, March 11-15, 2007. (ISI WoS, IEEE, Cites: 7)

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4. Frequency-Domain Detection of OQPSK Signals with Quasi-Constant Envelope and High Spectral Efficiency, Marco Serrazina, Rui Dinis and Paulo Carvalho, International Wireless Communications and Mobile Computing Conference (IWCM'07), Honolulu, USA, August 12-16, 2007.

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7. IEEE 802.11 Delay Analysis for Multirate Variable Frame Length, Rodolfo Oliveira, Luis Bernardo, Paulo Pinto, 18th Annual IEEE International Symposium on Personal, Indoor, and Mobile Radio Communications (PIMRC'07), ISBN: 1-4244-1144-0, Athens, Greece, September 3-7, 2007. (ISI WoS, IEEE, Cites=2)

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21. A Load-adaptive Timeout for Beaconing-based Link Protocols in Ad Hoc Networks, Rodolfo Oliveira, Luis Bernardo, Paulo Pinto, Rui Dinis, European Wireless Conference 2008 (EW'2008), Prague, Czech Republic, June 22-25, 2008. (ISI WoS, IEEE)

22. Low SNR analysis of the non-coherent MIMO channel under arbitrary channel and noise correlation structures, M. Beko, J. Xavier, V. Barroso, IEEE Ninth Workshop on Signal Processing Advances in Wireless Communications (SPAWC'08), Recife, Brasil, July 6-9, 2008. (ISI WoS, IEEE)

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24. On Pre-Processing for MIMO W-CDMA, M.Silva, A.Correia and R.Dinis, WPMC'08, Lapland, Finland, Sept. 2008.

25. Efficient Channel Estimation for Iterative MIMO SC-FDE Systems, J.Silva, R.Dinis and N.Souto, IEEE VTC'08(Fall), Calgary, Canada, Sept. 2008.

26. Analytical Evaluation of Nonlinear Distortion Effects on OFDMA Signals used in the Downlink Transmission, T.Araújo and R.Dinis, IEEE ISWCS'08, Reykjavik, Iceland, October 21-24, 2008. (ISI WoS, IEEE)

27. Performance Evaluation of Decision-Directed Carrier Synchronization for SC-FDE Schemes, P.Pedrosa, R.Dinis and F.Nunes, IEEE ISWCS'08, Reykjavik, Iceland, October 21-24, 2008. (ISI WoS, IEEE).

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42. DTIA: An Architecture for Inter-domain Routing, Pedro Amaral, Luis Bernardo, Paulo Pinto, IEEE 44th International Conference on Communications (ICC'09), Dresden, Germany, 14-18 June 2009. (ISI WoS, IEEE, Cites: 1)

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45. SC-FDE with OQPSK-Type Schemes: An Efficient Transmission Technique for Broadband Wireless Systems, R.Dinis, P.Carvalho and T.Marques, IEEE ICCCN'09, San Francisco, USA, Aug. 2009. (IEEE)

46. UWB Digital Carrier User Codes for Narrow Band Interference Cancelation, P.Carvalho, R.Dinis and D.Lourenço, 3rd International Conference on Signal Processing and Communication Systems (ICSPCS'09), Omaha, USA, Sep. 2009. (ISI WoS, IEEE)

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59. Generalized GL Fractional Derivative and its Laplace and Fourier Transform, Ortigueira, M. D. and Trujillo, J.J., Proceedings of the ASME 2009 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC/CIE 2009, San Diego, California, USA, August 30 - September 2, 2009.

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62. A Model of an Iterative Estimator of the Carrier Frequency Offset, P.Pedrosa, R.Dinis and F. Nunes, IASTED SPPRA'2010, Innsbruck, Austria, Feb. 2010.

63. Analytical Performance Evaluation of a Class of Receivers with Joint Equalization and Carrier Frequency Synchronization, P. Pedrosa, R. Dinis, F. Nunes, IEEE Sarnoff Symposium 2010, Princeton, EUA, Apr. 2010.

64. Improving Topology-based Routing in High Mobility VANETs, M. Luis, R. Oliveira, L. Bernardo, and P. Pinto, Poster at 33rd IEEE Sarnoff Symposium 2010, ISBN: 978-1-4244-5593-5, Princeton, USA, Apr. 12-14 2010. (IEEE)

65. Improving Routing Performance in High Mobility and High Density ad hoc Vehicular Networks, M. Luis, R. Oliveira, L. Bernardo, and P. Pinto, 33rd IEEE Sarnoff Symposium 2010, Princeton, USA, Apr. 12-14 2010. (IEEE)

66. Iterative Frequency-Domain Equalization for General Constellations, R. Dinis, P. Montezuma, N. Souto, and J. Silva, 33rd IEEE Sarnoff Symposium 2010, Princeton, USA, Apr. 12-14 2010. (IEEE, Cites: 1)

67. A Simple Design of Structured Space-Time Block Codes for Communication in Spread Systems, M. Beko, and R. Dinis, 33rd IEEE Sarnoff Symposium 2010, Princeton, USA, Apr. 12-14 2010. (IEEE)

68. On the Design of Frequency-Domain Equalizers for OQPSK Modulations, R. Dinis, M. Luzio, and P. Montezuma, 33rd IEEE Sarnoff Symposium 2010, Princeton, USA, Apr. 12-14 2010. (IEEE)

69. Joint topology control and routing in ad hoc vehicular networks, M. Luis, R. Oliveira, L. Bernardo, A. Garrido and P. Pinto, 16th European Wireless Conference (EW'10), Lucca, Italy, Apr. 12-15 2010. (IEEE)

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72. Delay optimization on a p-persistent MAC protocol for a multi-packet detection in SC-FDE system, M. Pereira, L. Bernardo, R. Dinis, R. Oliveira, P. Carvalho and P. Pinto, IEEE Wireless Communications and Networking Conference (WCNC'10), Sydney, Australia, Apr. 18-21 2010. (IEEE, Cites=1)

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74. Should we Avoid Nonlinear Effects in a Digital Transmission System?, P. Montezuma, R. Dinis and R. Oliveira, IEEE Wireless Communications and Networking Conference (WCNC'10), Sydney, Australia, Apr. 18-21 2010. (IEEE)

75. Space-time block code design for communication in spread systems, M. Beko and R. Dinis, 11th IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC'10), Marrakech, Morocco, Jun. 20-23 2010. (IEEE)

76. An analytical approach for performance evaluation of a class of receivers with joint equalization and carrier frequency synchronization, P. Pedrosa, R. Dinis, F. Nunes, IEEE SPAWC'10, Marrakech, Morocco, Jun. 20-23 2010. (IEEE)

77. Performance comparison of diversity combining ARQ error control schemes with multi-packet detection schemes, M. Pereira, L. Bernardo, R. Dinis, R. Oliveira and P. Pinto, IEEE 19th International Conference on Computer Communications and Networks (ICCCN'10), Zurich, Switzerland, Ago. 2-5 2010. (IEEE)

78. Energy per useful packet optimization on a TDMA WSN channel, F. Ganhão, M. Pereira, L. Bernardo, R. Dinis, R. Oliveira and P. Pinto, IEEE 19th International Conference on Computer Communications and Networks (ICCCN'10), Zurich, Switzerland, Ago. 2-5 2010. (IEEE)

79. On the design of turbo equalizers for SC-FDE schemes with different error protections, R. Dinis, J. Silva, N. Souto and P. Carvalho, IEEE 72nd Vehicular Technology Conference (VTC'10-Fall), Ottawa, Canada, Sep. 6-9 2010. (IEEE)

80. On the design of linear receivers for SC-FDE schemes employing OQPSK modulation, M. Luzio, R. Dinis and P. Montezuma, IEEE 72nd Vehicular Technology Conference (VTC'10-Fall), Ottawa, Canada, Sep. 6-9 2010. (IEEE)

81. Energy per useful packet optimization on a TDMA HAP channel, F. Ganhão, M. Pereira, L. Bernardo, R. Dinis, N. Souto, J. Silva, R. Oliveira and P. Pinto, IEEE 72nd Vehicular Technology Conference (VTC'10-Fall), Ottawa, Canada, Sep. 6-9 2010. (IEEE)

82. Joint Detection and Channel Estimation for Block Transmission Schemes, F. Coelho, R. Dinis and P. Montezuma, IEEE MILCOM'2010, San Jose, USA, Oct. 2010. (IEEE)

83. On the accuracy of the Gaussian approximation for the evaluation of nonlinear effects in OFDM signals, T. Araújo, R. Dinis, IEEE VTC'2010 (Fall), Ottawa, Canada, Sept. 2010.

84. Power Saving Techniques for E-MBMS Transmissions in LTE-Advanced, A.Correia, N.Souto, R.Dinis, IEEE WPMC'2010, Recife, Brasil, Vol. 1, pp. 1 - 6, Oct., 2010.

85. On the Use of TCH Sequences for Synchronization and Channel Estimation in MIMO Systems, J. Silva, H. Silva, R. Dinis, N. Souto, ICSPCS'2010, Gold Coast, Australia, Dec., 2010.

86. A Robust Design of TC-OQAM Schemes with Nonlinear Transmitters, P. Montezuma, R. Dinis and F. Coelho, IEEE MILCOM'2010, San Jose, USA, Oct. 2010. (IEEE)

87. On the Impact of Multipath Propagation and Diversity in Performance of Iterative Block Decision Feedback Equalizers, F. Coelho, R. Dinis and P. Montezuma, IEEE WiMob 2010, Niagara Falls, Canada, Oct. 2010. (IEEE)

88. On the Design of Iterative FDE Receivers for OQAM Modulations, M.Luzio, R. Dinis and P. Montezuma, IEEE GLOBECOM'2010, Miami, USA, Dec. 2010. (IEEE)

89. RailScan: a tool for the detection and quantification of rail corrugation, Gomes, R., Batista, A., Ortigueira, M. and Rato, R., DOCEIS, Doctoral Conference on Computing, Electrical and Industrial Systems, Caparica, Portugal, February 22-24, 2010.

90. MicroECG: an integrated platform for the Cardiac Arrhythmia Detection and Characterization, Nascimento, B., Batista,A., Ortigueira, M. D., Alves, L., and Rato. R., DOCEIS, Doctoral Conference on Computing, Electrical and Industrial Systems, Caparica, Portugal, February 22-24, 2010.

91. A Contribution for the Automatic Sleep Classification Based on the Itakura-Saito Spectral Distance, Cardoso, E., Batista, A., Rodrigues, R., Ortigueira, M., Barbara, C., Martinho, C., and Rato, R., DOCEIS, Doctoral Conference on Computing, Electrical and Industrial Systems, Caparica, Portugal, February 22-24, 2010.

92. Fractional Filters: An Optimization Approach, Matos, C. J., Batista, A.G. and Ortigueira, M. D., DOCEIS, Doctoral Conference on Computing, Electrical and Industrial Systems, Caparica, Portugal, February 22-24, 2010.

93. The power functions and their Fourier transforms, Ortigueira, M.D. and Magin R.L., 3rd Conference on Nonlinear Science and Complexity, Ankara, Turkey, July 28 - 31, 2010.

94. An Automatic System for the Cardiac Arrythmia Detection and Characterization, Nascimento, B., Batista,A., Ortigueira, M. D., Alves, L., and Rato. R., 3rdConference on Nonlinear Science and Complexity, Ankara, Turkey, July 28 - 31, 2010.

95. Generalized GL, Caputo, and Riemann-Liouville derivatives for analytic functions, Ortigueira, M.D., Rodríguez-Germá, L., and Trujillo, J.J., 3rdConference on Nonlinear Science and Complexity, Ankara, Turkey, July 28 - 31, 2010.

96. Are RL and C derivatives really useful?, Ortigueira, M.D. and Coito, F.J. 4rd IFAC Workshop on Fractional Differentiation and its Applications, Badajoz, Spain, October 18 – 20, 2010.

97. The incremental ratio based causal Fractional Calculus for analytic functions, Ortigueira, M.D., Rivero, M., and Trujillo, J., 4rd IFAC Workshop on Fractional Differentiation and its Applications, Badajoz, Spain, October 18 – 20, 2010.

98. Fractional Lower Order Moments in NMR: A New Measure of Tissue Complexity, Magin R.L. and Ortigueira, M.D., Mathematical Methods in Engineering International Symposium, Coimbra, Portugal, October, 21-24, 2010.

99. On a not so Fast Fourier Transform, Ortigueira, M.D. and Coito, F.J., Mathematical Methods in Engineering International Symposium, Coimbra, Portugal, October, 21-24, 2010.

Annex

Publication framework organized to be the publication reference frame of CTS in the different research areas.

Telecommunications

List of 25 selected journal, classified based on "5 Year Impact Factor" criteria (A+>2.5 / Q1, A>1.0/Q1, B>1/Q2, C>0,5):

Rank	Abreviated Journal Title	ISSN	Impact Factor 2008	5y Impact Factor 2008	Rank SCIMago
A+	Proceedings of the IEEE	0018-9219	4,613	6,824	Q1
A+	IEEE Signal Processing Mag.	1053-5888	3,758	6,157	Q1
A+	IEEE Wireless Communications	1536-1284	3,18	5,935	Q1
A+	IEEE Journal on Selected Areas on Communications	0733-8716	4,249	5,615	Q1
A+	IEEE Trans. on Information Theory	0018-9448	3,793	5,434	Q1
A+	IEEE Trans. Mobile Computing	1536-1233	3,352	5,021	Q1
A+	IEEE/ACM Trans. on Networking	1063-6692	2,576	4,818	Q1
A+	IEEE Network	0890-8044	3,068	4,422	Q1
A+	IEEE Pervasive Computing	1536-1268	2,615	4,159	Q1
A+	IEEE Communications Mag.	0163-6804	2,799	3,927	Q1
A+	IEEE Trans. on Communications	0090-6778	2,07	3,694	Q1
A+	IEEE Trans. Signal Processing	1053-587X	2,335	3,485	Q1
A+	IEEE Trans. on Wireless Communications	1536-1276	2,181	3,324	Q1
A+	IEEE Trans. Multimedia	1520-9210	2,288	2,932	Q1
A	Wireless Communications & Mobile Computing	1530-8669	0,909	2,329	Q2
A	IEEE Trans. Vehicular Technology	0018-9545	1,308	2,239	Q1
A	Wireless Networks	1022-0038	1,194	2,04	Q2
A	IEEE Communications Letters	1089-7798	1,232	1,876	Q1
A	Mobile Networks & Applications	1383-469X	1,619	1,871	Q1
A	Computer Networks	1389-1286	1,304	1,804	Q2
A	IEEE T AERO ELEC SYS	0018-9251	1,024	1,757	Q1/Q2
A	Digital Signal Processing	1051-2004	1,486	1,575	Q2
A	Ad Hoc Networks	1570-8705	1.293		Q1
A	IEEE SIGNAL PROC LET	1070-9908	1,203	1,528	Q1
A	TELECOMMUN POLICY	0308-5961	1,244	1,534	Q1
A	IEEE SIGNAL PROC LET	1070-9908	1,203	1,528	Q1
A	SIGNAL PROCESS	0165-1684	1,256	1,319	Q2
A	INTERNET RES	1066-2243	0,8	1,157	Q2

A	ELECTRON LETT	0013-5194	1,14	1,152	Q1
A	EURASIP J ADV SIG PR	1687-6172	1,055	1,151	Q2
A	Computer Communications	0140-3664	0,884	1,005	Q2
B	EURASIP Journal on Wireless Communications	1687-1499	0,976		Q2
B	INT J DISTRIB SENS N	1550-1329	0,722	0,93	Q2/Q3
B	PERS UBIQUIT COMPUT	1617-4909	0,865	0,865	Q2
B	IEE Proceedings in Communications	1350-2425	0,788	0,853	-
B	Int. Journal on Satellite Communications & Networks	1542-0973	0,607	0,81	Q3
B	Telecommunication Systems	1018-4864	0,396	0,78	Q3
B	IET SIGNAL PROCESS	1751-9675	0,762	0,762	Q2/Q3
B	J NETW SYST MANAG	1064-7570	0,685		Q3
B	European Trans. on Telecommunications	1124-318X	0,472	0,549	Q2
B	BELL LABS TECH J	1089-7089	0,492	0,547	Q3
B	INT J COMMUN SYST	1074-5351	0,394	0,539	Q3
C	Canadian Journal of Electrical and Computer Eng.	0840-8688	0,389	0,424	Q3
C	Wireless Personal Communications	0929-6212	0,331	0,418	Q3
C	IET COMMUN	1751-8628	0,345	0,345	Q2
C	Space Communications	0924-8625	0,077	0,167	Q3

List of 30 selected conferences, classified based on indexing, sponsors, indexing and interest/impact for the community in the scientific area

Rank	Conference	Title	Sponsors	Indexing	Class
1	IEEE Infocom	IEEE Infocom -IEEE Computer and Communications Societies	IEEE Comm./Comp. Soc.	ISI-WoS, IEEE	A+
2	ACM SIGCOMM	ACM SIGCOMM -ACM Conf on Applic, Techno, Archit, and Protocols for Comp Comm	SIGCOMM	ISI-WoS	A+
3	ACM MobiCOM	ACM MobiCom -Intl Conf on Mobile Computing and Networking	SIGMOBILE	ISI-WoS	A+
4	ACM MobiHoc	ACM MobiHoc - ACM Int Symp on Mobile Ad Hoc Networking and Computing	SIGMOBILE	ISI-WoS	A+
5	IEEE ICC	IEEE ICC -IEEE Int Conf on Communications	IEEE Comm. Soc.	ISI-WoS, IEEE	A
6	IEEE WCNC	IEEE WCNC -IEEE Conf on Wireless Communications and Networking	IEEE Comm. Soc.	ISI-WoS, IEEE	A
7	IEEE ICDCS	IEEE ICDCS -Int Conf on Distributed Computing Systems	IEEE Computer Soc.	ISI-WoS, IEEE	A
8	IEEE ICCCN	IEEE ICCCN -Int Conf on Computer Communications and Networks	TCCC -Comm. Soc.	ISI-WoS, IEEE	A
9	IEEE LCN	IEEE LCN -Conf on Local Computer Networks	IEEE Computer Soc.	ISI-WoS, IEEE	A
10	IFIP Networking	IFIP Networking	IFIP	ISI-WoS	A
11	EWSN	EWSN - European Conf on Wireless Sensor Networks		-	A
12	ACM CoNEXT	ACM CoNEXT -Conf on emerging Networking EXperiments and Technologies	SIGCOMM	ISI-WoS	A
13	IEEE Globecom	IEEE Globecom -IEEE Conf and Exhibition. Global	IEEE Comm. Soc.	ISI-WoS, IEEE	A

			Telecommunications			
14	IEEE PIMRC		IEEE PIMRC -IEEE Int Symp on Personal, Indoor and Mobile Radio Communications	IEEE Comm. Soc.	ISI-WoS, IEEE	A
15	IEEE SPAWC		IEEE SPAWC-IEEE Int Workshop on Signal Processing Advances for Wireless Communications	IEEE Signal Proc. Soc.	ISI-WoS, IEEE	A
16	IEEE ICASSP		IEEE ICASSP - Int Conf on Acoustics, Speech, and Signal Processing	IEEE Signal Proc. Soc.	ISI-WoS, IEEE	A
17	IEEE ISIT		IEEE ISIT - IEEE Int Symp on Information Theory	IEEE Inform. Th. Soc.	ISI-WoS, IEEE	A
18	EUSIPCO		EUSIPCO - European Signal Processing Conference		ISI-WoS	A
19	IEEE VTC		IEEE VTC -IEEE Conference on Vehicular Technology	IEEE Vehic. Tec. Soc.	ISI-WoS, IEEE	A
20	IEEE MILCOM		IEEE MILCOM -Military Communications Conference	IEEE Comm. Soc.	IEEE (some years)	B
21	IEEE APCC		IEEE APCC - Asia Pacific Conference on Communications	IEEE Comm. Soc.	IEEE	B
22	IEEE ISWCS		IEEE ISWCS -International Symposium on Wireless Communication Systems	IEEE Vehic. Tec. Soc.	ISI-WoS, IEEE	B
23	IEEE BMSB		IEEE BMSB -IEEE International Symposium on Broadband Multimedia Systems and Broadcasting	IEEE BTS	IEEE	B
24	IEEE PACRIM		IEEE PACRIM -IEEE Pacific Rim Conference on Communications, Computers and Signal Processing	IEEE	IEEE	B
25	IEEE IWSSC		IEEE IWSSC -Int Workshop on Satellite and Space Communications	IEEE, ESA	IEEE	B
26	ACM IWCMC		ACM IWCMC- Int Wireless Communications and Mobile Computing Conf	ACM	-	B
27	EW		EW – European Wireless Conference		ISI-WoS	B
28	WMNC		WMNC - IFIP Wireless and Mobile Networking Conference	IFIP	-	B
29	Sarnoff		Sarnoff Symposium	IEEE	ISI-WoS, IEEE	B
30	IEEE ICSPCS		IEEE ICSPCS -International Conference on Signal Processing and Communication Systems	IEEE	IEEE	C

Advisors:

-   Prof. Jordi Domingo-Pascual (UPC - Spain)
-   Prof. D. Falconer (Canada)

Signal Processing

List of selected journal, classified based on "5 Year Impact Factor" criteria (A+>1.5, A>1):

Rank	Abreviated Journal Title
A+	NeuroImage
A+	IEEE Signal Processing Magazine
A+	IEEE Transactions on Medical Imaging
A+	Medical Image Analysis

A+	Automatica
A+	IEEE Transactions on Signal Processing
A+	IEEE Transactions on Circuits and Systems
A+	Mechanical Systems and Signal Processing
A+	Journal of Neuroscience Methods
A	Physics Letters A
A	Digital Signal Processing
A	International Journal of Adaptive Control and Signal Processing
A	Computer Methods and Programs in Biomedicine
A	IET Control Theory and Applications
A	Signal Processing
A	IEEE Circuits and Systems Magazine
A	Computers and Mathematics with Applications
B	ASME Journal of Computational and Nonlinear Dynamics
B	Applied Mathematical Modelling
B	Journal of Vibration and Control
B	IET Signal Processing
B	European Transactions on Telecommunications
B	Commun Nonlinear Sci Numer Simulat
B	Discussiones Mathematicae: Probability and Statistics

List of 12 selected conferences, classified based on indexing, sponsors, indexing and interest/impact for the community in the scientific area

Rank	Title
A+	ICASSP - International Conference on Acoustics, Speech, and Signal Processing
A+	EUSIPCO - European Signal Processing Conference
A	IEEE Conference on Decision and Control
A	IFAC International Conference on Intelligent Control Systems and Signal Processing
A	ISCAS - IEEE International Symposium on Circuits and Systems
A	FDA - IFAC Workshop on Fractional Differentiation and Its Applications
A	ENOC – EUROMECH Nonlinear Dynamics Conference
A	International Conference on Multibody Systems, Nonlinear Dynamics and Control (MSNDC)
B	IEEE Engineering in Medicine and Biology Society, Sciences and Technologies for Health
B	CIMED International Conference on Computational Intelligence in Medicine and Healthcare
B	Nonlinear Science and Complexity, NSC
B	Symposium on Fractional Signals and Systems
B	Symposium on Applied Fractional Calculus
B	Portuguese Conference on Automatic Control
B	Workshop on New Trends in Science and Technology
B	International Conference on Informatics in Control, Automation and Robotics, ICINCO
B	DOCEIS, Doctoral Conference on Computing, Electrical and Industrial Systems
B	Mathematical Methods in Engineering International Symposium

LINE B

– Energy Efficiency, Industrial and Intelligent control and Decision Support Systems –

Group B1: Energy

Research Group Coordinator

- Armando Pires (AP), Coordinator Professor, email: armando.pires@estsetubal.ips.pt

Doctoral Research Team

- Amadeu Leão Rodriges (ALR), Full Professor, email: leão@uninova.pt
- Armando Pires (AP), Coordinator Professor, email: armando.pires@estsetubal.ips.pt
- João Martins (JM), Auxiliar Professor, email: jf.martins@fct.unl.pt
- Mário Ventim Neves (MVN), Auxiliar Professor, email: ventim@uninova.pt
- Stanimir Valtchev (SV), Auxiliar Professor, email: ssv@fct.unl.pt
- Anabela Gonçalves (AG), Auxiliar Professor, email: amg1@fct.unl.pt
- João Murta Pina (JMP), Auxiliar Professor, email: jmmp@fct.unl.pt

PhD students

- David Inácio, email: ddi@fct.unl.pt
- Daniel Foito, email: daniel.foito@estsetubal.ips.pt
- Pedro Pereira, email: pmrp@fct.unl.pt
- José Lima, email: jose.a.o.lima@gmail.com
- Pedro Magalhães, pedro_magalhaes86@hotmail.com
- Pedro Lobato, email: pedro.lobato@estsetubal.ips.pt
- António Pombo, email: antonio.pombo@estsetubal.ips.pt
- Elena Nikolaevna Baikova, email: elena.baikova@estsetubal.ips.pt
- Ezequiel F. do Vale Carvalho, email: ecarvalho@deea.isel.ipl.pt
- Svetlana Chemetova, email: svetlana.chemetova@estsetubal.ips.pt

Collaborators, as research engineers

- Rui Medeiros, Project of UNINOVA
- David Cavalheiro, Project of NMT
- Rossen Vitanov, TU Sofia

Summary

Main indicators and achievements:

This report mainly summarizes research activities undertaken from 2007 until 2010 (evaluation period).

Highlights of achievements (since 2007)

5. Experimental System for Teaching Induction Motors with Fault Detection and Diagnosis Capabilities: The system is based on only one healthy induction machine that is operated under faulty operating modes. Several fault types and the behavior of the electrical machine for different load types can be tested. (Patent pending)

6. Reconfigurable Remote Laboratory, using Oscilloscope/PLC network for www access: Remote laboratory facility that allows the students to conduct real power electronics reconfigurable experiments through the internet, promoting a more efficient learning through on-line industrial automation operation using the internet and www services. (IEEE Trans. on Industrial Electronics, June 2008)

7. Mobile Analog Electronics Course: Mobile learning framework for analog electronics course specially designed as a supplementary mean to the classical analog electronics courses and specifically designed to be accessed from PDA mobile devices. (EDUCON2010, April 2010)

8. Energy Consumption Monitoring System for Large Complexes: Open source system for monitoring and data acquisition of several energy analyzers. Verifies, in real time, the energy profile and keeps consumption records. (DoCEIS'10, February 2010)

9. Energy Harvesting: in cooperation with the Department of Mechanical Engineering (DEMI), two teams of students of FCT won the contest "New Idea", created by the Rector of UNL and BPI, obtaining in May 2009 1st and 4th place for Energy harvesting ideas: FOOT BY FOOT (students of FCT-UNL e FE-UNL) and PIEZOKEY (students of FCT-UNL, FCSH-UNL e FE-UNL). Attributed money (8000 €) mobile phones and other prizes. The research continues in the higher energies area in cooperation with DEMI.

10. Energy Harvesting in Biomedical Area: in cooperation with other colleagues from FCT, the enterprise NMT, and foreign institutions, research for autonomous biomedical sensors, research engineer admitted through NMT.

11. Electric Vehicle: Invited Cooperation with TU Delft and Schiphol Group (NL) in the project DIEMINGO (Integration of Electric Mobility in the Buildings), mainly on fast battery chargers and contactless battery charging, two months stay paid by TU Delft in 2009.

12. Electric Vehicle: Keynote speaker at International Symposium on Electric Vehicle, Representing Person in the Memorandum for Combined Studies between Faculties of TU Warsaw and FCT, signed in 2010. Professor Szumanowski has been to FCT and his lectures were highly appreciated. Recent ERASMUS agreements and long-time cooperation with: TU Delft, Technical

University of Warsaw, University of Bucharest, University of Transport in Sofia, and with Technical University of Sofia.

13. Wireless Energy Transfer: Coordinating and cooperating in the (current) project SERVROBOT (through UNINOVA), several other projects in preparation, where the energy is transferred without a direct physical (mechanical) contact. Invited lectures in KAIST (Republic Korea), and Tokyo City University (Japan). Invited meeting in the Tokyo University. Research scholarship attributed to a research engineer (through UNINOVA).

14. Wireless Energy Transfer and (Electromagnetic) Induction Heating: Preparation (in course) of the shielded room for experiments, ordered equipment (already in Portugal) for induction heating (high and middle frequencies) which will be modified by several researchers in cooperation with APRONECS, Lda, to be used for the contactless energy transfer.

15. Switched Reluctance Machine (SRM) Control: development of two lab prototypes for the SRM angular position control, one with an encoder and the other without it (sensorless).

16. Fractional power superconducting motors: different motors developed, compared and analysed, namely an ironless linear synchronous motor with superconducting armature and excitation system; a variable poles hysteresis disc motor with superconducting rotor; and an induction disc motor with superconducting armature (in iron and ironless topologies).

17. Superconducting fault current limiters: original modelling and simulation tool for inductive current limiters with bulk superconductor in the secondary.

18. Patents: Polyphase motor with variable number of poles (WO/2010/013226) – The invention consists in a polyphase motor and operating system thereof that allows obtaining an arbitrary relation of the number of magnetic poles without mechanical commutations within the stator.

Summary Tables

	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	0	17	0,0	4,1
Journals A/A+	0	7	0,0	1,7
Conferences	52	59	26,0	14,3
Conferences A/A+	3	29	1,5	7,0
MSc Theses	8	27	4,0	6,5
PhD Students	4	14	2,0	3,4
PhD Theses	0	3	0,0	0,7
Teams PhD	*2*	*4,13*		

Global data
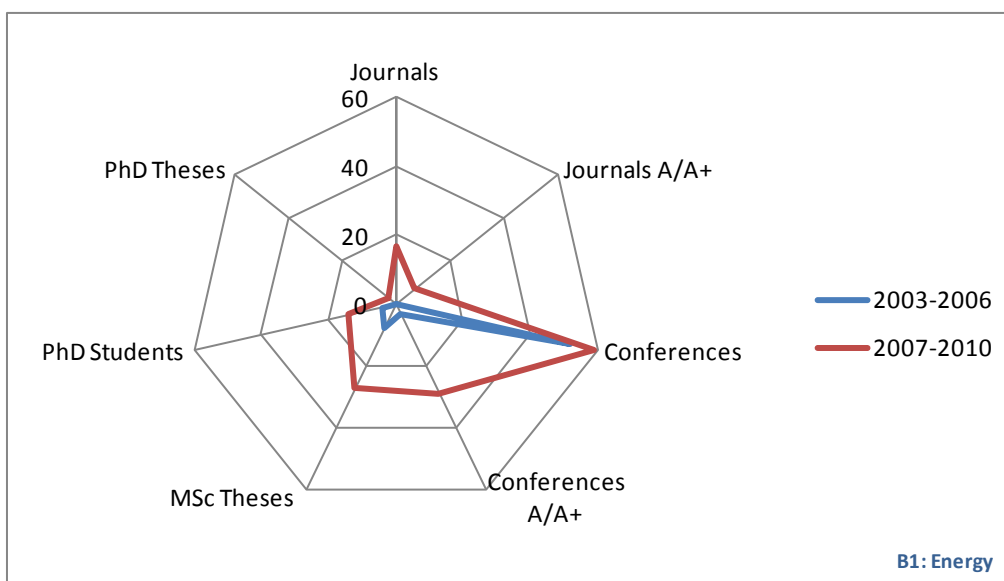
B1: Energy

	Journals	2003-2006	2007-2010
A+	IEEE Transactions on Industrial Electronics		3
A+	IEEE Transactions on Power Electronics		1
A+	Energy Conversion and Management		3
B	Engineering Applications of Artificial Intelligence	1	1
B	International Journal of Electrical Power & Energy Systems		1
C	Physica C		1
C	Journal of Superconductivity and Novel Magnetism		1
	Total	1	11
	Total Others	1	3
	Grand Total	2	14
	Cites	0	73

	Conferences	2003-2006	2007-2010
A+	IECON - Annual Conference of the IEEE Industrial Electronics Society		6
A+	IEEE ECCE (was PESC+IAS) - IEEE Energy Conversion Congress and Expo	1	
A+	EPE-PEMC (was PEMC) – Conference on Power Electronics and Motion Control		
A+	INTELEC - International Telecommunications Energy Conference		
A+	ASC – Applied Superconductivity Conference		2
A	POWERENG - International Conference on Power Engineering, Energy and Electrical Drives		11
A	ISIE – International Symposium on Industrial Electronics		1
A	PEDS - International Conference on Power Electronics and Drive Systems		3
A	EUCAS - European Conference on Applied Superconductivity	3	6
B	ETFA – IEEE International Conference on Emerging Technologies and Factory Automation		1
B	Conference on Telecommunications	2	
B	EDUCON - IEEE Engineering Education		1
	Total	6	31
	Total Others	3	33
	Grand Total	9	64

Introduction

This line of research refers to the application of electronics and electrical sciences for the enhancement of industrial processes and energy efficiency. This line of research concerns with the latest developments in intelligent and computer control systems, modelling and control of distributed parameter systems, industrial agents, electrical machines and drives, power electronics, robotics, factory automation and flexible manufacturing, building automation, power quality, renewable energies, energy efficiency and the sustainable development of these technologies.

Research

The research of our group focuses on electrical energy efficiency and the sustainable development of inherent technologies. Particular areas of interest are:

Modern Electric Energy Processing
- Advanced Power Electronics and Modern Energy Converters
- Wireless Energy Transfer
- Induction Heating (High and Middle Frequencies)
- Electric Vehicles and Hybrid Electric Vehicles, Battery Management
- Energy Harvesting, Energy Recuperation, Self-Powered Energy Consumers
- Conversion of Renewable Energies, Efficiency Maximizing
- Grid and End-User Efficiency

Alternative Energies and Electrical Drives
- Machines Design
- Fault Diagnosis and Fault Tolerant Operation
- Control and Simulation
- Intelligent Control and power quality
- Alternative energies and intelligent buildings

Superconductivity and Low Temperature Electrotechnics
- Design and Modelling of Power Systems Employing High Temperature Superconductors
- Fractional Horsepower Superconducting Motors
- Superconducting Fault Current Limiters
- Characterization of Electrical Materials and Devices at Cryogenic Temperatures

Area characterization:

Modern Electric Energy Processing (Power Electronics)
Modern Energy Processing involves the recent trends in power electronics aimed to achieve: a) the highest possible efficiency of power convertors (e.g. through soft switching and resonant conversion); b) the most efficient storage of energy (e.g. by

modern battery stacks management); c) the efficient utilization of environment energies (e.g. mechanical, thermal, electromagnetic) as additional autonomous sources of electrical energy (including the specific power converters); d) the most convenient and efficient transfer of electrical energy applying non-conventional methods (e.g. contactless charging, rotary transformer, high-frequency energy beams, etc.)

Alternative Energies and Electrical Drives

Alternative Energies and Electrical Drives is concerned with the design, supply, operation and control of electrical drives, to meet the future demand of energy usage while satisfying the current and future environmental constrains. These concerns cover several topics, going from the supplied energy, the design of the drive itself, its control and related power quality issues, fault diagnosis and fault tolerant operation, to its integration into modern intelligent facilities. The research approach involves, not only technological issues, but also mathematical and computational techniques for modelling, estimation and control of these systems.

Superconductivity and Low Temperature Electrotechnics

This research area is related with the application of high temperature superconductors (HTS) in power systems, due to the specific properties of these materials, as non-linear impedance, flux pinning, diamagnetic behaviour and low losses when compared to conventional conductors. Amongst the investigated systems there is a special focus on fractional horsepower motors and fault current limiters. Other aspects of superconducting technologies are developed, as cryogenic characterization of ferromagnetic materials for HTS power transformers, or power electronics for cryogenic drives. A strong effort is dedicated to the development of modelling techniques for design and simulation of HTS materials and devices.

Ongoing research themes:

1- *Renewable Energies and End-User Efficiency (2 PhD ongoing)*
   a. Home Energy Adviser: Worldwide energy demand with carbon footprint environmental consequences is the problem context. Housing in the EU contributes approximately 25% of all CO_2 emissions; therefore, it is imperative to find robust methodologies to reduce it. How energy efficient "home-styles" (our living in our house) can contribute to valuable savings in root energy consumption without unduly compromising comfort and convenience must be addressed. This is essential for countries to meet the national, European and world targets for energy reduction (and renewable sources).
   b. Monitoring and Control for Large Complexes Electrical Distribution: Simply understanding where and how you use energy can yield up to 10% savings without any capital investment, using only procedural and behavioural changes. Sustaining an energy management program costs around 1 to 2% of total energy expenditures and consumption can be reduced anywhere from 10 to 40%. Metering, remote monitoring and

control must provide information that evokes confidence in decision making and helps users to keep sustained savings: 1) Energy use analysis & tariff optimization with power management systems; 2) Energy savings with Control; 3) Energy reliability for continuity in critical applications. The use of the IEC61850 standard in order to integrate renewable production equipment, distribution equipment and building automation systems is essential to meet the aforementioned goals.

c. Solar tri-generation Systems: Using Solar Energy as an energy source for conversion into electrical energy, heat and cold (in a process that will be renamed as Solar Trigeneration) it is an important feature to meet the objectives of end-user's energy efficiency. The goal is to develop an integrated solution for integration in buildings that includes the solar trigeneration with the following basic characteristics: 1) Electricity - 3.68 kW; 2) Solar Hot Water - 250 liters of water per day; 3) Cold and heat - 15 to 20 kWt.

2- *Fault diagnosis and fault tolerant operation in electromechanical systems (1 PhD ongoing)*

a. Fault diagnosis: Most failures of electrical machines interrupts the process, with the corresponding reduction in output, and may even cause damage to other machinery installation. The machine control system associated with an efficient diagnosis of electrical and mechanical failures will avoid costly repairs and lost production. Maintenance costs will also be reduced based on an appropriate maintenance strategy. Integrated innovative fault detection algorithms, both for the electric machine and the power electronics converter, are being pursued in order to increase the efficiency of the diagnosis process.

b. Fault tolerant operation: No electrical drive is free of malfunction under a specific combination of single or simultaneous faults (either in the electrical machine either in the power electronics converter). Fault tolerant operation should be implemented as a dynamic control procedure that takes into account the type of fault and the under fault performance electrical drive goals.

3. ***The use of Switched Reluctance Machine as motor and generator (1 finished PhD and 1 PhD ongoing)***

a. Position Control of a SRM: The Switched Reluctance Machine is, nowadays, assuming a strong position in the industrial and domestic market replacing successfully other electrical machines. This is due, not only by its good performance and robustness but also by its low cost in production and maintenance. However the nonlinearities that

characterize it, present a challenge when trying to apply it in the most demanding motion drives such as the angular shaft position control.

b. <u>The SRM in Wind Energy Systems:</u> The Switched Reluctance Machine is nowadays a good alternative in several industrial and domestic applications. Its operation as electrical generator has not been much explored by researchers compared with the motor operation. The study is focused on the operation of a Switched Reluctance Generator (SRG) in a stand-alone system of renewable electrical energy production with wind turbines.

4. *New Energies and Technologies, and their economical and behavioural impact in the Power Grid (2 PhD ongoing)*

a. <u>Integration of Electric Vehicles into the Portuguese Power System-Impacts on Renewable Penetration:</u> The increasing integration of renewable energy in electrical grids may cause unbalances between production and demand of electrical energy and this unbalance can lead to partial cuts in renewable production. The integration of the electric vehicles (EVs) in the transportation sector can contribute to increase penetration of renewable generation on the grid, as it will originate a distributed storage capacity, which potentially contributes to mitigate the referred unbalances. In a way that they can be used to store the excess renewable wind energy and contribute to flatten the load curve by means of charging their batteries during the night, EVs can contribute to increase the penetration of intermittent renewable energies (such as wind power) in the Portuguese electricity grid. However the impact of the additional EVs load on the Electric grid has to be addressed. Thus it is important to know what will be the impacts of EVs integration into the Portuguese grid and in what a way EVs can help to assist a stronger penetration of renewable generation on the Portuguese grid. In this study impacts of EVs on renewable integration in the grid as well as environmental impacts will be studied under different penetration scenarios and different charging profiles.

b. <u>Estimation and Recognition of Electrical Power Demand Patterns:</u> Until the 80's decade of the XXth century, the electrical power industry was organized as "vertical2 companies, which produced, transported, distributed and commercialized the electrical power, and owned the physical grid of lines. Since then, the electrical grid has becoming the physical support of multiple free producers, consumers and traders, which access the grid in a competition environment. The recent innovations in the independent production area have spurred this new situation. This new free-economy power trade allows for the existence of Retail Companies (RESCO), but these must adopt a dynamic prices

system and adopt a Demand Side Management (DSM) strategy. In this course, the load estimation and load pattern recognition is an important tool to assist the companies' management strategy. This work intends to develop electrical load estimation and pattern recognition techniques to be used in the Electrical Power free market.

5. ***Design and modelling of power systems employing high temperature superconductors (1 finished PhD)***

   a. <u>All superconducting synchronous linear motor:</u> one of the foreseen advantages in employing HTS material in fractional horsepower motors is related with eliminating conventional conductors and ferromagnetic materials, leading to lighter and compact machines. The study was concerned with developing numerical methodologies for the analysis of an ironless synchronous linear motor with superconductors in the armature and excitation system.

   b. <u>Modelling of superconducting inductive fault current limiters:</u> the integration of renewable and embedded generation in power grids raises questions as the increase in the levels of fault currents. HTS current limiters are a solution to obviate these problems, and the research was focused on modelling these devices allowing building a simple design and simulation tool.

6. ***Wireless Energy Transfer (2 PhD ongoing)***

   a. <u>Energy Transfer at High Power without Wires:</u> The contactless energy transmission was started in the end of 1900s by Dr. Nicola Tesla. His experiments did not succeed completely, because of the insufficient technology level at that time. The idea is now being developed further (again) by many researchers, e.g. from the University of Auckland (New Zealand), MIT (USA), KAIST (Korean Republic), Tokyo University (Japan), etc. The energy transfer methods generally involve electromagnetic waves, resonant processes, higher frequencies, etc. It is still limited to short distance/high power or larger distance/low power. The transfer of energy (both) at higher power level and larger distance is a problem and an attractive challenge.

   b. <u>Electric Vehicle Battery (Fast) Charging without Wires:</u> The contactless energy transfer is a method that attracts the technology developers since 1980s with a varied success. The main problem is the efficiency and the battery life which depend strongly on the applied method of energy transfer, battery type, etc. This challenge worth the efforts to obtain a better and more scientific answer to the problem of the battery charge.

7. *Energy Harvesting (2 PhD ongoing)*

a. Autonomous Power obtained from the Highways, Thermal Power Turbines, Buildings Constructions, etc.: Energy Harvesting is a method of obtaining electric energy from not conventional sources, thus making possible self-powered autonomous devices. It was started in the 1990s but is rapidly gaining speed. The challenge is in the quantity of energy (very low) that is collected, but can be joined from many sources of mechanical vibrations, light, etc. to achieve reasonable level of supplied power.

b. Human Body Energy Harvesting: The life supporting devices and many biomedical sensors depend on battery supply which can be successfully substituted by Energy Harvesting (a method that obtains electric energy from the human body functioning), thus making possible to avoid periodic surgery or guarantee a more normal life to diseased persons. The challenge is in the very small quantity of energy that the human body leaves to be harvested.

Projects

Ongoing projects on 2007 and thereafter

RenH2 - Stand-Alone Energy System Supported by Totally Renewable Hydrogen Production - 2005/ 2009.
Partners: ESTSetúbal/IPS, FCT/UNL, INETI, IPTomar.
Global Budget: 99,635 €

Research on the Power Inverter and the Control System for Solar Energy Photovoltaic Power Plant System - 2010/2012.
Partners: ESTSetúbal/IPS, FCT/UNL and China University of Mining & Technology.
Global Budget: 7,000 €

COST Action 542 - High Performance Energy Storages for Mobile and Stationary Applications: HPSMT – 2006 – 2010.
Country Partners: Belgium, Bulgaria, Czech Republic, Estonia, France, Germany, Greece, Ireland, Israel, Italy, Lithuania, Latvia, Netherlands, Portugal, Romania, Spain, United Kingdom.

NEMO & CODED - NEtworked MOnitoring & COntrol, Diagnostic for Electrical Distribution – 2010 - 2012.
Partners: CRITICAL SOFTWARE,FCT/UNL, ATECNIC.
Global Budget: 122,000 €

SOL3 - Development of a Trigeneration Solar System for single family homes – 2010 - 2012.
Partners: SELFENERGY, FCT/UNL, LNEG, ESTSetúbal/IPSsetúbal.
Global Budget: 528.867 €

"**DIEMIGO** (De Integratie van Elektrische Mobiliteit In de Gebouwde Omgeving = The Integration of Electric Mobility in the Builded Environment)", 2009-2010
Partners: European Union, Industry (Schiphol Group), TU Delft
Global Budget: 500000 €

FLUCON EN –Turbo-Hydraulic Generator - 2010-2012
Partners: VALCON Ltd., Tecnilab Portugal SA, FCT-UNL (Department of Environment Engineering), 2010-2012
Global Budget: 200000€.

HARV4CO (energy HARVesting network FOR university-enterprise COoperation), a TEMPUS IV Joint Project - 2010-2012
Partners: EU, Universities from Spain, Portugal, Ucraine, Bulgaria, UNINOVA / FCT
Global Budget: 538.891,91 €

SERVROBOT (Service robot, reconfigurable, off-road, with autonomous behavior) - 2010-2012
Partners:UNINOVA (UNL), HOLOS, IAPMEI
Global Budget: 559.949,87 €

Program EU, Area 4.1: Unlocking and developing the research potential of research entities in the EU's convergence regions and outermost regions – REGPOT-2011-1

System for the Automatic Modelling of CMOS Ring Voltage Controlled Oscillators - 2005-2010
Partners: FFCT/FCT/UNL
Global Budget: 16.000,00 €

TAO-VCO - Technology-Aware Optimization of deep submicron of LC-VCOs - 2010-2011
Partners: FCT/UNL, ENIS- National Engineering School of Sfax (Tunisia)

Recognition

1. General Chair in international conferences: POWERENG

2. Chair in international conferences: INDIN, POWERENG, CPE, ICELIE, DÓCEIS, EUROCON

3. Keynote speaker: COBENGE 2010, International Symposium on Electric Vehicle and 2-nd Annual Conference of Polish Society for Environment Friendly Vehicles, Warsaw, 2010: "The Charging of Hybrid and Electrical Vehicles' Batteries: Contactless Energy Transfer as the key to the future", "An Insight to Potential Actions Facing Future Needs of Electric and Hybrid Electric Vehicles"

4. Invited lectures: Fault diagnosis in electrical machines (China University of Mining & Technology, China); Resonant Effects Applied in Power Conversion for Contactless Energy Transfer and Energy Harvesting (KAIST, Republic of Korea); Resonant Effects Applied in Power Conversion for Contactless Energy Transfer and Energy Harvesting (City University of Tokyo, Japan)

5. Seminars: Contactless Power Transfer (TU Delft and Tokyo University)

6. External expert consultant: Agência de Inovação (Portuguese Innovation Agency) and National innovation program (QREN)

7. Evaluator and reviewer activities: National research program (QREN); International Journals (IEEE Trans. on Industrial Electronics, IEEE Trans. on Power Electronics, IEEE Trans. on Circuits and Systems, Elsevier Energy Conversion and Management, Wiley International Journal of Energy Research, IEEE Transactions on Systems, Man, and Cybernetics, Elsevier Mechatronics, Elsevier Mechanical Systems and Signal Processing); International Conferences (PESC, ECCE, OPTIM, ICEST, ASC, ICSM, EUCAS, IECON, ISIE, ICELIE, PEDS, ICIT, INDIN, ETEP, MELECON, ICMLA, DoCEIS, HSI, EUROCON, POWERENG)

Collaboration   Colaboração

The Research Group has enlarged collaboration of ongoing research activities with other organizations at national and international level, i.e., joint publications in international conferences and journals, member of consortia of international and national projects, joint preparation of special issues in journals and organization of conferences and workshops, joint training activities, development of eLearning material, etc.

Internationally:

10. TU Delft, Netherlands (visiting teacher in 2009 and continuous collaboration with Prof. Bram Ferreira, Prof. Paul Bauer and other previous colleagues), ERASMUS;
11. Technische Hogeschool Delft, Prof.Ben Klaassens, TU Eindhoven, TU Delft, TNO, ECN, etc., coorganizing INTELEC 2011 in Amsterdam.
12. TU Sofia, Bulgaria (joint PhD students and continuous collaboration with Prof. Rumen Arnaudov, Prof. Antoaneta Popova and Prof.Marin Hristov (previous Vice Rector and from 2011 future Rector, the same signed the mutual agreement with Prof. Leopoldo Guimaraes, some years ago)), ERASMUS, joint publications with R.Arnaudov, Kostadin Brandisky (Dean Electr. Engg.) and others;
13. University of Transport of Sofia, Bulgaria (joint PhD students and continuous collaboration with Prof. Vikenti Spasov and Prof Petar Kolev (Rector))), ERASMUS;
14. Warsaw University of Technology (Politechnica Warszawska), Poland (continuous collaboration with Prof. Antoni Szumanowski and Prof. Marian Kazmierkowski)), ERASMUS;
15. Bucarest University, Prof. Aurelian Craciunescu, Dean Electrical Engineering (working together in 1987, TU Delft), já temos ERASMUS assinado
16. University of Tokyo, Prof Yoichi Hori (Hori Laboratory), scientific cooperation
17. City University of Tokyo, Prof Yoshikazu Kanamiya, scientific cooperation
18. Korea Advanced Institute of Science and Technology, Prof. Seong Jeub Jeon, scientific cooperation
19. Technical
                              . Antoni Grau);
20. Universidade Federal de Itajubá, Itajubá, Brasil (joint publication with Prof. Borges da Silva);
21. Universidade Autónoma de Madrid, Spain, Romania (joint publication with Prof. Carlos Aguirre);
22. Universidad de Extremadura, Badajoz, Spain (joint publications and continuous collaboration with Prof. Alfredo Alvarez);
23. Universidad de Extremadura, Badajoz, Spain (continuous collaboration and project proposal with Prof. Enrique Romero Cadaval);
24. Universidad de Malaga, Spain (continuous collaboration and conference joint organization with Prof. Jose Aguado);
25. China University of Mining & Technolog, Prof. Chen Hao, scientific cooperation.

Nationally:

1. Universidade de Évora: Energy efficiency and fault diagnosis (joint publications with Prof. João Figueiredo and Prof. Fernando Janeiro).
2. Instituto Superior Técnico: Electrical Drives (joint publications with Prof. António Dente, Prof. Paulo Branco, Prof. Fernando Silva and Prof. Rui Castro).
3. Instituto Politécnico de Setúbal: Energy and Electrical Drives (project collaboration and joint publications with Prof. Vitor Pires, Prof. Páscoa Dias, Prof. Sousa Martins and Prof. Paulo Santos).
4. LNEG (former INETI): Renewable Energies (project collaboration and joint publications with Dr. Antonio Joyce and Dra. Carmen Rangel).
5. INESC-Coimbra: Energy forecasting (joint publications with Prof. Antonio Gomes Martins).
6. Department of Mech Eng. FCT, joint publ. with Prof Pamies Teixeira
7. IST-UTL, Center of Math Studies, joint publ. with Prof Svilen Valtchev

Outreach

Conference Proceedings in Book Form

- Emerging Trends in Technological Innovation. Editors Luis M. Camarinha-Matos, Pedro Pereira, Luis Ribeiro. Doctoral Conference on Computing, Electrical and Industrial Systems - DoCEIS'10. Published by Springer, ISBN 978-3-642-11627-8, eISBN 978-3-642-11628-5, 2010.

General Conference Chair

- 2ND International Conference on Power Engineering, Energy and Electrical Drives – POWERENG2009, IES/IEEE, Portugal, 18-20 March 2009
- 1ST International Conference on Power Engineering, Energy and Electrical Drives – POWERENG2007, IES/IEEE, Portugal, 12-14 April 2007

Scientific, Programme, Advisory Chair

- Program Chair, 2ND International Conference on Power Engineering, Energy and Electrical Drives – POWERENG2009, IES/IEEE, Portugal, 18-20 March 2009
- Program Chair, 1ST International Conference on Power Engineering, Energy and Electrical Drives – POWERENG2007, IES/IEEE, Portugal, 12-14 April 2007
- Section Chair of POWERENG'09, ICEST´2009, OPTIM´2010

Other organizing activities

- Workshop organizer, European Network for Supercapacitors Session, COST Action 542 (High Performance Energy Storages for Mobile and Stationary Applications). Portugal, 18-20 March 2009.
- Conference organizer, Second International Conference on Power Engineering, Energy and Electrical Drives, POWERENG2009. Portugal, 18-20 March 2009.
- Conference organizer, Doctoral Conference on Computing, Electrical and Industrial Systems - DoCEIS'10. Portugal, 22-24 February 2010.
- since 2008 - Conference organizer and technical program, INTELEC (the oldest now Power Electronics conference)

Editorial Boards and referee of Books and Journal Articles

Reviewer/Referee for books and articles in international journals: IEEE Trans. on Industrial Electronics, IEEE Trans. on Power Electronics, IEEE Trans. on Circuits and Systems, Elsevier Energy Conversion and Management, Wiley International Journal of Energy Research, IEEE Transactions on Systems, Man, and Cybernetics, Elsevier Mechatronics, Elsevier Mechanical Systems and Signal Processing

Total of perform reviews to present: 49

Keynote/Invited speaker

- Keynote Speaker for International Symposium on Electric Vehicle and 2-nd Annual Conference of Polish Society for Environment Friendly Vehicles, Warsaw

Scientific / Technical organizations

- Institute of Electrical and Electronic Engineers
- Power Electronics Society of IEEE
- Industrial Electronics Society of IEEE
- Instrumentation Society of IEEE

Education & Training

A completely new two-years MSc program of studies was created aimed at the Renewable Energy Engineering, designated as MERCEUS, i.e. Master's Degree in Renewable Energies and Sustainable Development. Many subjects are new and specially prepared for the course by the group.

Several foreign ERASMUS students were taught, several Portuguese students studied abroad.

New ERASMUS exchange treaties started: with TU Delft / the Netherlands, with Technical University of Warsaw / Poland, with University of Bucharest / Romania, with University of Transport in Sofia and with Technical University of Sofia / Bulgaria. Many students are already admitted for those new exchanges.

Facilities

The acquisition of new equipment was relatively successful. The major part of the acquired equipment will be beneficial for the department and for the entire faculty.

A High-voltage laboratory is equipped.

A screened room for experiments (Faraday Cage) is in process of construction for the experiments of wireless energy transfer and for other measurements and experiments that require shielding from electromagnetic emissions.

Energy harvesting: Piezoelectric devices were acquired from the Smart Materials Company in Dresden, affiliated to the company in USA, created by NASA. With the cooperation of the Department of Mechanical Engineering, some students are successfully working on their theses.

Contactless energy transfer: High-frequency power generators were acquired, originally intended for ultrasonic and dielectric heating (middle and high frequencies), type APRONECS, more than 2 kW each, which will be modified and used by several MSc and PhD researchers in cooperation with APRONECS, Lda, for contactless energy transfer.

A weather acquisition system, composed by: a DCG-40800 Em50 logger (5 channel, all Decagon sensors); a DCG-40006 Pyranometer with levelling plate; a DCG-40030 Davis cup anemometer; a DCG-40651 Air and a Soil Temperature Sensor. An integrated acquisition system (in correlation with renewable energy production) was already developed by DEE's students.

Renewable energy source: A fuel cell system is acquired from Ballard Company, type 1,2kW Nexa Fuel Cell Power Module. It provides up to 1200 watts of DC power at a nominal output voltage of 26 VDC. The fuel cell is connected to the DEE building electrical network through a "HydroBoy" power inverter.

Renewable energy source: A wind generator of 2 kW (3.2 m diameter) is bought from Yangzhou Shenzhou and mounted on the roof of the DEE building. It delivers 3 phase AC voltage to the power converters, and protection circuits were acquired from SWEA (the Netherlands). The converters are connected to inject energy to the DEE building electrical network.

Renewable energy source: A set of 7 Photovoltaic panels are mounted on the roof of the DEE building and with the 3 power converters (acquired from SWEA, the Netherlands), each one rated 250W nominal power. They deliver energy to the DEE building electrical network.

Superconductivity and Low Temperature Electric Equipment: Equipment acquired for one laboratory of low temperature tests and measurements: Power transformers with rated secondary currents up to 100 Arms; Electronically controlled current sources; Torque sensors; Lock-in amplifier; Liquid nitrogen Dewar Flasks; Computational infrastructure for the research foreseen, based on finite elements software simulation programs.

Strategy

6. Develop the inherent activities and increase the productivity always improving quality and merge all the knowledge and different expertise from sub research-areas of CTS targeting the design of complete energy based solutions;

7. Reinforce national and international cooperation emphasizing interdisciplinary work, namely integrating complete SoC solutions;

8. Encourage all staff and Ph.D. students to disseminate their research results priory in journals with major 5-Years impact factors and in leading international conferences (accordingly to the DEE Publishing Reference List);

9. Reinforce work and collaboration in the area of energy efficiency and related areas

Production

Books (with ISBN)

Conference Proceedings in Book Form
Total: 1

1. Emerging Trends in Technological Innovation. Editors Luis M. Camarinha-Matos, Pedro Pereira, Luis Ribeiro. Doctoral Conference on Computing, Electrical and Industrial Systems - DoCEIS'10. Published by Springer, ISBN 978-3-642-11627-8, eISBN 978-3-642-11628-5, 2010.

Refereed Book Chapters

*NOTE: **Not included** here are articles and addresses presented at conferences, published only in the conference's proceedings/minutes, even when these are published in book form (with ISBN).*

Total 2007-2010: 3, annual average: 0,75

1. "RenH2 – A Stand-Alone Sustainable Renewable Energy System"; João Martins, Carmen M. Rangel, António Joyce, João Sotomayor, Armando Pires, Rui Castro, Renewable Energy, T J Hammons (Ed.), December 2009, ISBN: 978-953-7619-52-7, INTECH.

2. "Image Processing based Classifier for Detection and Diagnosis of Induction Motor Stator Fault"; T. G. Amaral, V. F. Pires, J. F. Martins, A. J. Pires and M. M. Crisóstomo, Image Processing, Yung-Sheng Chen (Ed.), December 2009, ISBN: 978-953-307-026-1, INTECH.

3. "PLC Control and Matlab/Simulink Simulations – A Translation Approach", Joao Martins, Celson Lima, Antoni Grau and Herminio Martinez, Matlab - Modelling, Programming and Simulations, ISBN 978-953-7619-X-X, Sciyo, 2010.

Refereed Articles in Journals

NOTE: This section does not include editorial articles.

Total 2007 and following: 14, annual average: 3,5

2007

1. "Unsupervised Neural-Network Based Algorithm for an On-Line Diagnosis of Three-Phase Induction Motor Stator Fault"; J. F. Martins, V. Fernão Pires, A. J. Pires; IEEE Trans. on Industrial Electronics, vol. 54, no. 1, pp. 259-264, Feb 2007. (ISI WoS IF: 4.678, cites: 44)

2. "Entropy Based Choice of a Neural Network Drive Model"; J. F. Martins, P. J. Santos, A. J. Pires, L. E. Borges da Silva and R. Vilela Mendes; IEEE Trans. on Industrial Electronics, vol. 54, no. 1, pp. 110-116, Feb 2007. (ISI WoS IF: 4.678, cites: 7)

3. "Designing the input vector to ANN-based models for short-term load forecast in electricity distribution systems"; P. J. Santos, A. G. Martins, A. J. Pires; International Journal of Electrical Power & Energy Systems, Elsevier Science Ltd. – vol. 29, nº4, pp. 338-347, May 2007. (ISI WoS, cites: 7)

2008

4. "Design and Implementation of a Reconfigurable Remote Laboratory, Using Oscilloscope/PLC Network for WWW Access"; Rui Marques, Jaime Rocha, Silviano Rafael, J. F. Martins. IEEE Trans. on Industrial Electronics, vol. 55, no. 6, pp. 2425-2432, June 2008. (ISI WoS IF: 4.678, cites: 8)

5. "Next hour load forecast in medium voltage electricity distribution"; P. Jorge Santos, A. Gomes Martins, A. J. Pires; International Journal of Energy Sector Management, Special issue on Operational Research Models and Methods in the Energy Sector, Vol. 2, n.º 3, 2008 - pp.439-448, Emerald Group Publishing Limited, 1750-6220. (ISI WoS, cites: 0)

2009

6. "From controlled dynamical systems to context-dependent grammars: A connectionistic approach"; J.F. Martins, J.A. Dente, A.J. Pires and R. Vilela Mendes. Engineering Applications of Artificial Intelligence (Elsevier), 22 (March 2009) 192–200. (ISI WoS IF: 1.444, cites: 0)

7. "Rotor cage fault diagnosis in three-phase induction motors based on a current and virtual flux approach"; Dulce F. Pires, V. Fernão Pires, J.F. Martins, A.J. Pires. Energy Conversion and Management, (Elsevier), 50, Issue 4, (2009) 1026–1032. (ISI WoS IF: 1.944, cites: 7)

8. "Three-Phase PWM Rectifier Employing Two Single-Phase Buck-Boost PFC Modules and a Scott Transformer"; Vitor Fernão Pires, Manuel Guerreiro, João F. Martins, Jose Fernando Silva, PRZEGLĄD ELEKTROTECHNICZNY (Electrical Review), ISSN 0033-2097, R. 85 NR 10/2009. (Cites: 0)

9. "Reluctance machines incorporating high temperature superconducting materials on the rotor"; A.L. Rodrigues, A.J. Pires; Physica C (ELSEVIER), 470 (2010), pp. 98-103. (ISI WoS, cites: 0)

10. Valtchev, S., K. Brandisky, B. Borges, J. B. Klaassens, Resonant Contactless Energy Transfer with Improved Efficiency, IEEE Transactions on Power Electronics, vol. 24, No. 3, pp. 685–699, 2009.

2010

11. "Eigenvector/eigenvalue analysis of a 3D current referential fault detection and diagnosis of an induction motor"; V. Fernão Pires, J.F. Martins and A.J. Pires; Energy Conversion and Management (Elsevier), 51, Issue 6 (2010) 901–907. (ISI WoS IF: 1.944, cites: 0)

12. "Energy Production System Management - Renewable energy power supply integration with Building Automation System"; Joao Figueiredo, Joao Martins, Energy Conversion and Management (Elsevier), 51, Issue 6, (2010) 1120-1126. (ISI WoS IF: 1.944, cites: 0)

13. "Development of an experimental system for teaching induction motors with fault detection and diagnosis capabilities"; V. Fernão Pires, J.F. Martins and Tito G. Amaral; Computer Applications in Engineering Education (Wiley), March 2010. (ISI WoS IF: 0.556, cites: 0)

14. A. Gonçalves Pronto, M. Ventim Neves, A. Leão Rodrigues, "Measurement and Separation of Magnetic Losses at Room and Cryogenic Temperature for Three Types of Steels Used in HTS Transformers", Journal of Superconductivity and Novel Magnetism, September 2010, Springer.

15. "Induction Motor Fault Detection and Diagnosis Using a Current State Space Pattern Recognition"; J.F. Martins, V. Fernão Pires, and Tito Amaral; Pattern Recognition Letters (Elsevier), accepted for publication. (ISI WoS IF: 1.303)

16. Pina, J., Inácio, D., Luís, G., Ceballos, J. M., Pereira, P. M., Martins, J., Ventim Neves, M., Álvarez, A., Rodrigues, A., "Research and Development of Alternative Concepts in HTS Machines", accepted for publication on IEEE Transactions on Applied Superconductivity. (ISI WoS IF: 1.31).

17. Inácio, D., Pina, J., Martins, J., Ventim Neves, M., "Experimental characterization of a Conventional (Aluminum) and a Superconducting (YBCO) Axial Flux Disc Motor", accepted for publication on IEEE Transactions on Applied Superconductivity. (ISI WoS IF: 1.31).

Refereed International Conferences

Total 2007 and following: 59, annual average: 14,75

2007

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1. "PLC controlled industrial processes on-line simulator"; V Pinto, S. Rafael, J: F: Martins; IEEE International Symposium on Industrial Electronics, ISIE 2007, 4-7 Junho 2007, Vigo, Espanha. (Cites: 2)

2. "Image Processing to a Neuro-Fuzzy Classifier for Detection and Diagnosis of Induction Motor Stator Fault"; Tito G. Amaral, V. Fernão Pires, J. F. Martins, A. J. Pires, Manuel M. Crisostomo; IEEE IECON 2007, November 5-8, 2007, Taipei, Taiwan. (Cites: 1)

3. "A Single Stage Flyback PFC Converter for Testing Distance Relay Systems"; V. Fernão Pires, J. F. Martins, J. Fernando Silva; PEDS 2007, November 27-30, 2007, Bangkok, Thailand. (Cites: 1)

4. "On-Line Diagnosis of Three-Phase Closed Loop Induction Motor Drives Using an Eigenvalue $\alpha\beta$– Vector Approach"; J. F. Martins, V. Fernão Pires, A. J. Pires; PEDS 2007, November 27-30, 2007, Bangkok, Thailand. (Cites: 0)

5. "RenH2 – Stand-Alone Energy System Supported by Totally Renewable Hydrogen Production"; J. F. Martins; Antonio Joyce; Carmen Rangel; João Sotomayor; Rui Castro; Armando Pires; João Carvalheiro; Raquel A. Silva; Susana Viana; POWERENG 2007, April 12-14, 2007, Setúbal, Portugal. (Cites: 2)

6. "Statistic Moment Based Method for the Detection and Diagnosis of Induction Motor Stator Fault"; Tito G. Amaral, V. Fernão Pires, J. F. Martins, A. J. Pires, Manuel M. Crisostomo; POWERENG 2007, April 12-14, 2007, Setúbal, Portugal. (Cites: 0)

7. "Delay Propagation of a CMOS Inverter Using the Nexp Transistor Model". Pereira, Pedro and Fino, Maria H. In: XXII Conference on Design of Circuits and Integrated Systems, 21-23 November, Sevilla - Spain. 2007 (Cites: 0)

8. "High Performance, Environment Friendly, Modular and Fault To-lerant Renewable Energy Microgrid". Pina, João and Caracaleanu, C. and Gonçalves, A. and Pereira, Pedro and Valtchev, S and Neves, Mário and Rodrigues, A. In: 12th International Energy Conference & Exhibi-tion (ENERGEX2007), 26-30 Nov 2007, Singapore. (Cites: 0)

9. "Shaft Position for an 8/6 Switched Reluctance Machine: Theoretical concept, FEM analysis and Experimental results"; Silviano Rafael, P. J. Costa Branco, A. J. Pires – PEDS'07 - 7th International Conference on Power Electronics and Drive Systems – pp. 712-716 - Bangkok, Thailand, November 2007 – ISBN: 1-4244-0645-5. (ISI WoS, cites:0).

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31. "Modeling for Computer Simulation as a Tool for the Teaching of Transient Power Systems"; Luis Sousa Martins, Dulce Costa, Joao Martins and Vitor Pires, International Conference on Power Engineering, Energy and Electrical Drives (POWERENG 2009), Lisbon, Portugal March 2009. (Cites: 0)

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48. "Impact of Plug-in Electric Car Loading on Portuguese National Power Grid – An Analysis Methodology"; J. Beenken Braga, João F. Martins, 2010 International Symposium on Electric Vehicle, Warsaw, Poland, 07-08 July, 2010. (Cites: 0)

49. "Development of a mobile learning framework for analog electronics course"; Octavio Páscoa Dias, Vitor Fernao-Pires, Rui Madeira, João Martins; EDUCON2010, Madrid, Spain, April 14-16, 2010. (Cites: 0)

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51. "Disc Motor: Conventional and Superconductor Simulated Results Analysis", David Inácio, F. F. Martins, M. Ventim Neves, A. Álvarez, and Amadeu Rodrigues, Doctoral Conference on Computing, Electrical and Industrial Systems - DoCEIS'10, 22-24 February 2010, Caparica, Lisbon - Portugal. (Cites: 0)

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59. Pina, J., Ventim Neves, M., Álvarez, A., Rodrigues, A., "High Temperature Superconducting Fault Current Limiters as Enabling Technology in Electrical Grids with Increased Distributed Generation Penetration", In: Doctoral Conference on Computing, Electrical and Industrial Systems - DoCEIS'10, 22-24 February 2010, Caparica, Lisbon - Portugal. (ISI WoS, Cites: 0).

Doctoral and Post-doc Advising

Doctoral candidates, completed

- Desenho e Modelização de Sistemas de Energia Empregando Materiais Supercondutores de Alta Temperatura, João Murta Pina, 2010
  High temperature superconducting materials are foreseen as vehicles of important developments in the Energy field. Their electromagnetic properties, as the transport of electrical currents with minimal or virtually no losses when compared to conventional conductors; its high diamagnetism, never found in any other material; or flux pinning; allow for the advent of new technologies that would be unfeasible or even impossible in any other way. Amongst some of the (many) current energy issues that societies are facing, there is the distribution of energy in dense urban areas; the integration of distributed generation in existing grids; the need, not only economical, but also environmental, to reduce losses associated with energy generation, transmission and distribution; or even some specific problems as requirements to obtain lighter and compact electrical machines. For each of the above mentioned problems, superconductivity has one or several answers. Nevertheless, it is difficult to find commercial applications. This is due to several factors: the current electrical and electromechanical degree of maturation and reliability, which hinder the penetration of new alternatives; the unavailability of practical and efficient project tools; or the need for cryogenics, maybe the most important reason, but whose trivialization depends also on the advent of superconducting technologies. This thesis intends to answer to some of the above issues. First, a methodology for aided design of superconducting machines, without conventional materials such as copper, aluminium or iron, is presented. This is consolidated on a linear synchronous motor with superconductors on the armature and in the field excitation system. These materials are characterized, and its features used in the design of the device. Secondly, a methodology for modelling and design of inductive fault current limiters is described, whose ultimate goal is the simulation of these devices when integrated in more or less complex grids. One of this work's driving lines is the replacement of finite elements software, namely the package Flux2D, by the developed methodologies, unbeatably faster and, in certain cases, more adequate. On the other hand, only applications involving high temperature superconducting materials are considered, due to the possibility of operation in liquid nitrogen (77 K), much cheaper when compared with other technologies and temperatures range.

- Análise de Perdas em Sistemas de Energia que Empregam Materiais Supercondutores de Alta Temperatura, Anabela Gonçalves Pronto, 2010
  The discovery of high temperature superconductors, working at liquid nitrogen temperature, was the starting point to build up several power systems prototypes, namely power transformers. In these systems the efficiency is a fundamental aspect because the optimization of only some decimals of per cent will correspond to a considerable energetic save which is as higher as the machine power is.
  Superconducting transformers' allow the reduction of power losses through the substitution of copper conductors by superconductor materials, which electrical resistivity is almost null. Nevertheless, magnetic losses in transformers cores' are equal to that of conventional transformers or are worse, if cores are immersed in cryogenic liquids.
  Consequently, analysis of low temperature behaviour of electrical machines' structural and functional materials was become more important at least, because materials choice optimization could contribute even more for efficiency machine optimization.

In this work, some of the most important magnetic properties of three soft magnetic materials, are measured at room and liquid nitrogen temperature (298 K and 77 K, respectively). The main objective is to understand if magnetic materials chosen to integrate machines operating at 77 K should be the same that are used in room temperature operating machines. The chosen materials are usually used in transformers' cores: one, is a non-oriented grain silicon-iron alloy and the other two are grain oriented electrical steels. The materials have different thicknesses. Mainly to compare, measurements are also made in an amorphous silicon-iron alloy, also used in transformers.

Total magnetic losses are measured for all selected materials, at power frequency of 50 Hz and under sinusoidal excitation. Second, hysteresis losses are also measured, and classical and excess losses are determined. All measurements are made at both temperatures. Chemical composition, volume density and electrical resistivity are also measured.

The main achieved conclusion is that ferromagnetic materials used in conventional transformers do not optimize the efficiency of cold core superconducting transformer. It's necessary to produce electrical steels which composition and microstructure are specifically manipulated to use them at 77 K.

Several suggestions are made for future work, namely :

- quantification of materials thermal contraction at 77 K, and the study of magnetostrictive and magnetoresistive effects at low temperature,
- selection of other different crystalline electrical steels used in power transformers and their characterization, at room and cryogenic temperatures, using the Epstein Frame apparatus
- design and construction of a amorphous core to test at 298 and 77 K.

- Angular Position Control of an 8/6 Switched Reluctance Machine, Silviano Rafael, 2010

The Switched Reluctance Machine is, nowadays, assuming a strong position in the industrial and domestic market replacing successfully other electrical machines. This is due, not only by its good performance and robustness but also by its low cost in production and maintenance. However the nonlinearities that characterize it, present a challenge when trying to apply it in the most demanding motion drives such as the angular shaft position control.

In this thesis the study of geometry, the electromagnetic characteristic, the torque characteristic of the switched reluctance machine 8 / 6, as well as operating parameters for position control are presented. Also, it is presented a new control methodology applied to the angular position for switched reluctance machine with position sensor. This methodology is based on nonlinear control techniques well suited to the microprocessor systems.

Another method for angular position control based on indirect position measurement is presented and characterized. The indirect position measurement system proposed uses a frequency modulation technique to encode the induction coefficient. A new position control structure based on the classic controller is presented considering its suitability to the indirect position measurement system.

The development and implementation of the laboratory prototypes was a corollary of the proposed systems study. These prototypes allowed this thesis to be illustrated with experimental results of the developed systems performance and also allowed to validate the applied theoretical concepts.

Doctoral candidates, current (FCT/UNL)

- Fault Detection and Fault-Tolerant Control in Polyphase Induction Machine Electrical Drives, Daniel Foito (2013)
- "Energy Conversion Analysis and Characterization in the Superconductor Disc Motor", David Inácio (2013)
- "Service Based Architecture for Efficient and Dynamic Energy Systems", José Lima (2014)
- "Trigeneration Solar System", Pedro Magalhães, (2015)

- "Switched Reluctance Generator in Wind Power Electrical Production", Pedro Lobato (2013)
- "Optimal planning in Electrical Power Distribution", António Pombo (2014)
- "Energy Transfer at High Power without Wires", Elena Baikova (2014)
- Integration of Electric Vehicles into the Portuguese Power System-Impacts on Renewable Penetration, Ezequiel F. do Vale Carvalho (2013)
- Estimação e reconhecimento de padrões de consumo de energia eléctrica, Svetlana Chemetova (2014)

Masters advising

Masters, completed (pre-Bologna)

Masters, completed (Bologna)

- Projecto e Construção de um sistema de Monitorização de Energia Eléctrica para uma Habitação, João Gil Josué (2010)
- Projecto e ensaio de um motor de indução em disco com armadura supercondutora, Gonçalo Ferreira Luís (2010)
- "Sensor Devices for Solar Tracking", David Gomes (2010)
- "E-Cars integration into SmartGrids", José Braga (2010)
- "Supporting Decision Tool for Energy-Independent Housing specifications", Ricardo Francisco (2010)
- "Critical Analysis and Technical-Economic Feasibility of Autonomous Systems", Mário de Jesus (2010)
- "Energy Consumption Monitoring System for Large Complexes", André Jorge (2010)
- "PCA and NN Fuel Cell Modeling", Inês Gonçalves (2010)
- "Monitoring Weather Conditions for Renewable Energy Systems", Marcos Afonso (2010)
- "Direct Torque Control in Asynchronous Machines", Pedro Magalhães (2010)
- "Survey, Study and Critical Analysis of an Electrical Distribution Protection System", José do Ó (2010)
- "Matlab/Simulink Energy Systems Modeling", Teresa Deveza (2010)
- "Dimensionamento Automático de Consolas e Pêndulos para Sistemas de Tracção Eléctrica", Gonçalo Sena (2009)
- "Energy Efficiency and Energy Consumption Monitoring System", João Guerreiro (2009)
- Conversor DC-DC com busca de ponto de potência máxima (MPPT) para painéis solares, José Aniceto (2010)
- Seguidor fotovoltaico: uma variação do P&O - Simulação e Prototipagem. Paulo Bonifacio (2010)
- Accionamento de um Motor Passo a Passo com Velocidade e Direcção Controladas e com Binário de Arranque Aumentado. Pedro Sousa (2009)
- Projecto de uma caixa de velocidades eléctrica por meio da variação do número de pólos para motores em disco de rotor em alumínio e em materiais supercondutores de alta temperatura (SAT). Steve Inacio (2008).

- Gerador de baixa rotação para aproveitamento de energia das ondas, José Alberto Oliveira Lima (2010)
- Sistema de armazenamento de energia em bobinas supercondutoras, José Francisco Alcario Bergano Oliveira (2010)
- Protecção de um transformador de potência permitindo transitórios devido à saturação, Paulo Alexandre Claro Pimenta Nogueira (2010)
- Módulo fotovoltaico com seguimento da posição solar, Fernando Mapota Emanuel (2009)
- Electrificação de serviços primários em povoados remotos africanos recorrendo a sistemas solares fotovoltaicos (PV), Ricardo José Dias Leote (2009)
- Controlo de motor assíncrono aplicado a veículos eléctricos, Samuel Alexandre Magarreiro Granadeiro (2009)
- Controlo de geradores de indução duplamente alimentados em turbinas eólicas, Jorge Filipe da Silva Barros Ferreira (2009)
- Gerador Linear para aproveitamento da energia das ondas, Sebastião Neves da Silva Mesquita e Carmo (2009)
- Impacto do mercado ibérico de electricidade (MIBEL) no comportamento competitivo dos agentes produtores de energia eléctrica, Alexandra Filipa Costa Fernandes da Silva Tavares (2009)

List of 25 selected journal, classified based on "5 Year Impact Factor" criteria (A+>2 / Q1, A>1.5/Q1, B>1/Q2, C>0,5):

Rank	Journal Title	ISSN	Total Cites	Impact Factor	5-Year Impact Factor	Cited Half-Life	Eigenfactor Score	Article Influence Score	Rank SJR	Classif
1	Renewable & Sustainable Energy Reviews	1364-0321	2580	4,842	5,348	2,9	0,00979	1,388	Q1	A+
2	IEEE Transactions on Fuzzy Systems	1063-6706	5961	3,343	4,657	7,8	0,00944	1,024	Q1	A+
3	IEEE Transactions on Industrial Electronics	0278-0046	10306	4,678	4,535	4,3	0,01962	0,707	Q1	A+
4	Journal of Power Sources	0378-7753	33580	3,792	4,24	4	0,10336	0,93	Q1	A+
5	Applied Physics Letters	0003-6951	186353	3,554	3,78	5,6	0,71698	1,348	Q1	A+
6	IEEE Transactions on Energy Conversion	0885-8969	4146	2,635	3,326	6,6	0,01213	1,039	Q1	A+
7	IEEE Transactions on Power Electronics	0885-8993	7168	2,929	3,258	5,7	0,01485	0,624	Q1	A+
8	IEEE Transactions on Power Systems	0885-8950	10890	1,938	2,992	9	0,01922	0,771	Q2	B
9	IEEE Transactions on Intelligent Transportation Systems	1524-9050	1021	2,092	2,873	4,6	0,00325	0,637	Q1	A+
10	Energy Conversion and Management	0196-8904	6791	1,944	2,465	5,6	0,01933	0,641	Q1	A+
11	Journal of Applied Physics	0021-8979	115445	2,072	2,278	8,4	0,32238	0,877	Q1	A+
12	IEEE Transactions on Industry Applications	0093-9994	7818	1,298	2,11	>10,0	0,01236	0,655	Q1	A+
13	IEEE Transactions on Circuits and Systems I	1549-8328	6707	1,42	2,106	7,1	0,02573	0,93	Q1	A+
14	IOP Superconductor Science and Technology	0953-2048	4725	2,694	1,828	3,8	0,02025	0,587	Q1	A
15	Engineering Applications of Artificial Intelligence	0952-1976	1483	1,444	1,8	5,4	0,00436	0,459	Q2	B
16	Pattern Recognition Letters	0167-8655	4545	1,303	1,772	6,4	0,0131	0,56	Q1	A
17	International Journal of Energy Research	0363-907X	1783	1,928	1,71	6,5	0,00426	0,426	Q1	A
18	IEEE Transactions on Power Delivery	0885-8977	6906	1,161	1,578	9	0,01336	0,422	Q2	B
19	IEEE Transactions on Electromagnetic Compatibility	0018-9375	2092	1,294	1,567	8,3	0,00468	0,459	Q1	A
20	International Journal of Electrical Power & Energy Systems	0142-0615	1156	1,613	1,466	5,6	0,00362	0,421	Q2	B
21	IEEE Transactions on Education	0018-9359	1011	0,822	1,327	6,8	0,00137	0,205	Q2	B
22	IET Electric Power Applications	1751-8660	173	1,212	1,212	2,4	0,00093	0,326	Q2	B
23	IEEE Transactions on Magnetics	0018-9464	15429	1,061	1,176	8,4	0,03472	0,356	Q1	B
24	IEEE Transactions on Instrumentation and Measurement	0018-9456	4986	1,025	1,15	8,1	0,0113	0,332	Q2	B
25	IEEE Transactions on Applied Superconductivity	1051-8223	5275	1,31	1,002	4,5	0,01412	0,214	Q1	B

__List of 12 selected conferences, classified based on indexing, sponsors, indexing and interest/impact for the community in the scientific area__

Rank	Conference	Title	Sponsors	Indexing	Class
1	IECON	Annual Conference of the IEEE Industrial Electronics Society	IEEE, IEEE-IES	WoS, IEEE	A+
2	IEEE ECCE (PESC+IAS)	IEEE Energy Conversion Congress and Exposition	IEEE, IEEE-PELS	WoS, IEEE	A+
3	EPE-PEMC (PEMC)	Conference on Power Electronics and Motion Control	IEEE, IEEE-IES, IEEE-PELS	WoS, IEEE	A+
4	ASC	Applied Superconductivity Conference	IEEE-CSC	WoS, IEEE	A+
5	INTELEC	International Telecommunications Energy Conference	IEEE, IEEE-PELS, ECPE	Wos, IEEE	A+
6	POWERENG	International Conference on Power Engineering, Energy and Electrical Drives	IEEE, IEEE-IES, IEEE-PES	WoS, IEEE	A
7	ISIE	International Symposium on Industrial Electronics	IEEE, IEEE-IES, IEEE-CSS	WoS, IEEE	A
8	PEDS	International Conference on Power Electronics and Drive Systems	IEEE, IEEE-IES, IEEE-PELS	WoS, IEEE	A
9	CPE	International Conference-Workshop on Compatibility and Power Electronics	IEEE, IEEE-IES	WoS, IEEE	A
10	EUCAS	European Conference on Applied Superconductivity	Institute of Physics (IoP)	WoS, IoP	A
11	ISCM	International Conference on Superconductivity and Magnetism		WoS, Springer	B
12	EDUCON	IEEE Engineering Education	IEEE	IEEE	B

Advisors:

1. John G. Kassakian, professor of Electrical Engineering at the MIT and Director of the MIT Laboratory for Electromagnetic and Electronic Systems; Founding President of the Institute of Electrical and Electronic Engineers (IEEE) Power Electronics Society (PELS); Former President of IEEE/PELS; Fellow IEEE.
2. Dr. Mathias Noe, Director of the Institute for Technical Physics of Karlsruhe Institute of Technology.
3. Leopoldo G. Franquelo, professor of Electrical Engineering at the University of Seville, Spain; Vice-President for Conferences of the IEEE-IES (2004-2007); Associate Editor for the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS; President of IEEE-IES; Fellow IEEE.

Group B2: Intelligent Control and Decision Support Systems

Research Group Coordinator

- Rui Neves-Silva, *Assistant Professor*, rns@fct.unl.pt

Doctoral Research Team

- Rui Neves-Silva (RNS), *Assistant Professor*, rns@fct.unl.pt
- Fernando Coito (FJC), *Associate Professor*, fjvc@fct.unl.pt
- Luís Brito Palma (LBP), *Assistant Professor*, lbp@fct.unl.pt
- Ana Rita Campos (ARC), *Senior Researcher*, arc@uninova.pt

PhD students

- Maria Marques, *Researcher*, mcm@uninova.pt
- João Virote, *Junior Researcher*, jtv@fct.unl.pt
- Filipe Barata, *External Researcher*, filipebarata@deea.isel.ipl.pt
- Dora Gonçalves, *External Researcher*, dgoncalves@deetc.isel.ipl.pt
- Nuno Domingues, *External Researcher*, nndomingues@gmail.com

Summary

Main indicators and achievements:
This report mainly summarizes research activities undertaken from 2007 until 2010 (evaluation period).
Highlights of achievements:

1. Successful conclusion of PhD Thesis of Ana Rita Campos on *intelligent decision support systems for collaboration in industrial plants* (UNL - November, 2010).

2. Approval of EnPROVE project (FP7-ICT-2009-248061) under the research group's global coordination. The objective of the project is to develop a DSS on energy-efficiency in buildings (February, 2010).

3. Approval of AQUANET project (PTDC/EEA-CRO/102102/2008). The objective of the project is to develop control methodologies for water canals (January, 2010).

4. Successful conclusion of K-NET project (FP7-ICT-2007-215584) under the research group's global coordination. This project has achieved all its initial objectives including the installation of the full prototype of the knowledge enrichment platform in 3 real industrial environments (November, 2010).

5. Successful conclusion of InLife project (FP6-NMP2-CT-2005-517018) under the research group's global coordination. This project has achieved all its initial objectives including the installation of the full prototype of the life-cycle management system in 3 real industrial environments (October, 2008).

6. Successful conclusion of InAmI project (FP6-2004-IST-NMP-2-16788) under the research group's global coordination. This project has achieved all its initial objectives including the installation of the full prototype of the DSS collaboration platform in 3 real industrial environments (September, 2008).

7. Successful conclusion of FLOW project (POSC/EEA-SRI/61188/2004) under the research group's global coordination (February, 2008).

8. Successful conclusion of PhD Thesis of Luis Brito Palma on *fault detection, diagnosis and fault tolerance approaches in dynamic systems based on black-box models*. (UNL - October, 2007).

9. Successful conclusion of PhD Thesis of José Manuel Igreja on *adaptive control of processes with transport phenomena*. (IST-UTL, 2007).

Summary Tables

	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	8	3	8,0	1,0
Journals A/A+	6	0	6,0	0,0
Conferences	36	39	36,0	13,0
Conferences A/A+	14	8	14,0	2,7
MSc Theses	5	4	5,0	1,3
PhD Students	1	5	1,0	1,7
PhD Theses	0	3	0,0	1,0
Teams PhD	1	3		

Global data
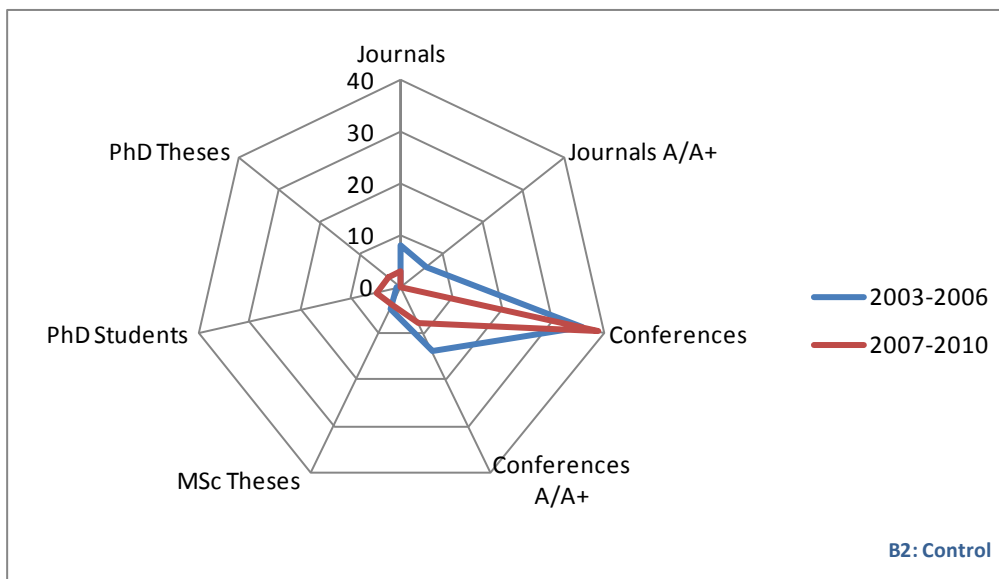
Research

This research line deals with the development of advanced control and decision algorithms for distributed and networked systems. Particular areas of interest are:

Intelligent Control Systems:
- Modelling and control of distributed parameter systems (e.g. water canal)
- Modelling and control of networked systems (e.g. smart-grids)
- Agentification of control networks
- Fault diagnosis and fault tolerant control

Intelligent Decision Support Systems:
- Prediction-based decision on energy-efficient buildings
- Life-cycle management of assembly and manufacturing systems
- Human-centric collaboration in industrial plants
- Context-based enhancement of activities in industrial plants

Research Activities

Advanced decision methodologies for the coordinated control of water distribution networks

This work aims at the development of advanced control methodologies for optimizing the management of water conveyance and delivery in multipurpose open-channel systems, with the goal of minimizing the use of energy and water spills. In short, the overall goal of the project is the development of decentralised controller networks for multipurpose hydraulic open-channel systems where a network of local decision agents cooperate in order to achieve a near optimum solution with fault tolerant capability. The systems are large, spatially distributed dynamic plants. Usually, they form branched networks where the basis for modelling each branch are the Saint-Venant equations, a set of nonlinear first order partial differential equations of hyperbolic type that embody conservation of mass and of moment. Together with suitable boundary conditions, their solution models the water level along the different branches. The control system to design receives data in real time from the sensors (water levels at selected points) and decides, at each sampling time interval what should be the value of the command for the actuators (gate levels). The major problems to confront are: 1) The distributed character and large scale of the system. 2) The uncertainty in the knowledge of the dynamics and its complexity. 3) The existence of operational constraints. 4) The existence of scheduled unexpected disturbances induced by water consumption at the turnouts. 5) The inherent delay between control action and result. The approach proposed in this work is the combination of the following features: 1) The use of distributed agents that cooperate in order to achieve a near optimum control solution that embeds fault tolerance; 2) The modularity of the basic algorithms, allowing their interconnection in order to produce solutions that are scalable and reconfigurable with respect to the type of hydraulic canal system considered. We are exploring the availability of a large scale pilot plant, where real tests are being conducted. This is the experimental canal of the Núcleo de Hidráulica e

Controlo de Canais from University of Évora with a total length of 150 m and designed for 90 l/s.

<u>Advanced control methodologies for distributed parameter systems with transport phenomena</u>

This work aimed the development of Advanced Non-Linear and Adaptive Control methodologies for distributed parameter systems with transport phenomena. These methods were motivated by different case studies such as: (i) the control of car density in highway traffic flow; (ii) the control of water flow in a water distribution channel system; (iii) the control of temperature in large-scale distributed heat-exchangers. 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. The tested strategy for controlling these systems consisted 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 research work followed 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 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 were the study of the stability of the internal dynamics and the robustness with respect to modelling errors, using non-linear methods.

<u>Decision support on energy-efficient renovations in buildings</u>

The objective of this work is to develop a software model for predicting the energy consumption of a specific building, with different scenarios implementing energy-efficient technologies and control solutions, based on actual measured performance and usage data of the building itself. The key hypothesis of is that it is possible, from adequate gathering and assessing data on how a structure performs and is being used from an energy viewpoint, to build highly accurate and specific energy consumption models relevant for prediction of alternative scenarios. The software tools assess the energy-efficiency impact of alternative technologies for which available investment resources can be directed and, thus, support the decision maker finding the optimised set of energy-efficient solutions to be implemented. These results are tailored to the actual building itself, through automated measurements of the building usage and energy efficiency. Technological solutions include energy-reducing, -generating, and –storing options, and with user-defined criteria on resources and restrictions, identify through new prediction algorithms when the return on investment will be realized. The application of the tools are being validated in two real buildings.

<u>Context-based decision support by knowledge provision and enhancement</u>

The objective of this work was to explore the fundamental problem on how different services to manage social interactions in a networked enterprise could be used to enhance knowledge and knowledge management (KM) services, such as decision-making. The key hypothesis was that the context under which knowledge is collectively generated and managed can be used to enhance this knowledge for its further use

within intra-enterprise collaboration. By extracting the context under which the knowledge is generated in a network (e.g. goals, teams, temporal and spatial aspects), it is possible to enrich it to be more effectively used within future work. In order to explore such hypothesis, the project answered several problems: how to efficiently monitor/trace a process of generation/usage of knowledge in the network so that this knowledge can be re-used for future work; how to extract context from this process; and how to enrich the knowledge generated with extracted context to support knowledge sharing in future network activities. This has resulted in a set of web services and methodology. Three demonstrators of the application of new services in real industrial environment and their usage for new business models were developed in the scope of this work.

Decision support in life-cycle management.

This work explored how a combination of Ambient Intelligence (AmI) and Knowledge Management (KM) technologies could be used to assure a sustainable and safe use of manufacturing and assembly lines (MAL) and their infrastructure over their life-cycle. The objective was to 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. As a result of the work the following results were achieved: (a) new methodology on how to apply a combination of AmI technology integrated in manufacturing processes and KM solutions to provide services and optimise life-cycle management of a MAL, addressing organisational issues regarding co-operation strategy within the extended enterprise (EE) concept, and (b) modular Life-Cycle Management System (LCMS) based on web technology. The platform and methodology were tested by different business cases with end-users, addressing different manufacturing concepts: highly automated and a combination of manual and automation MAL.

Decision support in human-centric maintenance services.

This work develop a new eCollaborative platform, based on Agent, Ambient Intelligence (AmI) and Semantic Based Knowledge Management (SBKM) technologies, to create and optimise different services for management of complex manufacturing and assembly lines (MAL), with special emphasis on Automation and Robotics, over the whole production-cycle. It explored how a combination of Agent, AmI and SBKM technologies could be used to assure an improved collaborative use of industrial installations over the production-cycle. The objective was to focus on the paradigm of eCollaboration to provide services supporting the access to relevant knowledge through a common interface for different agents along the production process. The platform and methodology were tested by different business cases with end-users.

Fault Diagnosis and Fault Tolerant Control

The objectives of this work are the development of approaches to fault detection and diagnosis, and to fault tolerant control in dynamical systems. The operation of industrial technical processes requires increasingly advanced supervision, fault detection and diagnosis (FDD) approaches, and fault tolerant control (FTC) methods to increase reliability, safety and economy. One of the main goals of the fault tolerant systems is to guarantee that faults do not cause dangerous failures, and even human fatalities. The main focus is on the development of real-time approaches to FDD and FTC, not only to local systems but also to remote control systems. The research has been centered on combined approaches based on classical analytical methods (parity

equations, observers and parameter estimation), on intelligent approaches (neural networks and fuzzy logic) and on statistical approaches (principal components analysis). The approaches have been tested on real setups and benchmarks. Some platforms for remote monitoring and control have been developed to support the research activities. In the future, it is expected to apply some of the proposed approaches in industrial environments, locally and remotely, in the areas of automation and control systems.

Projects

EnPROVE	Energy consumption prediction with building usage measurements for software-based decision support (http://www.enprove.eu)		
Grant Ag.: FP7-ICT-2009-248061	**Beginning:** 1-Feb-10		**Duration:** 36 M
Objective:	Development of methodologies and platform to support decision in selecting energy efficient technologies for buildings.		
Contribution:	Global coordination (scientific and financial) of the project. Development of methods and system modules of decision support system. Validation of results. Dissemination of results.		
Partners:	UNINOVA (Coordinator, PT), UCD (IE), PHILIPS (DE/NL), CSTB (FR), LABEIN (ES), GEM (DE), MOSTOSTAL (PL), ACTIVE3D (FR).		

K-NET	Services for Context Sensitive Enhancing of Knowledge in Networked Enterprises (http://www.k-net-fp7.eu)		
Grant Ag.: FP7-ICT-2007-215584	**Beginning:** 1-Dec-07		**Duration:** 36 M
Objective:	Development of methodology and platform to support monitoring and enhancing of decision support processes in industrial environments.		
Contribution:	Global coordination (scientific and financial) of the project. State-of-the-art analysis. Development of methods to support monitoring/enhancing of collaborative decision making in industrial environments. Dissemination of results.		
Publications:	[J10], [C76], [C72].		
Partners:	UNINOVA (Coordinator, PT), ATB (DE), DERI (IE), MBAS (UK), OAS (DE), INAEL (ES).		

AQUANET	Decentralised and Reconfigurable Control for Water Delivery Multipurpose Canal Systems (http://ramses.inesc.pt/AQUANET)		
Contr.: PTDC/EEA-CRO/102102/2008	**Beginning:** 1-Jan-10		**Duration:** 36 M
Objective:	Development of advanced methodologies of control and decision in networks of water distribution open canals.		
Contribution:	Development of decision methods based on distributed agents. These agents are responsible for generating reference values of local controllers aiming at the global optimisation of the network. Dissemination of results.		
Partners:	INESC-ID Lisboa, UNINOVA, IDMEC/IST, Universidade de Évora.		

InLife	Integrated Ambient Intelligence and Knowledge-Based Services for Optimal Life-Cycle Impact of Complex Manufacturing and Assembly Lines (http://www.uninova.pt/inlife)		
Contr.: FP6-NMP2-CT-2005-517018		**Beginning:** 1-Nov-05	**Duration:** 36 M
Objective:	Development of methodology and platform to optimise life-cycle of industrial installations (maintenance management and optimisation) using technologies of knowledge management, agents and ambient intelligence.		
Contribution:	Global coordination (scientific and financial) of the project. State-of-the-art analysis. Development of methods to support decision in adaptive management of industrial installations. Dissemination of results.		
Partners:	UNINOVA (Coordinator, PT), ATB (DE), FATRONIK (ES), ATECNIC (PT), AISIAKIN (ES), GSN (DE), SCHNEIDER ELECTRIC (DE), LSW-IWKA (DE).		

InAmI	Innovative Ambient Intelligence Based Services to Support Collaborative Work in Flexible Assembly and Manufacturing Systems (http://www.uninova.pt/inami)		
Contr.: FP6-2004-IST-NMP-2-16788		**Beginning:** 1-Oct-05	**Duration:** 36 M
Objective:	Development of methodology and platform to support collaboration in industrial environments using ambient intelligence and semantic-based knowledge management.		
Contribution:	Global coordination (scientific and financial) of the project. State-of-the-art analysis. Development of methodology to support decision making in collaboration environments among different actors in problem solving and innovation. Dissemination of results.		
Partners:	UNINOVA (Coordinator, PT), ATB (DE), FATRONIK (ES), ATECNIC (PT), SIEMENS (DE), BOSCH REXROTH (DE), LSW-IWKA (DE), AISIAKIN (ES).		

FLOW	Advanced Control of Processes with Transport Phenomena (http://www.uninova.pt/flow)		
Contr.: POSC/EEA-SRI/61188/2004		**Beginning:** 1-Mar-05	**Duration:** 36 M
Objective:	Development of advanced methodologies of adaptive and non-linear control for systems of distributed parameters with transport phenomena. These methods were applied to: i) control of road traffic, ii) control of water irrigation canals and iii) control of temperature in large-scale heat exchangers (e.g. in conventional power plants).		
Contribution:	Global coordination (scientific and financial) of the project. Development of general methods of adaptive and non-linear control for systems with distributed parameters. Development of model and simulator of a water irrigation canal and respective control system based on the methods developed. Development of model and simulator of road traffic in motorways and respective control system based on the methods developed. Dissemination of results.		
Partners:	UNINOVA (Coordinator), INESC-ID Lisboa, Universidade de Évora.		

Collaboration

The research group has enlarged its collaboration with other organisations at national and international levels.

Internationally:

- **ATB** – Institute for Applied Systems Technology Bremen GmbH. Continuous collaboration with Dr. Dragan Stokic in the scope of projects InAmI, InLife and K-NET, and the PhD work of Ana Rita Campos. Several conference papers have been written in collaboration.

- **National University of Ireland (Galway)**. Collaboration with Dr. Ke Ning in the scope of project K-NET, and joint publications.

- **University College Dublin**. Collaboration with Dr. Antonio Ruzzelli in the scope of project EnPROVE. Several conference papers have been written in collaboration.

- **Fundacion Fatronik (Tecnalia)**. Collaboration with Mr. Jon Agirre Ibarbia in the scope of projects InAmI and InLife, and joint publications.

- **Fundacion Labein (Tecnalia).** Collaboration with Eng. Juan Pérez and Eng. Nagore Tellado in the scope of the development of the EnPROVE proposal and joint publications.

- **Centre Scientifique et Technique du Bâtiment.** Collaboration with Mr. Marc Bourdeau in the scope of project EnPROVE and joint publications.

- **PHILIPS Research**. Collaboration with Dr. Peter Fuhrmann in the scope of project EnPROVE and joint publications.

- **Bosch Rextoth**. Collaboration with Dr. Ralph Bonefeld in the scope of poject InAmI.

- **SIEMENS AG**. Collaboration with Dr. Juergen Goehringer in the scope of InAmI project.

- **Schneider Electric**. Collaboration with Dr. Armando Colombo in the scope of InLife project.

- Several industrial companies that have been supporting the development of demonstrators of the developed methodologies, namely: INAEL, AISIZKIN, GER and ZAYER in Spain, OAS, LSW, GEM and GSN in Germany, MBAS in UK, Mostostal in Poland and Active3D in France.

Nationally:

- **Instituto Superior Técnico/ INESC-ID.**Continuous collaboration with Prof. João Miranda Lemos in the scope of projects FLOW and AQUANET. Additionally, a long-term research line is being developed in collaboration in the subject of model based predictive control of networked systems.

- **Universidade de Évora.** Continuous collaboration with Prof. Luís Rato in the scope of projects FLOW and AQUANET. In both cases, the university has provided access to its pilot canal for the test of control methodologies.

- **Universidade de Coimbra.** Continuous collaboration with Prof. Paulo Gil in the scope of several joint publications.
- **ATECNIC**. Collaboration with Eng. Ribeiro Teixeira and Eng. Helena Mourão in the scope of projects InLife and InAmI. In both cases, this company provided its industrial plant for the test of the prototype systems.

Publications

Theses and dissertations

1. Campos, A. Intelligent decision support systems for collaboration in industrial plants. PhD Thesis, FCT-UNL, Caparica (2010).

2. Virote, J. Algorithms and methodologies for decision support in energy efficiency on buildings. Master dissertation, FCT-UNL, Caparica (2010).

3. Cravid, C. Agentes inteligentes para coordenação do controlo descentralizado em sistemas de canais de distribuição de água. Master dissertation (in Portuguese), FCT-UNL, Caparica (2010).

4. Almeida, P. Estudo empírico do padrão de congestionamento formado num nó de uma auto-estrada urbana portuguesa. Master dissertation (in Portuguese), FCT-UNL, Caparica (2009).

5. Pina, P. Agentification for collaborative process planning. Master dissertation, FCT-UNL, Caparica (2008).

6. Igreja, J. Controlo adaptativo de processos com fenómenos de transporte. PhD Thesis, IST-UTL, Lisboa (2007).

7. Palma, L. Fault detection, diagnosis and fault tolerance approaches in dynamic systems based *on black-box models.* PhD Thesis, FCT-UNL, Caparica (2007).

Peer-Reviewed Book Chapters

1. Lemos, J. M., P. O. Shirley, R. Neves-Silva and B. Costa. Adaptive predictive control of superheated steam and economic performance. Power Plant Applications of Advanced Control Techniques (ISBN: 978-3-902655-11-0) ProcessEng Engineering GmbH, Wien (2010).

2. Lemos, J. M., L. M. Rato, and R. Neves-Silva. Adaptive control of distributed collector solar fields. Power Plant Applications of Advanced Control Techniques (ISBN: 978-3-902655-11-0) ProcessEng Engineering GmbH, Wien (2010).

3. Gomes, L., F. Coito, A. Costa, L. Brito Palma (2007), Teaching, Learning, and Remote Laboratories, Advances on Remote Laboratories and E-Learning Experiences, 189-204, Univ. of Deusto – Spain.

4. Antunes, R., F. V. Coito, and H. Duarte-Ramos. Using Human Dynamics to Improve Operator Performance. Emerging Trends in Technological Innovation, IFIP Advances in Information and Communication Technology. vol. 314/2010 (ISBN: 978-3-642-11627-8), p. 393-400. Springer Boston (2010).

5. P. Pereira, M. H. Fino, F. Coito and M. Ventim-Neves. GADISI – Genetic Algorithms Applied to the Automatic Design of Integrated Spiral Inductors. Emerging Trends in Technological Innovation, IFIP Advances in Information and Communication Technology. vol. 314/2010 (ISBN: 978-3-642-11627-8), p. 515-522. Springer Boston (2010).

Peer-Reviewed Publications in International Journals

1. Marques, M. e R. Neves-Silva. Development of a microscopic driver-vehicle model using a control theory approach. Accepted for publication at the International Journal of Modelling and Simulation (ISSN: 0228-6203) (2010).

2. Ortigueira, M. D. and F. Coito. System initial conditions vs derivative initial conditions. Computers & Mathematics with Applications (ISSN: 08981221), 59, 5, 1782-1789 (2010).

3. Mazharsolook, E., S. Scholze, S. Ziplies, R. Neves-Silva and K. Ning. Enhancing networked enterprise management of knowledge and social interactions. Journal of Computing in Systems & Engineering (ISSN 1472-9083), 10, 4, 176-184 (2009).

Peer-Reviewed Publications in International Conferences

1. Campos, A., M. Marques and R. Neves-Silva. A decision-support system for energy-efficiency investments on building renovations. IEEE International Energy Conference, Bahrain (BH) (2010).

2. Campos, A. and R. Neves-Silva. A combination of case-based reasoning and analytic hierarchy process to support innovation in industry. The 2nd International Symposium on Intelligent Decision Technologies, Baltimore (US) (2010).

3. Ning, K., S. Scholze, M. C. Marques, A. R. Campos, R. Neves-Silva and D. O'Sullivan. A service oriented framework for context aware knowledge enhancing. 5th Int. Conf. on Management and Control of Production and Logistics, Coimbra (PT) (2010).

4. Marques, M. C. and R. Neves-Silva. Decision support for life-cycle optimization using risk assessment. Doctoral Conference on Computing, Electrical and Industrial Systems - DoCEIS'10, Caparica (PT) (2010).

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7. Virote, J. and R. Neves-Silva. User behavior modeling of building's energy consumption using hidden markov models. IX Portuguese Conf. on Automatic Control, Coimbra (PT) (2010).

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9. Antunes, R. M., F. Coito and H. Duarte-Ramos. Human-machine control model approach to enhance operator skills. 2nd International Conference on Mechanical and Electrical Technology – ICMET (ISBN: 978-1-4244-4653-7), Singapore (SG) (2010).

10. Ortigueira, M. D. and F. Coito. Are RL and C derivatives really useful? 4th IFAC Workshops on Fractional Differentiation and its Applications - FDA'10, Badajoz (SP) (2010).

11. Ortigueira, M. D. and F. Coito. On a not so Fast Fourier Transform. Mathematical Methods in Engineering International Symposium – MME'10, Coimbra (PT) (2010).

12. Marques, M. C. and R. Neves-Silva. Decision Support System Using Risk Assessment for Life-Cycle Management of Industrial Plants. 13th IFAC Symposium on Information Control Problems in Manufacturing, Moscow (RU) (2009).

13. Gil, P., A. Cardoso, L. Brito Palma, Estimating the number of hidden neurons in recurrent neural networks for nonlinear system identification, IEEE International Symposium on Industrial Electronics (ISIE), July 5-8, Seoul – Korea (2009).

14. Pereira, P., H. Fino, F. Coito and M. Ventim-Neves. ADISI- An efficient tool for the automatic design of integrated spiral inductors. 16th IEEE International Conference on Electronics, Circuits, and Systems, (ICECS 2009), Yasmine Hammamet (TN) (2009).

15. Pereira, P., H. Fino and F. Coito. Using discrete-variable optimization for CMOS spiral inductor design. 2009 International Conference on Microelectronics - ICM (ISBN: 978-1-4244-5814-1), Marrakech (MA) (2009).

16. Ngolo, M., L. B. Palma, F. Coito, L. Gomes and A. Costa. Architecture for remote laboratories based on REST web services. 3rd IEEE International Conference on E-Learning in Industrial Electronics - ICELIE '09 (ISBN: 978-1-4244-46), Porto (PT) (2009).

17. Campos, A., D. Stokic, M. Würthele, K. Ning and R. Neves-Silva. Services for context sensitive enhancing of knowledge in networked enterprises. 14th Int. Conf. on Concurrent Enterprising ICE'08, Caparica (PT) (2008).

18. Marques, M., R. Neves-Silva, D. Stokic, P. Reimer, and J. Agirre. Life-Cycle Management of Complex Manufacturing and Assembly Lines. 14th Int. Conf. on Concurrent Enterprising ICE'08, Caparica (PT) (2008).

19. Correia, A., D. Stokic, R. Neves-Silva, A. Campos, and Jon Agirre. Collaborative Environment for Intelligent Monitoring in Manufacturing Industry. 14th Int. Conf. on Concurrent Enterprising ICE'08, Caparica (PT) (2008).

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38. Neves-Silva, R. and M. Marques. Traffic flow-density models based on systems theory. XXVI American Control Conf., New York (US) (2007).

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Group B3: Industrial Systems

Research Group Coordinator

- José Barata (JAB), Auxiliar Professor, email: jab@uninova.pt

Doctoral Research Team

- José Barata (JAB), Auxiliar Professor, email: jab@uninova.pt
- Celson Lima (CPL), Auxiliar Professor (50%)

PhD students

- Regina Maria Frei - finished
- Luís Ribeiro, email: ldr@uninova.pt (JAB)
- Gonçalo Candido, email: gmc@uninova.pt (JAB)
- Pedro Santana, email: pfs@uninova.pt
- Luís Flores, email: luis.flores@introsys.eu (JAB)
- Eduardo Pinto, emp@uninova.pt (JAB)
- Magno Guedes, email: magno.guedes@gmail.com (JAB)
- Pedro Neves, email: neves@iip.kth.se (Mauro Onori + JAB)
- Tiago Ferreira, email: tiago.ferreira@holos.pt (Pedro Sousa + JAB)
- André Cavalcante, email: andre.d.cavalcante@gmail.com (Carlos Eduardo + JAB)

Master students

- Giovanni Di Orio, email: gido@uninova.pt (JAB)
- Rogério Rosa, email: rpr18732@fct.unl.pt (JAB)
- Ricardo Mendonça
- Pedro Gomes

Collaborators, as research engineers

- Raphael Cunha, UFSC – Brazil, Final Project (JAB)
- Steffen Schuetz, KIT – Germany, Final Project (JAB)

Summary

Main indicators and achievements:

This report mainly summarizes research activities undertaken from 2007 until 2010 (evaluation period).

## Highlights of achievements (since 2007)

19. Main Scientific Achievements in the area of Manufacturing
    a. CoBASA – Coalition Based Approach for Shop Floor Agility. This is the foundation architecture that supports the development of Multiagent Based Evolvable Production Systems
    b. A diagnostic and self-healing architecture with orchestration based on SOA. We were one of the first group to demonstrate the application of DPWS and orchestration mechanisms for SOA in an industrial set up. (INLIFE Project and Luís Ribeiro's Master Thesis.
    c. An Exploratory Self-Organisation Methodology to support the development of evolvable assembly systems (Regina's PhD work)
20. Main Scientific Achievements in the area of Service Robots
    a. A swarm-based trail detection model for all-terrain robots equipped with monocular vision.
    b. A saliency-based obstacle detection model for all-terrain robots equipped with stereoscopic vision.
    c. A swarm cognition model on attention and spatial memory for local navigation in all-terrain robots equipped with stereoscopic vision.
    d. A model to predict affordances in the environment, given a global descriptor of the scene, the gist.
    e. A model for the shared control of a tele-operation camera equipping an all-terrain robot.
    f. A knowledge-based multi-agent system for the distributed execution of field human-robot teamwork.
    g. A model for robust wheel odometry in demanding off-road environments .
    h. An autonomous all-terrain robot prototype for humanitarian demining and surveillance tasks

Summary Tables

	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	1	9	1,0	6,0
Journals A/A+	0	5	0,0	3,3
Conferences	36	45	36,0	30,0
Conferences A/A+	11	31	11,0	20,7
MSc Theses	0	18	0,0	12,0
PhD Students	2	8	2,0	5,3
PhD Theses	0	2	0,0	1,3
Teams PhD	1	1,5		

Global data
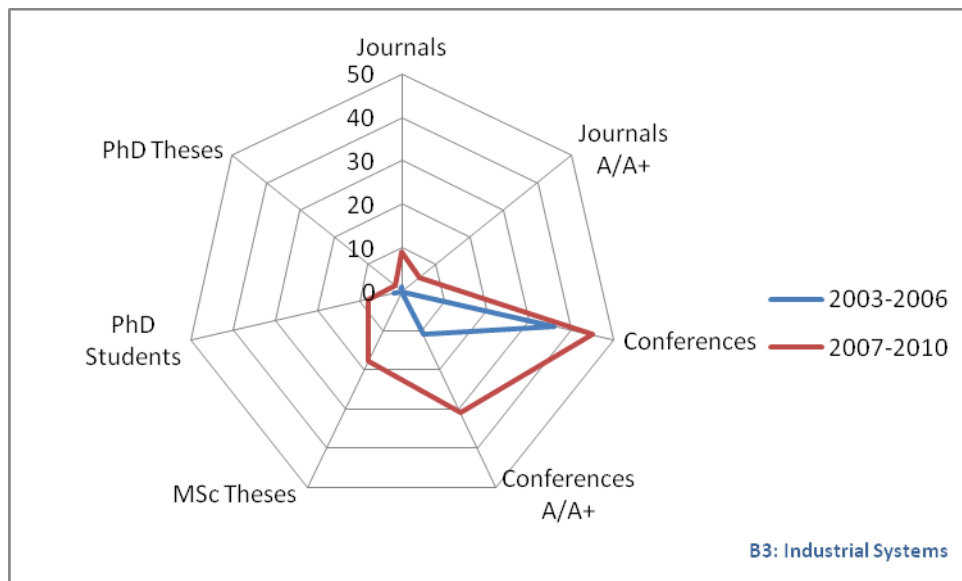
Intelligent Manufacturing Systems			
A	Engineering Applications of Artificial Intelligence		2
A	J. Robotics & Computer Integrated Manufacturing		1
C	J. Assembly Automation		1
Robotics / Vision / Adaptive Behavior / Alife			
A+	Journal of Field Robotics		1
A+	Adaptive Behavior		1
	Total reference	0	6

	Other journals ISI-WoS		
	Others	1	2

Conferences		2004-2006	2007-2010
Intelligent Manufacturing Systems			
A+	ICRA – IEEE Conference on Robotics and Automation		2
A	SMC - IEEE International Conference on Systems, Man and Cybernetics		1
A	SASO – IEEE International Conference on Self-Adaptive and Self-Organising		3
A	IROS – International Conference on Intelligent Robots and Systems		1
A	INDIN – IEEE International Conference on Industrial Informatics	1	5
A	ETFA - Int. Conf. On Emerging Technologies and Factory Automation	3	3
A	IECON - Annual Conference of the IEEE Industrial Electronics Society		1
A	ISIE – IEEE International Symposium on Industrial Electronics	2	5
A	ISAM - IEEE International Symposium on Assembly and Manufacturing	1	4
A	BASYS – IFIP Working Conference on Information Technology Balanced Automation	3	4
B	DET- International CIRP Conference in Digital Enterprise Technology		1
B	INCOM - IFAC Symposium on Information Control Problems in Manufacturing	1	1
C	SYROCO - IFAC Symposium on Robot Control		1
C	IMS – Intelligent Manufacturing Systems		6
Robotics / Vision / Adaptive Behavior / Alife			
A	IEEE Intl. Conf. on Robotics and Biomimetics (ROBIO)	1	
A	Intl. Conf. on Computer Vision Systems (ICVS)		1
A	Intl. Conf. on Simulation of Adaptive Behavior (SAB)		1
		12	40

	Other Conferences ISI-WoS	1	5
	Others	5	2
		18	47

Introduction

This line of research refers to the application of computer science, and electrical sciences for the enhancement of industrial processes and service robots. This line of research concerns with the latest developments in intelligent and computer control systems, industrial agents, robotics, factory automation and flexible manufacturing, building automation, and the sustainable development of these technologies. It must be highlighted that we have two distinct branches of applications: 1) manufacturing and production systems, 2) service robots.

We research on the principles of self-organising multiagent systems for the modelling of individual and collective behaviour of mechatronic devices. For this purpose we often recur to biology as an inspiration. At the practical level, with this research framework we aim at better exploiting the networking and parallelisation capabilities of emerging computational paradigms, whose benefits to automation and robotics domains are ground breaking. At the theoretical level, we expect to better understand how some cognitive aspects of embodied synthetic agents, as well as of their collective behaviour, can self-organise and consequently enable open-ended learning/evolution.

Research

The research of our group focuses on reconfigurable and adaptative systems composed of intelligent devices. Our main research areas are:

1. Manufacturing Systems - Evolvable Production Systems
   ◦ Enabling Architectures for EPS
   ◦ Self-Organising Principles for EPS
   ◦ Emergent Diagnostic Systems for EPS
   ◦ Service Oriented Architectures for EPS
   ◦ Multiagent Based Architectures for EPS

2. Field Robotics
   ◦ Visual Attention for All-Terrain Robots
     ▪ Stereo-Based Obstacle Detection using Visual Saliency
     ▪ Swarm-based Visual Saliency for Trail detection
     ▪ Swarm Cognition for All-Terrain Robots
     ▪ Using Visual Gist for Affordances Prediction
   ◦ Multiagent Architectures for Human-Robot Teamwork
     ▪ teamwork architectures
     ▪ tele-operation mechanisms
   ◦ Bio-Inspired Robot Control
     ▪ locomotion control
     ▪ odometry
   ◦ Applications
     ▪ Field Robots for Surveillance
     ▪ Field Robots for Humanitarian Demining
     ▪ Sensor Networks for Surveillance

Particular areas of interest are:

1. **Enabling Architectures for EPS**
   o PhD: Luís Flores (Heavy machinery) – *An architecture to support Evolvable Production Systems in a Heavy Machinery Context*
   o PhD: Luís Ribeiro (lightweight production systems) - *A Diagnostic Infrastructure for Manufacturing Systems*
   o Different types of architectures to support Evolvable Production Systems in different domains, namely heavy machinery (automotive industry) and lightweight production systems.

2. **Reconfigurable and Adaptable Systems based on the aggregation of intelligent components (mechatronic agents) – Evolvable Systems**
   - o PhD: Gonçalo Cândido (SOA) - *SOA-based Control Architecture for Industrial Automation*
   - o PhD: André Cavalcante (Agent Based) - *Desenvolvimento de Sistemas Auto-X para Aplicações Industriais Baseado em Componentes*
   - o Intelligent Autonomous Componentes with embedded computational power. Since these components are mechanical entities with embedded computational power they are called mechatronic agents.
   - o The main characterictic of these systems is that complex systems are compositions of intelligent components that can be aggregated or disaggregated without requiring reprogramming.
   - o In this way it is ensured that the systems are robust, easily reconfigured and easily modifiable.
   - o There are two sub-areas:
     - ▪ Agent Based Systems
     - ▪ Service Oriented Approach

3. **Intelligent Systems for Energy based on autonomous components that can be easily modified.**
   - o PhD: Gonçalo Cândido - *SOA-based Control Architecture for Industrial Automation*
   - o The idea is similar to evolvable production systems, but in this case the aggregation is made of energy related intelligent devices. These autonomous and intelligent devices when aggregated enable the construction of intelligent systems for energy management and optimization.

4. **Intelligent systems or components with self-learning**.
   - o Master and PhD: Giovanni Di Orio – *Self Learning Production Systems*
   - o Since evolvable systems are based on intelligent devices the notion of self-learning and self-healing is directly connected. Each of these systems possess functionalities that support learning and consequently can optimise their performance.

5. **Monitoring, Diagnosis and Prognosis Systems for Manufacturing.**
   - o PhD: Luís Ribeiro - *A Diagnostic Infrastructure for Manufacturing Systems*
   - o PhD: Pedro Neves
   - o It is fundamental to understand that these functionalities occur at two distinct levels: individual and group.
   - o Monitoring, Diagnosis and Prognosis and individual level is executed inside each mechatronic agent. Each intelligent device (mechatronic agent) includes capabilities to monitor and diagnostic or prognostic its own events.

- o Group or collective level is applied to situations in which these types of operations are performed when individual components are aggregated. It is fundamental to grasp the idea that a machine or system is a collection of individual components, with its own individual diagnostic, that are aggregated. Consequently, it is fundamental that diagnosis, monitoring, and prognosis do not happen only at individual level but also at collective level, which guarantees that systems have also monitoring, diagnosis, and prognosis.

6. **Monitoring, Diagnosis and Prognosis Systems for Field Robots.**
   - o PhD: Tiago Ferreira - *Reference Architecture for Maintainability and Reliability systems*
   - o This is work focused on the development of an architecture and supporting tools for monitoring and diagnosis inside field robots targeting surveillance applications.

7. **Application of Complexity Theory and Bio-Inspired Techniques such as Swarm, self organisation and emergence to implement complex systems based on autonomous components.**
   - o PhD: Regina Frei - *Self-Organisation In Evolvable Assembly Systems* (finished)
   - o Master and PhD: Rogério Rosa – *Complexity Theory to Solve Evolvable Production Systems*
   - o The idea is to apply bio-inspired techniques to create autonomous robust systems highly adaptable and modifiable.
   - o These techniques are applied both to the devlopment of service robots and complex production systems.

8. **Swarms of Service Robots for Inspection in Multienvironment (ground, air, and water)**
   - o PhD : Eduardo Pinto - *Swarms of Heterogeneous Unmanned Ground, Underwater, and Air Vehicles*
   - o The idea behind this work is the building of an architecture to support swarms of robots able to locomotion in three different types of environment.
   - o This work will involve:
     - the construction of a multi-environment robot
     - the design of an architecture to support the swarm of these robots for surveillance purposes

9. **Multiagent Architectures for Human-Robot Teamwork**
   - o PhD : Magno Guedes – Human Robot Team Work based on Video Cameras

- o The idea behind this work is building a multiagent based videocameras infrastructure to support human-Robot teamwork.
- o Based on the analysis of movements captured by video cameras the system will learn and optimize how to interact with humans. This activity will be relevant both for the manufacturing and field robot domain.

Projects

Ongoing projects on 2007 and thereafter

European Commission

- EC – FP7 ECHORD European Clearing House for Open Robotics Development, Call 3 Experiment Proposal – RIVERWATCH – Cooperating Robots for Monitoring of Riverine Environments – Accepted for two year funding. Global Budget: 435 360 €. UNINOVA Budget: 435 360 €.

- EC – FP7-NMP-2009-SMALL-3 Collaborative Project, Small or Medium Scale Focused Research Project – **IDEAS** – Instantly Deployable Evolvable Assembly Systems - NMP-2009-246083-2 – 1st Apr 2010 / 31st Mar 2013. Partners: KTH (SE), UNINOVA (PT), KIT (DE), Univ. Nottingham (UK), FESTO (DE), Electrolux (IT), MASMEC (IT), ELREST (DE), TEKS (FR), CRF (IT). Global Budget: 3 899 729 €. UNINOVA Budget: 408 800 €.

- EC – FP7 Collaborative Project, Small or Medium Scale Focused Research Project – **Self-Learning** – Reliable Self-Learning Production Systems Based on Context Aware Services - NMP-2008-228857 – 1st Nov 2009 / 31st Oct 2012. Partners: ATB (DE), UNINOVA (PT), TUT (FI), X/Open Company (UK), BOSCH Rexroth (DE), DESMA (DE), FASTEMS OY AB (FI). Global Budget: 2 110 000 €. UNINOVA Budget: 326 400 €.

- EC – FP6 Integrated Project – Integrating and Strengthening the ERA - **EUPASS** – Evolvable Ultra-Precision Assembly Systems - NMP2-CT-2004-507978 – 1st Nov 2004 / 31st Mar 2009. Partners: 4 Reserach Centres, 6 Universities, and 10 Companies. Global Budget: ~ 20 M€. UNINOVA Budget: 278 520 €.

- Marie Curie Actions, TOK - Transfer Of Knowledge, **A3** - Applied Agile Assembly, Project Number 29667, 1/06/2006 to 31/05/2009. Partners: IntRoSys, KTH, EPFL, University of Nottingham, Uninova.

National Projects

- QREN – Sistema de Incentivos à Investigação e Desenvolvimento Tecnológico (Portuguese National Project in co-promotion) – **DVA** – Project Number 2010/0013152 – 1st June 2010 to 31st May 2012. Partners: HOLOS SA, UNL-FCT. Global Budget: 454 622,58 €; UNL-FCT Budget: 126 838,26 €.

- QREN – Sistema de Incentivos à Investigação e Desenvolvimento Tecnológico (Portuguese National Project to Support Individual Company Research) – **INTROSYS ROBOT** –– Project Number 2008/002641 – 1st Nov 2009 to 30th Oct 2011. Partners: INTROSYS, UNINOVA, and LABMAG. UNINOVA Budget: 84 608 €.

- QREN – Sistema de Incentivos à Investigação e Desenvolvimento Tecnológico (Portuguese National Project in co-promotion) – **NEMO&CODED** - NEtworked MOnitoring & COntrol Diagnostic for Electrical Distribution – Project Number 2009/005442 – 1st Nov 2009 to 30th Oct 2011. Partners: Critical Software, UNL-FCT, ATECNIC. Global Budget: 490 099,77 €; UNL-FCT Budget: 112 779,12 €.

Recognition

Invited Talks in Scientific Conferences or Symposium

- SOHOMA 2011 – 1st International Workshop on Service Orientation in Holonic and Multi Agent Manufacturing Control (http://www.sohoma11.cimr.pub.ro/), *Evolvable Production Systems – Current Implementations using Multiagents and Services*. Keynote Presentation 2 at Plenary Session 1. Paris, France, 20th June 2011.
- RISS 2010 – Robotics International Summer School (http://www.roboschool.fsb.hr/), *Evolvable Production Systems – An Answer to Agile Manufacturing*. Invited Lecturer. Dubrovnik, Croatia, 26th June 2010.
- CIM 2009 – 12th International Scientific Conference on Production Engineering and High Speed Machining. *Multi-agent Robotic Based Assembly System*. Invited Lecturer. Biograd - Croatia, Jun 18th 2009.
- Swedish Production Symposium 2008. *Evolvable Assembly Systems*. Workshop on Evolvable Systems. Stockholm - Sweden, Nov 20th 2008.
- FESTO Symposium on Advanced Automation 2008. *Adaptive Production Systems*. Session 4: Future Adaptive Systems in Automation and Service. Esslingen - Germany, Nov 10-11 2008.

Invited Talks at International Universities or Research Centres

- Seminar organized by the Automation Department at the UFSC – Universidade Fedaral de Santa Catarina, *Evolvable Production Systems as an Answer to Agile Manufacturing*, José Barata, Florianópolis – Santa Catarina, Brasil, 5th May 2010.

Presentations at Workshops or Seminars

- Talk given to the "2º Congresso de Sistemas e Tecnologias de Informação para o Desenvolvimento de "Sectores-Chave" Angolanos: Sector Financeiro, Energia e Águas, Obras Públicas, Diamantes e Minas, Petróleos, Telecomunicações, Transportes, Agricultura e Províncias" organised by Escola de Negócios de Angola, *Inovação e Tecnologias de Informação no Sector Financeiro: Realidade e Futuro*, José Barata, Luanda – Angola, 12 Sep 2007.
- Workshop "Visão Empreendedora e Inovadora sobre África", *Papel do Engenheiro no Desenvolvimento Económico/Social de África*, José Barata, Monte da Caparica – Portugal, 30 May 2008.
- Workshop "Fomento da Sociedade Angolana de Automação e Robótica" organised by the Minister for the Higher Education and Science and Technology (MESCT), *A Importância da Automação no Desenvolvimento de Sistemas Ágeis de Produção*, José Barata, Universidade Agostinho Neto, Luanda – Angola, 20th April 2010.
- Workshop "Fomento da Sociedade Angolana de Automação e Robótica" organised by the Minister for the Higher Education and Science and Technology (MESCT), *Programas de financiamento de investigação científica e tecnológica da União Europeia para Institutos de Investigação. A possibilidade de exploração de programas da UE para África*, José Barata, Universidade Agostinho Neto, Luanda – Angola, 20th April 2010.

Research Programs Evaluation

European Commission
- ❑ Evaluator of the Sixth and Seventh EU Framework Programme for Research and Technological Development (FP7), **Marie Curie** Intra-European Fellowships (IEF), International Incoming Fellowships (IIF) and International Outgoing Fellowships (IOF) schemes.
    - o September and October 2010 (acting as Vice-Chair)
    - o September and October 2009
    - o September and October 2008.
    - o September and October 2007.
    - o March and April 2006.
- ❑ Evaluator of the Sixth EU Framework Programme for Research and Technological Development (FP6), a thematic call in the area of Nanotechnologies and nanosciences, knowledge-based multifunctional Materials and new Production processes and devices. Integrated Projects call **FP6-2003-NMP-NI-4**. October and November 2005.

National Research Programs
- ❑ IAPMEI –   .
Programa SIME. Project Evaluations (Portuguese Institute to Support Innovation and SMEs).
    - o "Desenvolvimento de Solução SIRIG+SISCOM+SAB", SIME nº00/12880. Jan 2007.
    - o "FROTCOM", SIME nº 00/10392. Jul 2008.
    - o "MOBILE MEMBERS", SIME nº 00/10392. Jul 2008.
    - o "Identificação Automática de Matrículas" and "IDNatural", SIME nº 00 \ 13450. Mar 2009.

- ❑ QREN –   .
Programa Projectos de I&DT Empresas Individuais e Co-Promoção (National Program to Support research to be carried out by companies both individually or in coopration with other companies or academic institutions). Evaluation of several proposals from Individual Companies.
    - o Mar 2008. AAC n.º 05/SI/2007 Individual I&DT - 15.11.07 to 29.2.08.
    - o Jun 2008. AAC n.º 07/SI/2008 Individual I&DT - 17.03.08 to 15.05.08.
    - o Mar 2009. AAC n.º 21/SI/2008 Individual I&DT - 03.11.08 to 16.01.09.
    - o Jun 2009. AAC n.º 05/SI/2009 Individual I&DT - 13.04.09 to 14.05.09.
    - o Sep 2009. AAC n.º 15/SI/2009 Individual I&DT Associated to New Generation Networks - 27.05.09 to 31.07.09.
    - o Dec 2009. AAC n.º 32/SI/2009 Individual I&DT - 25.09.09 to 27.11.09.

- ❑ QREN –
Programa Projectos de I&DT Empresas Individuais e Co-Promoção (Promoção (National Program to Support research to be carried out by companies both individually or in coopration with other companies or academic institutions). Evaluation of several proposals of Individual Companies. Contrary Allegations.
    - o Sep 2008. Contrary Allegations to AAC n.º 05/SI/2007.
    - o Dec 2008. Contrary Allegations to AAC nº 07/SI/2008.
    - o July 2009. Contrary Allegations to AAC n.º 21/SI/2008.

    o   November 2009. Contrary Allegations to AAC n.º 05/SI/2009.
    o   Apr 2010. Contrary Allegations to AAC n.º 15/SI/2009.
    o   Jun 2010. Contrary Allegations to AAC n.º 32/SI/2009.

International Research Programs

- Program "Investigación Científica y Tecnológica", Agencia Nacional de Promoción Científica y Tecnológica, Argentina.
- Slovak Research and Development Agency, Slovak. Peer Review of Basic Research Project: "Partial and aggregate demand simulation by modelling of consumer behaviour´s bounded rationality" – APVV-0716-07. Dec 2007.
- Slovak Research and Development Agency, Slovak. Peer Review of Basic Research Project: "New Methods of Reinforcement Learning for Collaborating Multiagents" – APVV-0430-10. Dec 2010.

Judge in Scientific and Technological Contests

Microsoft ImagineCup – Software Design
- ImagineCup 2009 – Cairo, Egypt; 3-8 July 2009.
- ImagineCup 2010 – Warsaw, Poland; 3-8 July 2010.

Positions in Scientific Societies

IFAC – International Federation of Automatic Control
- Member of the Technical Committee TC 4.4 (Cost Oriented Automation)
- Member of the Technical Committee TC 5.1 (Manufacturing Plant Control)

IEEE – Institute of Electrical and Electronics Engineers
- Member of the TC-EEIT – Technical Committee on Education in Engineering and Industrial Technologies of the Industrial Electronics Society.
- Member of the TC-IA – Technical Committee on Industrial Agents of the Industrial Electronics Society. Co-chair of the subcommittee on Intelligent Supervision.
- Member of the TC-SOCDS – Technical Committee on Self-Organisation and Complex Distributed Systems of the Systems, Man, & Cybernetics Society.

Positions in Scientific Events

Conference Chairman
- IMS 2010 – 10th IFAC Workshop on Intelligent Manufacturing Systems, Lisbon, Portugal, 1-2 July.

Program Committee Chair
- INDIN 2011 – 9th IEEE International Conference on Industrial Informatics, Caparica, Portugal, 26-29 July (Co-Chair).
- SIES 2007 – IEEE Second International Symposium on Industrial Embedded Systems, Costa da Caparica, Portugal, 4-6 July (Co-Chair).

Organising Committee
- IMS 2010 – 10th IFAC Workshop on Intelligent Manufacturing Systems, Lisbon, Portugal, 1-2 July.

Track Co-Chair
- INDIN 2010 – 8th IEEE International Conference on Industrial Informatics, July 13-16, Osaka - Japan. **Track** *Emerging Platform Technologies in Industrial Informatics*.

Tutorial Co-Chair
- IECON'09 – 35th Annual Conference of the IEEE Industrial Electronics Society.Porto.

Program Committee
- PRO-VE'04 - 5th IFIP Working Conference on Virtual Enterprises, Toulouse – France,
- PRO-VE'07 - 8th IFIP Working Conference on Virtual Enterprises, Guimarães – Portugal, 10-12 Sep 2007.
- HOLOMAS'07 – 3rd International Conference on Industrial Applications of Holonic and Multi-Agent Systems, 3-5 Sep 2007, Regensburg - Germany.
- SOS'07 – Self-Organised Systems Workshop, Part of the 2007 Summer Computer Simulation Conference (SCSC'07), 14 – 19 Jul, San Diego, CA, USA.
- ISC2007 – Industrial Simulation Conference 2007 – Track Simulation in Engineering Processes, Delft – Netherlands, 11-13 June 2007.
- ESM 2007 – European Simulation and Modelling Conference 2007 – Track Web Based Simulation, St Julian – Malte, 22-24 October 2007.
- ETFA 2007 – 12th IEEE International Conference on Emerging Technologies and Factory Automation, Patras - Greece, 25-28 Sep 2007 (Track 8 – Intelligent Robots and Systems).
- ISAM 2007 – IEEE International Symposium in Assembly and Manufacturing, Ann Arbor, Michigan – USA, 22-25 July 2007.
- INADIS 2007 – 2nd Workshop on Industrial Applications of Distributed Intelligent Systems, Salamanca, Spain, 12th November.
- IMS 2008 – 9th IFAC Workshop on Intelligent Manufacturing Systems, Szczecin, Poland, 9-10 October.
- SACC 2008 – 4th International Conference on Self-organization and Self-management in Computing and Communications, Glasgow, UK, 22-24 July.
- ETFA 2008 – 13th IEEE International Conference on Emerging Technologies and Factory Automation, Hamburg - Germany, 15-18 Sep (Track 6 – Intelligent Robots and Systems).
- INDIN 2008 – 6th International IEEE Conference on Industrial Informatics, Daejeon, Korea, 13-16 Jul.

- ❑ SIES 2008 – 3rd International Symposium on Industrial Embedded Systems, Montpellier, France, 11-13 June.
- ❑ HSI'08 – Conference on Human Systems Integration, Krakow, Poland, 25-27 May 2008.
- ❑ Robótica 2008 – 8th Conference on Autonomous Robot Systems and Competitions.
- ❑ PRO-VE'08 - 9th IFIP Working Conference on Virtual Enterprises, Poznam – Poland, 8-10 Sep 2008.
- ❑ ENICS 2008 – International Conference on Advances in Electronics and Micro-Electronics, Valencia – Spain, 29th Sep to 4th Oct 2008.
- ❑ SARC 2008 – Self-Adaptation for Robustness and Cooperation in Holonic Multi-Agent Systems, Venice – Italy, 20-24 Oct 2008.
- ❑ HOLOMAS'09 – 4th International Conference on Industrial Applications of Holonic and Multi-Agent Systems, 31 Aug to 2 Sep 2009, Linz - Austria.
- ❑ ETFA 2009 – 14th IEEE International Conference on Emerging Technologies and Factory Automation, Mallorca - Spain, 22-26 Sep (Track 6 – Intelligent Robots and Systems).
- ❑ ISAM 2009 – IEEE International Symposium in Assembly and Manufacturing, Seoul, Korea, 17-20 November 2009.
- ❑ ESM 2009 – European Simulation and Modelling Conference 2009 – Track Web Based Simulation, Leicester – UK, 26-28 October 2009.
- ❑ ICELIE 2009 – 3rd IEEE International Conference on E-Learning in Industrial Electronics, Porto, Portugal, 3-5 November 2009.
- ❑ SARC 2009 – 2nd Self-Adaptation for Robustness and Cooperation in Holonic Multi-Agent Systems and in MultiAgent Systems, San Francisco – California – USA, 14-18 Sep 2009.
- ❑ DoCEIS 2010 – Doctoral Conference on Computing, Electrical and Industrial Systems, Caparica, Portugal, 22-24 February 2010.
- ❑ ETFA 2010 – 15th IEEE International Conference on Emerging Technologies and Factory Automation, Bilbao - Spain, 13-16 Sep (Track 7 – Intelligent Robots and Systems).
- ❑ CODS 2010 – 4th International Conference on Complex Distributed Systems, Chongqing - China, 12-14 July.
- ❑ HSI 2010 – 4th International Conference on Human System Interaction, Gdansk - Poland, 13-15 May 2010 (Track Education and Training).
- ❑ SMC 2010 – IEEE International Conference on Systems, Man, and Cybernetics, Istanbul – Turkey, 10th to 13th October 2010.
- ❑ IoT 2010 – First IEEE International Workshop on Internet of Things and Internet of Services: Cyber-Physical Systems, Istanbul – Turkey, 10th to 13th October 2010.
- ❑ IESM 2011 – 4th International Conference on Industrial Engineering and Systems Management, Metz, France, May 2011.
- ❑ DoCEIS 2011 – Doctoral Conference on Computing, Electrical and Industrial Systems, Caparica, Portugal.
- ❑ HOLOMAS'11 – 5th International Conference on Industrial Applications of Holonic and Multi-Agent Systems, 29th to 31st Aug 2011, Toulouse - France.
- ❑ ETFA 2011 – 16th IEEE International Conference on Emerging Technologies and Factory Automation, Toulouse - France, 5-9 Sep (Track 4 – Automated Manufacturing Systems & Track 7 – Intelligent Robots and Systems).

- ❑ INCOM 2012 – 14th IFAC Symposium on Information Control Problems in Manufacturing, Bucharest – Romania, 23rd to 25th May 2012.
- ❑ SMC 2011 – IEEE International Conference on Systems, Man, and Cybernetics, Anchorage – Alaska – USA, 9th to 12th October 2011.

Special Session Organiser in Scientific Conferences

- ❑ ISIE'07 – IEEE International Symposium on Industrial Electronics, Vigo, Spain, July 4th – 7th, 2007.
    - o Special Session *ss17 – Evolvable Production Systems (2 sessions EPS1 & EPS2).*
- ❑ ISIE'10 – IEEE International Symposium on Industrial Electronics, Bari, Italy, July 4th – 7th, 2010.
    - o Special Session *ss13 – Evolvable Production Systems.*

Session Chairman at Scientific Conferences

- ❑ IAD/IMS 2007 – IFAC International Workshops on Intelligent Assembly and Disassembly, and Intelligent Manufacturing Systems, Alicante – Spain, 23-25 May 2007.
    - o Session 6 – *Intelligent Manufacturing Systems*. 24 May 2007 – 14:30 às 16:00
- ❑ ISIE'07 – IEEE International Symposium on Industrial Electronics, Vigo, Spain, June 4th – 7th, 2007.
    - o Session *EPS 1 – Evolvable Production Systems*. 5 Jun 2007 – 15:00 to 17:00
    - o Session *EPS 2 – Evolvable Production Systems*. 6 Jun 2007 – 09:30 to 10:50
    - o Session *FTPEC 1 – Fault-Tolerant Power Electronic Converter*. 7 Jun 2007 – 11:30 to 13:00
- ❑ IMS 2010 – IFAC International Workshop on Intelligent Manufacturing Systems, Lisboa – Portugal, 1-2 July 2010.
    - o Keynote Speaker 3 – *Evolution of Motion: The Interaction of Intelligent Mechanics and Control*. 2nd July 2010 – 09:00 to 10:00
    - o Discussion Panel – *Discussion Panel: Enriching Manufacturing with Bio-Inspiration*. 2nd July 2010 – 10:00 to 11:00
    - o Session D.2 – **Biologically Inspired Systems**. 2nd July – 11:30 to 13:00
- ❑ INDIN'1' – 8th IEEE International Conference on Industrial Informatics, Osaka, Japan, July 13th – 16th, 2010.
    - o Session *TT4-1 Emerging Platform technologies in Industrial Informatics*. 14th Jul 2010 – 09:15 to 10:30
    - o Session *TT4-2 Emerging Platform technologies in Industrial Informatics*. 14th Jul 2010 – 10:45 to 12:00

Reviewer of scientific publications

Journals

- ❑ IEEE Computer Magazine – Oct 2004.
- ❑ Computación y Sistemas – Revista IberoAmericana de Computación – ISSN 1405-5546.
- ❑ IEEE Transactions on Industrial Informatics – IEEE IES Society.
- ❑ IEEE Transactions on Industrial Electronics – IEEE IES Society.

- ❏ Computers & Industrial Engineering – Elsevier.
- ❏ Computers and Electronics in Agriculture – Elsevier.
- ❏ Control Engineering Practice – Elsevier.
- ❏ Engineering Applications of Artificial Intelligence – Elsevier.
- ❏ IEEE Transactions on Automation Science and Engineering – IEEE Robotics & Automation Society.

Short Teaching Activities at Foreign Universities

- ❏ Master Class delivered to the PROMEC/UFRGS – Programa de Pós Graduação da Engenharia Mecânica da Universidade Federal do Rio Grande do Sul, entitled *Abordagem de Controlo para os Novos Desafios da Manufactura*. Porto Alegre – Brasil, 4th May 2007.
- ❏ Class delivered to the Production Engineering Department of the Universidade Federal do Rio Grande do Sul, entitled *Evolvable Assembly Systems: Challenges and Opportunities*. Porto Alegre – Brasil, 31st October 2007.
- ❏ PhD Seminar Class delivered to PhD students from the Department of Production Engineering of the Royal Institute of Technology (KTH). *Advanced Control Systems to Support Evolvable Production Systems*. Stockholm – Sweden, 26th September 2008.
- ❏ Invited Master Class entitled *Evolvable Assembly Systems*, given to the Artificial Intelligence Course from the Faculty of Mechanical Engineering & Naval Architecture of the University of Zagreb. Zagreb, Croatia, 10th Apr 2009. (Invited by Prof Bojan Jerbic).
- ❏ Invited Class for the Pos-Graduation Program (Master and PhD students) from the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Brazil, entitled *Service Oriented Architectures to Support Evolvable Assembly Systems*. Class ELE00012 – Barramentos Industriais, 28th May 2010. (Invited by Prof Carlos Eduardo Pereira).
- ❏ Master Class entitled *Distributed Control Systems* as part of the Micro Assembly Systems Course worth 5 credits (FMG 3003) delivered at the KTH – Royal Institute of Technology, Stockholm, Sweden, Department of Production Engineering, 20th September 2010.
- ❏ Master Class entitled *Architectural Needs: Why?* as part of the Micro Assembly Systems Course worth 5 credits (FMG 3003) delivered at the KTH – Royal Institute of Technology, Stockholm, Sweden, Department of Production Engineering, 22nd September 2010.
- ❏ Invited Class for the Pos-Graduation Program (Master and PhD students) from the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Brazil, entitled *Evolvable Production Systems – An Answer to Agile Manufacturing*. Class ELE00002 – Sistemas de Automacao - PPGEE, 15th June 2011. (Invited by Prof Carlos Eduardo Pereira).

Collaboration

The Research Group has enlarged collaboration of ongoing research activities with other organizations at national and international level, i.e., joint publications in international conferences and journals, member of consortia of international and national projects, joint preparation of special issues in journals and organization of conferences and workshops, joint training activities, participation in PhD defences, etc.

The universities with whom this research group actively cooperate are:
1. Royal Institute of Technology (KTH) – Stockholm. Department of Production Engineering. Prof. Mauro Onori
2. University of Nottingham – Nottingham, UK. Department of Mechanical Engineering. Prof. Svetan Ratchev and Dr Niels Lohse
3. Karlsruhe Institute of Technology – Department of Microassembly. Andreas Hoffmann.
4. Universidade Federal do Rio Grande do Sul (UFRGS) – Porto Alegre, RS, Brazil. Department of Electrical Engineering. Prof. Carlos Eduardo Pereira.
5. Tampere University of Technology – Tampere, Finland. Department of Automation. Prof Reijo Tuokko and Prof Jose Lastra

The industrial companies with whom this research group actively cooperates are:
1. FESTO – Germany
2. Schneider Electric – France
3. MASMEC – Italy
4. Electrolux - Italy

Facilities

The most important facilities for the support of the research activities are:

1. An assembly system composed of two robot cells with several exchangeable gripers, one conveyor system, and one automatic warehouse.
2. One FESTO assembly cell to test modular evolvable assembly systems
3. One FISCHERTEKNIK cell to test modular evolvable assembly systems
4. Several boards to test agent based control
5. Service based components to test service based plugability

Strategy

10. Develop the inherent activities and increase the productivity always improving quality and merge all the knowledge and different expertise from sub research-areas of CTS targeting the design of distributed industrial systems;

11. Reinforce national and international cooperation emphasizing interdisciplinary work, namely integrating complete manufacturing solutions;

12. Encourage all staff and Ph.D. students to disseminate their research results priory in journals with major 5-Years impact factors and in leading international conferences (accordingly to the DEE Publishing Reference List);

13. Reinforce work and collaboration in the area of agile manufacturing and related areas

Production

Books (with ISBN)

- Barata, J. (2005) Coalition Based Approach For ShopFloor Agility. Lisbon: ORION.

Refereed Book Chapters

*NOTE: **Not included** here are articles and addresses presented at conferences, published only in the conference's proceedings/minutes, even when these are published in book form (with ISBN).*

Total 2007-2010: 5, annual average: 1,7

1. Cândido G, Barata J. A Multiagent Control System for Shop Floor Assembly. In: Marik V, Vyatkin V, Colombo AW, editors. Holonic and Multi-Agent Systems for Manufacturing. Berlin / Heidelberg: Springer 2007. pp. 293-302. (**WoS**) – 2 Citations

2. Santana, P., Cândido, C., Santos, P., Almeida, L., Correia, L., & Barata, J. (2008). The Ares Robot: Case Study of an Affordable Service Robot In *European Robotics Symposium 2008*, (Bruyninckx, H., et al., Eds.), Vol. 44/2008, pp. 33-42. Springer Berlin / Heidelberg. (**WoS**)

3. Santana, P., Correia, L. &, Barata, J. (2008). Developments on an Affordable Robotic System for Humanitarian Demining. In: Habib, Maki K., editor. Humanitarian Demining. Viena: I-Tech Education and Publishing. p 263-288.

4. Barata, J., Ribeiro, L., & Colombo, A.W. (2010). A Service-oriented Shop Floor to Support Collaboration in Manufacturing Networks. In *Artificial Intelligence Techniques for Networked Manufacturing Enterprises Management*, (Benyoucef, L., & Grabot, B., Eds.), pp. 483-503. Springer, London. DOI: 10.1007/978-1-84996-119-6_16.

5. Santana, P., Correia, L., & Barata, J. (2010). Locomotion and Localisation of Humanitarian Demining Robots. In *Using Robots in Hazardous Environments: Landmine Detection, Demining and Other Applications*, (Baudoin, Y., & Habib, M.K., Eds.), p. 712. Woodhead Publishing.

Refereed Articles in Journals

1. Santana P., Barata J., Correia L. (2007). Sustainable Robots for Humanitarian Demining. International Journal of Advanced Robotic Systems, Vol 4, Number 2, pp 207-218.

2. Barata, J., Camarinha-Matos, L.M. and Cândido, G. (2008). A multiagent-based control system applied to an educational shop floor. Robotics and Computer Integrated Manufacturing, Vol 24, Number 5, pp 597-605. (WoS) 2 citations.

3. Ribeiro, L., Barata, J. and Colombo, Armando. (2009). Supporting Agile Supply Chains Using a Service-Oriented Shop Floor. Engineering Applications of Artificial Intelligence, Vol 22, Number 6, pp 950-960. (**WoS**) (1 citation)

4. Cândido, G., Barata, J. and Colombo, Armando. (2009). SOA in Reconfigurable Supply Chains: A Research Roadmap. Engineering Applications of Artificial Intelligence, Vol 22, Number 6, pp 939-949. (WoS) (1 citation)

5. M. Onori, and J. Barata Oliveira. (2010). Outlook report on the future of European Assembly automation, Assembly Automation, vol. 30, Number 1, pp. 7-31. (WoS) 10.1108/01445151011016028

6. R. Frei, and J. Barata. (2010). Distributed Systems – from natural to engineered: three phases of inspiration by nature, International Journal of Bio-Inspired Computation, vol. 2, Number 3/4., pp. 258-270. DOI:10.1504/IJBIC.2010.033094

7. P. Santana, L. Correia. Swarm Cognition on Off-Road Autonomous Robots. Swarm Intelligence, DOI: 10.1007/s11721-010-0051-7. (WoS)

8. P. Santana, M. Guedes, L. Correia, J. Barata. Stereo-Based All-Terrain Obstacle Detection Using Visual Saliency. Journal of Field Robotics, DOI: 10.1002/rob.20376, 2010. (WoS)

9. P. Santana, and L. Correia. A Swarm Cognition Realization of Attention, Action Selection and Spatial Memory. Adaptive Behavior, Vol. 18, No. 5, pp. 428-447, 2010. (WoS)

Refereed International Conferences

1. Frei R, Barata J, Serugendo G, (2007). A Complexity Theory Approach to Evolvable Production Systems, In Proceedings of the MARS 2007 – 3rd International Workshop on Multi-Agent Robotic Systems in conjunction with ICINCO 2007 – 4th International Conference on Informatics in Control, Automation and Robotics, INSTICC Press, p. 44-53. (WoS)

2. Leitão P, Barata J. An Agent-based Disturbance Handling Architecture in Manufacturing Control. In: Proc IMS'07 - IFAC Intelligent Manufacturing Systems Alicante - Spain, 23-25 May, 2007.

3. Barata J, Cândido G, Colombo AW. A Multiagent Based Control System for an Assembly Cell. In: Proc IMS'07 - IFAC Intelligent Manufacturing Systems Alicante - Spain, 23-25 May, 2007.

4. Barata J, Ribeiro L, Colombo AW. (2007) Diagnosis using Service Oriented Architectures (SOA). In: INDIN'07 - 5th IEEE International Conference on Industrial Informatics, (Daejeon – Korea: IEEE Xplore), pp 951-956. (WoS)

5. Barata J, Ribeiro L, Onori M. (2007) Diagnosis on Evolvable Production Systems. In: Proc ISIE'07 - IEEE International Symposium on Industrial Electronics, (Vigo – Spain: IEEE Xplore), pp. 3221-3226. (WoS)

6. Barata J, Frei R, Onori M. (2007) Evolvable Production Systems: Context and Implications. In: Proc ISIE'07 - IEEE International Symposium on Industrial Electronics, (Vigo – Spain: IEEE Xplore), pp. 3233-3238. (WoS)

7. Barata J, Onori M, Frei R, Leitão P. Evolvable Production Systems: Enabling Research Domains. In: Proc CARV'07 - 2nd International Conference on Changeable, Agile, Reconfigurable, and Virtual Production Toronto - Canada, 22-24 July, 2007.

8. Frei R, Ribeiro L, Barata J, Semere D. Evolvable Assembly Systems: Towards User Friendly Manufacturing. In: Proc ISAM'07 - IEEE International Symposium on Assembly and Manufacturing Ann Arbor - Michigan - USA, 22-25 Jul, 2007. pp 288-293. (WoS)

9. Semere D, Barata J, Onori M. Evolvable Assembly Systems: Developments and Advances. In: Proc ISAM'07 - IEEE International Symposium on Assembly and Manufacturing Ann Arbor - Michigan - USA, 22-25 Jul, 2007. pp 282-287. (WoS)

10. Santana, P., Correia, L., Salgueiro, M., Santos, V. and Barata, J. A Knowledge-Based Component for Human-Robot Teamwork. In Filipe, J., Cetto, J.A. and Ferrier, J.L., eds. ICINCO 2008 - Fifth International Conference on Informatics in Control, Automation and Robotics, pp. 228-233 (INSTICC - Institute for Systems and Technologies of Information, Control and Communication, Funchal - Portugal, 2008).

11. Frei, R., & Barata, J. (2008a). Embodied Intelligence To Turn Evolvable Assembly Systems Reality. In Innovation in Manufacturing Networks, (Azevedo, A., Ed.), Vol. 266/2008, pp. 269-278. Springer, Boston. (WoS)

12. Frei, R., & Barata, J. (2008b). Manufacturing Systems Of The Future: A Multi-Disciplinary Approach In Innovation in Manufacturing Networks, (Azevedo, A., Ed.), Vol. 266/2008, pp. 239-244. Springer, Boston. (WoS)

13. Onori, M., Semere, D., & Barata, J. (2008). Evolvable Assembly Systems: From Evaluation to Application. In Innovation in Manufacturing Networks, (Azevedo, A., Ed.), Vol. 266/2008, pp. 205-214. Springer, Boston. (WoS)

14. Ribeiro, L., Barata, J., & Mendes, P. (2008). MAS and SOA: Complementary Automation Paradigms. In Innovation in Manufacturing Networks, (Azevedo, A., Ed.), Vol. 266/2008, pp. 259-268. Springer, Boston. (WoS)

15. Ribeiro, L., Barata, J., Colombo, A.W. and Jammes, F. (2008). "A Generic Communication Interface for DPWSbased Web Services." in INDIN'08 - 6th IEEE International Conference on Industrial Informatics (Daejeon - Korea: IEEE Xplore), pp 762-767. (WoS)

16. Ribeiro, L., Barata, J., Ferreira, B. and Pires, J. (2008). "An Architecture for a Fault Tolerant Highly Reconfigurable Shop Floor." in INDIN'08 - 6th IEEE International Conference on Industrial Informatics (Daejeon - Korea: IEEE Xplore), pp 1194-1199. (WoS)

17. Cândido, C., Santana, P., Correia, L. and Barata, J. (2008). "Shared Control of a Pan-Tilt Camera on an All-terrain Mobile Robot." in ETFA'08 - 13th IEEE International Conference on Emerging Technologies and Factory Automation (Hamburg - Germany: IEEE Xplore), pp 177-183. (WoS)

18. Santos, V., Santana, P., Correia, L. and Barata, J. (2008). "ATeleoperation mechanisms in a Multi-Agent System." in *ETFA'08 - 13th IEEE International Conference on Emerging Technologies and Factory Automation* (Hamburg - Germany: IEEE Xplore), pp 170-176. (**WoS**)

19. Ribeiro, L., Barata, J., Onori, M., & Amado, A. (2008). OWL Ontology to Support Evolvable Assembly Systems. IMS'08 - 9th IFAC Workshop on Intelligent Manufacturing Systems, (Pereira, C.E., et al., Eds.), pp. 290-295. IFAC, Szczecin- Poland.

20. Frei, R., Ferreira, B. and Barata, J. (2008). "Dynamic Coalitions for Self-Organizing in Evolvable Assembly Systems." in CIRP ICME '08 - 6th CIRP International Conference on Intelligent Computation In Manufacturing Engineering (Napoles - Italy: CIRP), pp xx-xx..

21. Frei, R., Di Marzo Serugendo, G. and Barata, J. (2008). "Designing Self-Organization for Evolvable Assembly Systems." in SASO '08 - Second IEEE International Conference on Self-Adaptive and Self-Organizing Systems S. Brueckner, P. Robertson and U. Bellur, eds. (Venice - Italy: IEEE Computer Society), pp 97-106. (WoS)

22. L. Ribeiro, J. Barata and A. Colombo, (2008) "MAS and SOA: A Case Study Exploring Principles and Technologies to Support Self-Properties in Assembly Systems," in SASOW 2008 - Second IEEE International Conference on Self-Adaptive and Self-Organizing Systems Workshops, G. Di Marzo Serugendo and M.-P. Gleizes, eds. (Venice - Italy: IEEE Computer Society), pp 192-197. (WoS)

23. Santana, P., Santos, P., Correia, L. and Barata, J. (2008). "Cross-country obstacle detection: Space-variant resolution and outliers removal." in IROS 2008 - IEEE/RSJ International Conference on Intelligent Robots and Systems, pp 1836-1841. (WoS)

24. Santana, P., Guedes, M., Correia, L. and Barata J. (2009). "Saliency-Based Obstacle Detection and Ground-Plane Estimation for Off-Road Vehicles," in Computer Vision Systems - 7th International Conference, ICVS 2009, (Fritz, M., Schiele, B. and Piater, J.H., Eds.), Vol. 5815/2009, (Berlin Heidelberg: Springer-Verlag), pp 275-284. (WoS)

25. Neves P. and Barata, J. (2009) "Evolvable Production Systems - Approach towards Economical and Ecological Production Systems," in *ISAM 2009 - IEEE International Symposium on Assembly and Manufacturing* (Suwon - Korea: IEEE Xplore), pp 189-194. (**WoS**)

26. Ribeiro, L., Barata, J. and Sousa, P. (2009) "An Algorithm for Management of Automotive Buffers with Drawers," in ISAM 2009 - IEEE International Symposium on Assembly and Manufacturing (Suwon - Korea: IEEE Xplore), pp 71-76. (WoS)

27. Ribeiro, L., Barata, J., Cândido, G. and Onori, M. (2009) "Evolvable Production Systems: An Integrated View on Recent Developments " in Proceedings of the 6th CIRP-Sponsored International Conference on Digital Enterprise Technology, (Huang, G.Q, Mak, K.L., and. Maropoulos, P.G., Eds.) Vol. 66/2010, (Berlin / Heidelberg: Springer), pp 841-854. (WoS)

28. Frei, R., Ferreira, B., Di Marzo Serugendo, G. and Barata, J. (2009) "An Architecture for Self-Managing Evolvable Assembly Systems," in SMC 2009 - IEEE International Conference on Systems, Man and Cybernetics (San Antonio - TX - USA: IEEE Xplore), pp 2707-2712. (WoS)

29. Cândido, G., Jammes, F., Barata, J. and Colombo, A.W. (2009) "Generic Management Services for DPWS-enabled Devices," in IECON 2009 - 35th Annual Conference of the IEEE Industrial Electronics Society (Porto - Portugal: IEEE Xplore), pp 3967-3972. (WoS)

30. Ribeiro, L., Barata, J., Leitão, P. and Silverio, N. (2009) "Maintenance Management and Operational Support As Services In Reconfigurable Manufacturing Systems," in *INCOM 2009 - 13th IFAC Symposium on Information Control Problems in Manufacturing* (Moscow - Russia: IFAC-PapersOnLine), pp 1778-1783.

31. Onori, M. and Barata, J. (2009). "Evolvable Production Systems: Mechatronic Production Equipment with Process-Based Distributed Control," in SYROCO 2009 - 9th IFAC Symposium on Robot Control (Gifu - Japan: IFAC-PapersOnLine).

32. Cândido, G., Barata, J., Jammes, F., and Colombo, A.W. (2010). "Applications of Dynamic Deployment of Services in Industrial Automation" In Emerging Trends in Technological Innovation, (Camarinha-Matos, L.M., Pereira, P., & Ribeiro, L., Eds.), Vol. 314/2010, (Boston: Springer), pp. 151-158. (WoS) DOI: 10.1007/978-3-642-11628-5_16.

33. Maffei, A., Onori, M., Neves, P., and Barata, J. (2010). "Evolvable Production Systems: Mechatronic Production Equipment with Evolutionary Control" In Emerging Trends in Technological Innovation, (Camarinha-Matos, L.M., Pereira, P., & Ribeiro, L., Eds.), Vol. 314/2010, (Boston: Springer), pp. 133-142. (WoS) DOI: 10.1007/978-3-642-11628-5_14.

34. Ribeiro, L., Barata, J., and Ferreira, J. (2010). "The Meaningfulness of Consensus and Context in Diagnosing Evolvable Production Systems" In Emerging Trends in Technological Innovation, (Camarinha-Matos, L.M., Pereira, P., & Ribeiro, L., Eds.), Vol. 314/2010, (Boston: Springer), pp. 143-150. (WoS) DOI: 10.1007/978-3-642-11628-5_15.

35. P. Santana, M. Guedes, L. Correia and J. Barata. (2010). "A Saliency-Based Solution for Robust Off-Road Obstacle Detection," in *ICRA 2010 - International Conference on Robotics and Automation* (Anchorage, AK - USA: IEEE Xplore), pp 3096-3101. (**WoS**) DOI:10.1109/ROBOT.2010.5509178.

36. P. Santana, N. Alves, L. Correia and J. Barata. (2010). "A Saliency-Based Approach to Boost Fast Trail Detection," in ICRA 2010 - International Conference on Robotics and Automation (Anchorage, AK - USA: IEEE Xplore), pp 1426-1431. (WoS) DOI:10.1109/ROBOT.2010.5509929.

37. G. Candido, F. Jammes, J. B. de Oliveira and A. W. Colombo. (2010). "SOA at device level in the industrial domain: Assessment of OPC UA and DPWS specifications," in INDIN'10 - 8th IEEE International Conference on Industrial Informatics (Osaka - Japan: IEEE Explore), pp 598-603. DOI:10.1109/INDIN.2010.5549676. (WoS)

38. L. Ribeiro, J. Barata and J. Ferreira. (2010). "An agent-based interaction-oriented shop floor to support emergent diagnosis," in INDIN'10 - 8th IEEE International Conference on Industrial *Informatics* (Osaka - Japan: IEEE Explore), pp 189-194. DOI:10.1109/INDIN.2010.5549436. (**WoS**)

39. R. Frei, G. Di Marzo Serugendo, N. Pereira, J. Belo and J. Barata, (2010). "Implementing self-organisation and self-management in evolvable assembly systems," in ISIE'10 - 2010 IEEE International Symposium on Industrial Electronics (Bari - Italy: IEEE Explore), pp 3527-3532. DOI:10.1109/ISIE.2010.5637273. (WoS)

40. G. Candido, J. Barata, A. W. Colombo and F. Jammes, (2010). "Service-oriented Architecture at device level to support Evolvable Production Systems," in ISIE'10 - 2010 IEEE International Symposium

on Industrial Electronics (Bari - Italy: IEEE Explore), pp 2669-2674. DOI:10.1109/ISIE.2010.5637527. (WoS)

41. M. Onori and J. Barata, (2010). "Evolvable Production Systems: New domains within mechatronic production equipment," in ISIE'10 - 2010 IEEE International Symposium on Industrial Electronics (Bari - Italy: IEEE Explore), pp 2653-2657. DOI:10.1109/ISIE.2010.5637827. (WoS)

42. L. Ribeiro, J. Barata and J. Ferreira, (2010). "Implementing self-organisation and self-management in evolvable assembly systems," in ISIE'10 - 2010 IEEE International Symposium on Industrial Electronics (Bari - Italy: IEEE Explore), pp 2647-2652. DOI:10.1109/ISIE.2010.5637853. (WoS)

43. L. Ribeiro, J. Barata and B. Alves, (2010). "Exploring the network dimension of diagnosis in Evolvable Production Systems," in ETFA 2010 - 15th IEEE Conference on Emerging Technologies and *Factory Automation* (Bilbao - Spain: IEEE Explore), pp 1-6. DOI:10.1109/ETFA.2010.5641349. (**WoS**)

44. L. Ribeiro, J. Barata, B. Alves and J. Ferreira, (2010). "Global Vs Local: A Comparison of Two Approaches to Perform Diagnosis in Networks of Mechatronic Agents," in SASO'10 - 4th IEEE International Conference on Self-Adaptive and Self-Organizing Systems (Budapest - Hungary: IEEE Explore), pp 84-93. DOI:10.1109/SASO.2010.36. (WoS)

45. P. Santana, C. Santos, D. Chaínho, L. Correia and J. Barata, (2010). "Predicting Affordances from Gist," in From Animals to Animats 11 - 11th International Conference on Simulation of Adaptive Behaviour, S. Doncieux, B. Girard, A. Guillot, J.-A. Meyer, J.-B. Mouret and J. Hallam, eds. (Berlin - Heidelberger: Springer), pp 325-334. DOI:10.1007/978-3-642-15193-4_31

Doctoral and Post-doc Advising

Doctoral candidates, completed

- ***Self-Organisation In Evolvable Assembly Systems***, Regina Maria Frei Santos Barbosa, FCT, Universidade Nova de Lisboa, 17th May 2010.

LINE C

– Computer Engineering –

Group C1: Collaborative Networks

Research Group Coordinator

Luis M. Camarinha-Matos, cam@uninova.pt

Doctoral Research Team

- Luis M. Camarinha-Matos, Full Professor   email: cam@uninova.pt
- António F. Abreu, Pos-doc (25%)*   email: ajfa@dem.isel.ipl.pt

PhD students

- João Rosas (finished in Jun 2010)   email: jrosas@uninova.pt
- Luis Octavio Castolo (finished in April 2008)**   email: *<left in 2008>*
- Patrícia Macedo   email: pmacedo@est.ips.pt
- Tiago Cardoso   email: tomfc@uninova.pt
- Filipa Ferrada (since 2008)   email: faf@uninova.pt
- Ana Inês Oliveira (since 2008)   email: aio@uninova.pt
- Hadi Nateg (since Dec 2010)   email: hnt@uninova.pt

* Adjunct professor at Polytechnic Institute of Lisbon and Polytechnic Institute of Setubal
** Left the group after conclusion of the PhD (returned to Mexico)

Summary

- Main indicators and achievements:

This report mainly summarizes research activities undertaken from 2007 until 2010 (evaluation period) of the Collaborative Networks and Distributed Industrial Systems (CoDIS) research group of CTS.

The activities of this group are concentrated in the area of Collaborative Networks, covering both the theoretical foundation and applied research to distributed enterprise networks and elderly support networks.
We have co-authored 1 book and 16 international book chapters, 20 papers in A/A+ journals, 3 in other international refereed journals, and 35 in international refereed conferences. A significant effort was made to increase the quality of the publications in Journals and conferences, as can be seen in the summary tables below.
We were also awarded one national various international projects, some of which led by our group.

Highlights of achievements (since 2007)

1. ARCON modelling framework and reference model for Collaborative Networks, the most comprehensive attempt to capture all important facets of collaborative networks (1 book by Springer and various papers). Nowadays ARCON is followed by several research initiatives worldwide.

2. Successful conclusion of ECOLEAD integrated project, which generated a large amount of scientific and technical results (e.g. 207 publications by the consortium, 6 special journal issues, 22 prototype systems), highly cited, and also trial implementations in 9 real world networks in different regions of the world (Europe, Mexico, China). A summary of achievements is recorded in two books published by Springer.

3. Significant increase in the number of high quality journals.

4. Conclusion of 3 PhD thesis.

5. Substantial progress on modelling (and supporting decision making) regarding the behavioural dimension of collaborative networks - value systems, collaboration readiness, benefits modelling (3 PhD thesis finished, 1 being finished).

6. Strategic research roadmap for extension of active professional life of seniors, according to a collaborative networks perspective.

7. Prototype of a negotiation support wizard (WizAN) for collaborative networks, focused on supporting the formation of dynamic virtual organizations. Prototype of telecare system to assist elderly at home (1 finished PhD thesis).

8. Leading role in international projects (ECOLEAD, ePAL, GloNet <new>).

9. Significant contribution to the consolidation of the international community involved in the collaborative networks research area (through SOCOLNET association), which also increased the recognition of the group (also reflected by the number of citations).

10. *Doctor Honoris Causa* awarded to the CoDIS group leader in recognition for his contribution to the area of collaborative networks and computer integrated manufacturing.

Summary Tables

Figure 1 and Table 1 represent the production of the CoDIS group considering the same parameters as the other groups of CTS.

	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	9	23	5,1	13,1
Journals A/A+	5	16	2,9	9,1
Conferences	32	35	18,3	20,0
Conferences A/A+	24	30	13,7	17,1
MSc Theses	2	0	1,1	0,0
PhD Students	6	8	3,4	4,6
PhD Theses	1	3	0,6	1,7
Teams PhD	1,75	1,75		

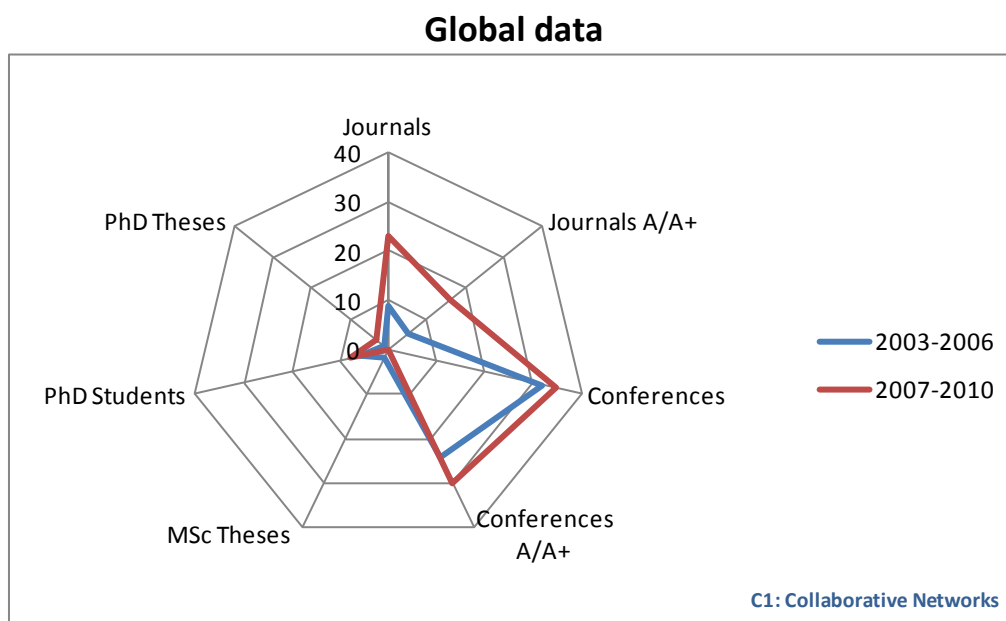Table 1. *Summary Table for Figure 1*

Figure 1. Global data of CoDIS

Now, if we look at the global production in terms of publications these also include publications in book chapters and also other conference papers published in proceedings. Table 2 provides the complete publication record for the CoDIS group.

TABLE 2: *Total publication record production of CoDIS*

	2003/06*	2007/10	% increase
Total Journals	8	23	+187,5 %
Journals A/A+	2	20	+900 %
Conferences A/A+	20	22	+10 %
Books		1	
Book Chapters	15	16	+6,6 %
Conferences B/C	10	13	+30 %
Edited books	8	6	-25 %
TOTAL publications	*61*	*81*	*+32,78 %*
Total per PhD	*48,8*	*64,8*	

* Excluding the publications of the sub-group that appears now in B1.

Observing Table 2, we can note a substantial increase in the number of publications (32,78%), both in global terms and numbers per PhD, with particular relevance to the high increment of journal publications. The highest increase is in the publications in A/A+ journals (900%). The only item with a slight decrease (edited books) is compensated by an authored book.

In summary the most relevant publications in A and B journals are:

	Publications in A+, A and B ranked Journals	2003-06	**2007-10**
	IEEE Transactions on Systems, Man and Cybernetics – C		**1**
	TECHNOVATION		**1**
	J. Computers in Industry	1	
	Annual Reviews in Control		**3**
A+ / A	*Journal of Production Planning and Control*		**4**
	Journal of Intelligent Manufacturing	1	**2**
	International Journal of Production Research		**6**
	Journal of Robotics & Computer Integrated Manufacturing		**2**
	Journal of Computers & Industrial Engineering		**1**
B	*Information Systems Frontiers*		**1**
	Int. Journal of Computer Integrated Manufacturing	1	
	Total (A+,A,B)	3	**21**
	Other Journals	5	**2**
	TOTAL JOURNALS	8	**23**

	Publications in A+, A and B ranked conferences	2003-06	2007-10
A+ / A	*PRO-VE (IFIP Working Conference on Virtual Enterprises),* **DEXA** *(International Conference on Database and Expert Systems Applications),* **BASYS** *(IFIP Working Conference on IT for Balanced Automation),* **DEST** *(IEEE Int. Conf on Digital Ecosystems and Technologies), IEEE* **IEMC** *(Europe 2008 – International Engineering Management Conference on Managing Engineering, Technology and Innovation for Growth),* **ETFA** *(IEEE Int. Conf. On Emerging Technologies and Factory Automation),* **SAINT** *(Symposium on Applications and the Internet),* **INDIN** *(International IEEE Conference on Industrial Informatics)*	20	**22**
B	*DET (International CIRP Conference in Digital Enterprise Technology),* **INCOM** *(IFAC Symposium on Information Control Problems Manufacturing),* **PROLAMAT** *(IFIP Int. Conf. On Knowledge Enterprise)*	4	
	Total (A+, A, B)	24	**22**
	Other indexed on ISI Web of Science or IEEE Xplorer		**8**
	Other conferences	6	**5**
	Total in WoS + IEEE Xplore	24	**30**
	TOTAL CONFERENCES	30	**35**

Introduction

In both industry and services collaborative networks have existed for a long time. For instance, global supply chains can be even exemplified with the ancient Silk Road. During the 15th century, with the navigation ventures started by the Portuguese and follow up initiatives by the Spanish and Dutch, the trading networks were reshaped. Centuries later, the global supply chains, mostly focused on basic needs, e.g. agricultural goods and raw materials, were affected and reformed by the Industrial Revolution. More recently, during the 1970s and 1980s, the Japanese manufacturing concepts and techniques, including just-in-time, co-makership and keiretsu networks, attracted the academic/research interest to the analysis of the interactions among autonomous but cooperating entities. In the 1990s, because of the drive for lower costs, greater efficiency and responsiveness to customer demand, the paradigm of core competencies emerged as well as the consequent move to outsourcing. One of the foundational works in this area was the study of the Transaction Cost Economics by Williamson in the 1970s. Particularly along the last decades, the shift from make-or-buy to co-makership and alliances, the search for flexibility, the emergence of concepts for computer integrated manufacturing, fractal company, holonic manufacturing systems, intelligent manufacturing systems, and balanced automation, all demonstrate a continuous move to more loosely connected industrial manufacturing entities. The industrial networks and concepts of distributed manufacturing are now perceived as potential solutions to the needed flexibility and agility in response to fast changes in market demands. Similarly in many other industrial areas, including the service industry, the emphasis on networking and partnership / cooperation has raised a large interest in a number of new disciplines such as the coordination theory, organizational theory, and sociology of the industrial organizations among others.

On the other hand, the advances in ICT area, and particularly the Internet and pervasive computing, have revolutionized virtual collaborations and have enabled and induced the emergence of new paradigms such as extended enterprise, virtual enterprise (VE) / virtual organization (VO), and professional virtual community, all representing temporary alliances of entities that come together to share their skills, core competencies and resources in order to better respond to emerging business opportunities, and whose collaboration is supported by computer networks. The development of grid computing, which was initially very focused on a perspective of resources management, has also evolved to cover some aspects of VOs. In practice however, the rapid formation of a consortium to respond to a business opportunity, a major aim of the VE/VO paradigm, faces some obstacles due to the large heterogeneity of the involved autonomous participants (in terms of their technological infrastructures, business practices, culture, etc.) as well as the time needed to build trust. Therefore the concept of VO Breeding Environment (VBE) has emerged representing a long term association aimed at increasing the level of preparedness of its members in advance, to enable their more efficient integration and participation in temporary alliances, triggered by emerging business opportunities. This concept is a successor of earlier organizational structures such as industry clusters or industrial districts, empowered by better ICT support and more adequate governance models. A business ecosystem, also known as digital business ecosystem, can be seen as a particular case of a VBE, also involving some inspiration on its principles and mechanisms from biological ecosystems. It is frequently focused on one geographical region and tries to involve the socio-economic *living forces* of that region. Besides the production and services industries, the above new organizational structures and related concepts are being adopted, although some times with different terminology, in a growing variety of other domains such as for instance the collaborative e-government, education networks, remote assistance networks for elderly, collaborative e-science and virtual laboratories, integrated transportation systems, and environmental and disaster management systems, among many

others. Related notions can also be found in some developments within the service oriented systems, such as the service parks and service ecologies.

Aiming to capture the essence of all these "manifestations" of networks and encompassing a new theoretical framework to support further developments, *Collaborative Networks (CNs)* have been emerging as a new scientific discipline. CNs are complex systems featuring many facets whose proper understanding requires contribution from multiple disciplines. In fact the various manifestations of this paradigm have been studied by different branches of science, including computer science / computer engineering, management, economy, sociology, industrial engineering, law, etc. During the last 15 years a large number of R&D projects tried to establish some technological foundations as well as some operating practices for the support of different forms of CNs. This effort is particularly visible in Europe, namely through the Esprit, IST and ICT programs, but also in the USA and other regions (Australia, Brazil, Japan, Mexico, to name a few). More recently, efforts are being directed towards the development of a better theoretical foundation. To this aim, contributions are "borrowed" from areas such as complexity and emergence, data mining, graph theory, federated systems, game theory, memetics, multi-agent systems, self-organizing systems, social network analysis, soft computing / computational intelligence, networks from the physics perspective, etc., which nevertheless due to the amount and variety of involved challenges in this multi-disciplinary area of research and development, so far only limited generic results have been achieved.

Research

CoDIS group focuses 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.

Research Area characterization:

Particularly during the last period CoDIS aimed at contributing to understand behavioral patterns in collaborative networks and business ecosystems in order to develop new mechanisms for effective promotion of **collaborative behavior**, what is an antecedent for the sustainability and goals achievement in these networks. Particularly, the goal is to develop a modeling framework and well-principled reference models to comprehensively capture diverse aspects related to behavior and their inter-relationships in collaborative/competitive business ecosystems. Such models serve to better understand, define and reason about the complex and dynamic emerging behavioral interactions among autonomous and heterogeneous actors, which may constitute organizations, people, and intelligent agents.

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 (e.g. distributed manufacturing, elderly support);
  - 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.

Ongoing research themes:

1- Behavioural models in Collaborative Networks (1 PhD finished, 1 PhD ongoing)

- *Assessment of collaboration readiness*: How to model, assess and enhance collaboration readiness of candidates for joining a collaborative network? This line of work presents an approach for assessing organizations' readiness to collaborate. This assessment is based in three fundamental aspects, namely (1) on collaboration preparedness, which aims at assessing whether a partner has adequate collaboration-related character traits; (2) on competencies fitness which is predominantly aimed at assessing how well an organization is able to use its competencies in a collaboration context; and (3) on willingness to collaborate, which is a concept applied to assess whether an organization is, or is not, really interested to engage in concrete collaboration opportunities. The proposed approach contributes to the formation of improved collaborative networks, increasing their likelihood of success. The principal characteristic of the model lies in the fact that it follows a behavioural perspective. As such, collaboration preparedness is based on the idea of the organizations' character, traits and behavioural patterns. Competencies fitness is in turn based on the so-called soft competencies, exploring the performance influences/effects of the soft competencies on the hard ones in a collaboration context. Finally, willingness to collaborate is based on the organization's planned

behaviour, attitudes and intentions that are perceived in/from a partner.

- *Emotions-oriented monitoring of Collaborative networks*: Despite the fact that collaboration has significant benefits especially in creating value and boosting innovation, some empirical studies indicate that although the number of CNs is increasing, a large percentage of them fail. One of the possible reasons for this is the lack of a proper assessment regarding the collaborative networks emotional state. It is known that emotions play a crucial role in humans; likewise in CNs they also can make the change, so this work line intends to give an answer to this identified problem through building emotional collective models, methods and methodologies to design an emotions-oriented monitoring system architecture and to develop a kind of self-healing based tool for regulating emotions in collaborative networks.

2- Value systems in Collaborative Networks (1 PhD finished, 1 PhD ongoing)

- *Induction of collaborative behaviour:* What will my organization benefit from embarking in a collaborative network? Will the benefits compensate for the extra overhead and even the risks that collaboration implies? How will my organization identify potential partners? These are questions that many SME managers ask when the issue of collaboration is brought in. In order to address this problem, the performed research contributes to establish the basis of a benefits model based on concepts from the social network analysis, discusses the applicability of a set of performance indicators based on collaboration benefits that are suitable for collaborative networks, and suggests a methodology to identify cooperative goals based on mathematical logic. Furthermore, the work explores the notion of social capital in CNs. We adopt a notion of social capital as the sum of the actual and potential resources (assets, markets) within, available through, and derived from the network of relationships possessed by an entity. Social capital thus comprises both the network (of relationships) and the assets that may be mobilized through the network. Access to new markets is one of the key motivators for enterprises to join a CN and thus deserve a particular attention in a proper modelling framework. A multi-dimensional approach will be followed to understand the various components of social capital. A modelling framework borrowing elements from graph theory and social network analysis is adopted.

- *Value systems modelling and alignment*: How to model, reason about, and measure alignment between the value systems of network participants? Decision making as well as the individual and joint behaviour in a CN depend on and are reflected by the underlying value system of network participants. Therefore, identification and characterization of the value system of the network as well as of their individual members are fundamental when attempting to improve and sustain a collaborative process. CNs are typically formed by heterogeneous and autonomous entities, and thus it is natural that each member has its own set of values. In the presence of different sets of values, conflicts among partners might emerge merely due to misalignment of values. With different value systems, partners might have different perceptions of the outcomes of the collaboration processes that might in turn lead to their non-collaborative behaviour. Since values are one driver of the behaviour of involved entities, at the VO creation stage, identifying partners with more compatible or common core values is important to the success of VOs. We intend to contribute to a sounder understanding of the concept of value system and to develop methods, combining crisp and soft computing approaches for value systems alignment, and for benefits and rewards distribution, thus proposing new support functionality for novel collaborative environments.

3- Collaborative Networks and Elderly support (1 PhD finished, 1 PhD ongoing)

- *Research roadmaps for a collaborative networks approach to ICT and Ageing:* A substantial and continued effort has been made in the last decade on ICT & Ageing but most initiatives have been focused on provision of assistance to senior citizens in that phase of life when a reduction of physical and even mental capabilities is observed. Current studies, however, recognize the importance of considering a broader perspective in the ageing process. In fact, more recently there is a growing recognition that the elderly population should not be considered a burden on the society but instead an asset that needs to be properly considered. A critical challenge for the

society in respect to the "active ageing / ageing well" process is to identify new organizational structures, approaches, and mechanisms so that elderly citizens not only get better support in their daily needs, but also do not feel excluded, and have the chance to use their knowledge and expertise in making valued contributions to the communities where they live. Collaborative Networks can play a fundamental role here. Nevertheless the sensitivity of the area, the dependency on the interplay between the introduction of new organizational models and creation of a new culture in society, the lessons learned with the limited success of past experiences, the risk of continuously developing technology that is not taken-up by target users, among others suggest the need for a careful analysis and a better planned approach towards what concerns new developments. In this context, roadmapping plays a fundamental role in the identification of a strategic research agenda and prioritization of needed actions. Taking into account our previous experience on roadmapping methodology, we are actively involved in the European efforts in this area.

- _Collaborative networks in ambient assisted living_: This work line addresses the problem of providing care to older people by technological means. In order to deal with a sustainable solution to this problem, our approach the development of collaborative networks to manage, promote, and deliver care services to help the elderly in their day-to-day life. In a first development, such networks are supported by an infrastructure developed according to a multi-agent approach, which takes advantage of the convergence of a number of new technologies, all of them representing the building blocks in the construction and deployment of services to provide quality care to aged people, thus supporting 'aging-in-place'. For the next stage other approaches shall be explored taking into account the developments of "Future Internet" as well as other areas such as Internet of Things and Affective Computing, following the findings of the research roadmaps mentioned above. The participation in a large national initiative provides a convenient context for further developments in the area.

- _Pro-active services ecosystem:_ The service concept is widely used in distinct research and application areas. Particularly in a Collaborative Business Ecosystem, Service Orientation represents a main trend in the development of support platforms. Nevertheless, a literature review shows that a common understanding of the concept of service is lacking, namely from the software and business perspectives. Moreover, as these Ecosystems evolve competition between members increase and they face the challenge to improve the chances of their services being selected. We address these problems through a refinement of the service concept itself and the usage of Pro-Activeness in the creation of a conceptual and technological support framework. This work also refines the Quality of Service notion for this context. These developments are then applied to a community of senior professionals in order to better support their continued participation in the socio-economic system in spite of age.

4- _Support tools for collaboration (1 PhD ongoing, 1 PhD starting)_

- _Negotiation and contracting in Collaborative Networks:_ The possibility of rapidly form virtual organizations to respond to a business or collaboration opportunity gives companies an expression of agility and survival mechanisms in face of the market turbulence. Besides the important and classical task of selecting the adequate partners with the most suitable competencies to form a consortium able to respond to the requirements of the business opportunity, it is also of extreme importance to have a robust and reliable negotiation mechanism that supports the potential VO partners in achieving agreements during the VO creation process, reducing the amount of time spent in this process. Being this topic identified as a research gap, this work aims to find better ways to support the negotiation process that happens during the VO creation phase, which certainly has a relevant impact on the agility and reliability of the process, and can contribute to the successful execution of the VO during its operation phase. The main motivating research question is: To what extent can negotiation wizard and mediation support tools facilitate conflict pre-emption and resolution? The assumption is that the dynamics of the negotiation process and the necessary support functionalities will be influenced by factors such as the characters of the involved organizations, their expectations regarding the collaboration opportunity, affective aspects, the governance principles adopted in the ecosystem, as well as the historic traces of past collaborations. Therefore, while acknowledging the rich legacy of past research in this area, we envisage a

behavioural knowledge enriched wizard.

- _Architectures and environments for collaborative ecosystems_: Aiming at designing, developing, and deploying agile support environments for collaborative ecosystems, including: (i) networks of SMEs involved in highly customized and service-enhanced products through end-to-end collaboration with customers and local suppliers (co-creation); (ii) networks of service providers for elderly assistance (ambient assisted living). In terms of approaches we explore the application of multi-agent systems, service ecologies, and cloud computing. Through the notion of collaboration space, we aim exploiting the synergies created by the involvement of the customer and local suppliers in all phases of the product development and life cycle support.

Projects

Ongoing projects on 2007 and thereafter

1. IST ECOLEAD - European Collaborative Networked Organizations Leadership Initiative
 - Apr 2004 – Jun 2008 (Integrated Project).
Funding: European Commission FP6
Participants: VTT (FI) [Administrative Manager], UNINOVA (PT) [**Scientific Coordinator**], University of Amsterdam (NL), TeS Teleinformatica e Sistemi (IT), Virtuelle Fabrik AG (CH), Gruppo Formula SPA (IT), Software AG España, S.A. (ES), T.X.T. e-solutions SPA (IT), Jozef Stefan Institute (SI), BIBA (DE), Czech Technical University (CZ), Universidade Federal De Santa Catarina (BR), ITESM (MX), Enicma GmbH DE), Certicon A.S. (CZ), LogicaCMG Nederland B.V. (NL), France Telecom SA (FR), Siemens Aktiengesellschaft Oesterreich (AT), Stichting AIESEC International (NL), Comarch SA (PL), ISOIN (ES), CeBeNetwork (DE), SMT(CZ), SNS (IE), Orona (ES), Edinform (IT), Joensuu Science Park (FI).

Development of the base foundation for collaborative networked organizations. ECOLEAD was a 6th Framework Program Integrated Project that aimed at creating the necessary strong foundations and mechanisms for establishing an advanced collaborative and network-based industry society in Europe. The ECOLEAD vision was that in ten years, in response to fast changing market conditions, most enterprises and specially the SMEs will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations. A holistic approach, combining VO Breading Environments, VO Management, Professional Virtual Communities, Theoretical Foundation and ICT Infrastructures, was followed.
Global Budget: 9 747 000 €
UNINOVA CTS Budget: 1 079 920 €

2. IST ePAL - extending Professional Active Life
 - Feb 2008 – Apr 2010.
Funding: European Commission FP7
Participants: Uninova (PT) [**Coordinator**], Skill Estrategia (ES), University of Amsterdam (NL), WhiteLoop Ltd (UK), SECOT (ES).

Development of strategic science and technology research roadmap. ePAL aimed to explore innovative ways to best facilitate the development of the active ageing process and to ensure an improved transition for the elderly citizen as they cope with the onset of age. In order to find appropriate ways towards this goal, a strategic RTD roadmap was developed focused on innovative solutions and ensuring a balanced post-retirement life-style. The ePAL vision - addressing new levels of quality of life - was that of an effective transformation of the current situation regarding retirement and the barriers to active ageing in Europe by introducing new approaches and ways to create actively contributing professional communities in society, which provides the elderly citizen with a supporting framework for leveraging their talents and expertise and creates value for the benefit of the Europe's economy. Moreover, such a framework would also support a balanced transition towards retirement.
Global Budget: 800 000 €
UNINOVA CTS Budget: 297 325 €

3. IST BRAID - Bridging Research in Ageing and ICT Development - Mar 2010 – Feb 2012.
Funding: European Commission FP7

Participants*:* Queen's University (UK), CSSC (IT), Trilateral Research (UK), Global Security Inc (UK), University of Tasmania (AU), UNINOVA (PT), University of Amsterdam (NL), Netwell Centre (IE), VDI/VDE (DE)

Development of a comprehensive RTD roadmap for active ageing by consolidating existing roadmaps and by describing and launching a stakeholder co-ordination and consultation mechanism. It will characterise key research challenges and produce a vision for a comprehensive approach in supporting the well-being and socio-economic integration of increasing numbers of senior citizens in Europe.

   Global Budget: 999 287 €
   UNINOVA CTS Budget: 108 236 €

4. QREN AAL4ALL - Ambient Assisted Living for All
 - Mar 2011 – Feb 2014. <Approved in 2010, starting in 2011>

Funding: QREN

Participants*:* Alcatel-Lucent Portugal, MSFT, INESC Porto, ISEP, Universidade do Minho, I.Zone Knowledge Systems, Associação Fraunhofer Portugal Research, ISCTE, Associação CCG / ZGDV, CITEVE, Critical Health, Exatronic, INOV, INOVAMAIS, Instituto Pedro Nunes, INTELLICARE, Universidade da Beira Interior, Meticube, FCT-UNL, Criavision, Plux, Portugal Telecom Inovação, FEUP, PROCESS.NET, Optimus, Conforto em Casa, CeNTITVC, Universidade de Aveiro, Escola Superior de Educação de Paula Frassinetti, Be Artis, GLINTT HS - Healthcare Solutions.

Development of an industry ecosystem for massive provision of products and services for Ambient Assisted Living and promotion of specific standards for the development of such products and services. Our group is responsible for the technical architecture of the AAL ecosystem.

   Global Budget : 5 000 000 €
   FCT CTS Budget: 202 275 €

New project (under negotiation):

5. IST FoF GLONET - Glocal enterprise network focusing on customer-centric collaboration
 - 2011 –2014. (under negotiation)

Funding: European Commission FP7

Participants*:* CAS Software (DE) [Administrative manager], UNINOVA (PT) [**Technical coordinator**], University of Amsterdam (NL), iPLON (DE), Steinbeis (DE), SKILL (ES), Komix (CZ), Prolon (DK)

GloNet aims at designing, developing, and deploying an agile virtual enterprise environment for networks of SMEs involved in highly customized and service-enhanced products through end-to-end collaboration with customers and local suppliers (co-creation). GloNet implements the glocal enterprise notion with value creation from global networked operations and invol¬ving global supply chain management, product-service linkage, and management of distributed manufacturing units.

   Global Budget: 2 618 000 €
   UNINOVA CTS Budget: 520 000 €

Other activities:

6. ARCON – Reference Model for Collaborative Networks - 2010 –2013.
Funding: SOCOLNET

Participants*:* Bi-lateral collaboration Uninova (CoDIS group) – University of Amsterdam (ColNet group).

The purpose of this special interest group is to pursue the reference modelling work for collaborative networks (ARCON) that was started in the ECOLEAD project.

Global Budget: resources for 6 trips / meetings.

Recognition

Awards

- L. M. Camarinha-Matos. **Doctor Honoris Causa**, University "Politehnica" of Bucharest, Romania, 30 Oct 2009 in recognition of his contributions to Collaborative Networks and Robotics and Computer Integrated Manufacturing.
- L. M. Camarinha-Matos. Best paper award, IEEE DEST 2009 IEEE International Conference on Digital Ecosystems and Technologies, 31 May – 3 Jun 2009, Istanbul, Turkey.
- L. M. Camarinha-Matos. Nominated IFIP Technical Committee 5 Fellow, 2008.

Editorial Boards and Guest Editor

- L. M. Camarinha-Matos. Associated Editor of: IEEE Transactions on Industrial Informatics (Aug 05-Jul 07), European Journal of Industrial Engineering (since 2006), Computación y Sistemas – Revista Iberoamericana de Computación (1997-2009).
- L. M. Camarinha-Matos. Member of Editorial Board of: Studies in Informatics and Control (since 1993), International Journal of Information Technology and Management (since 2002), Revista Produção - Brazil (since 2002), Robótica e Automatização (since 1989), International Journal of Logistics Systems and Management (since 2004), International Journal of Agile Systems and Management (since 2006), Multiagent and Grid Systems - An International Journal (since 2005), International Journal of Mobile Learning and Organisation (since 2005), International Journal of Electronic Markets (Associated reviewer) (2008), Revista Iberoamericana de Engenharia Industrial (since 2009).
- L. M. Camarinha-Matos. Guest editor of special issues of: Journal of Intelligent Manufacturing (Oct 2007, Jun 2010), International Journal of Production Research (2008), Journal of Robotics and Computer-Integrated Manufacturing (Oct 2008), International Journal of Information Technology and Management (2009).

Invited lectures & keynotes

- L. M. Camarinha-Matos. Invited lecture on Collaborative networks for the MSc and PhD program on "Ingeniería Avanzada de Producción, Logística y Cadena de Suministro", Polytechnic University of Valencia, Spain, Mar 2007.

- L. M. Camarinha-Matos. Invited talk on Collaborative networks: overview and success cases, *Seminario-Taller "Desarrollo de una red de organizaciones virtuales para el mejoramiento y fortalecimiento de la competitividad de las MIPyMEs Panameñas"*, Universidad Tecnológica de Panama, Panama, 26-27 Apr 2007.

- L. M. Camarinha-Matos. ECOLEAD – Achievements in Collaborative Networked Organizations, Opening talk, *PRO-VE'07 – 8th IFIP Working Conference on Virtual Enterprises*, 10 Set 2007, Guimarães, Portugal.

- L. M. Camarinha-Matos. Invited lecture on Collaborative networks for the MSc and PhD program on "Ingeniería Avanzada de Producción, Logística y Cadena de Suministro", Polytechnic University of Valencia, Spain, Apr 2009.

- L. M. Camarinha-Matos. Invited keynote on Collaborative Networked Organizations in manufacturing at *IFAC Conference on Cost Effective Automation in Networked Product Development and Manufacturing*, Monterrey, Mexico, 2-5 Oct 2007.

- L. M. Camarinha-Matos. Invited keynote on <u>Advances in collaborative networked organizations at</u> *BASYS'08,* 8th IFIP International Conference on Information Technology for
Balanced Automation, Porto, Portugal, 23-25 Jun 2008*.*

Scientific / Technical organizations

- L. M. Camarinha-Matos. President of SOCOLNET- International Society of Collaborative Networks (re-elected in 2009).

- L. M. Camarinha-Matos. Chairman of IFIP (International Federation for Information Processing) WG5.5 (COVE – COoperation infrastructure for Virtual Enterprises and electronic business) (till 2008).

- L. M. Camarinha-Matos. Portuguese representative to IFIP TC 5 (Computer Applications in Technology).

- L. M. Camarinha-Matos. Chair of the sub-committee on "R&D Issues" of the IEEE IES Technical Committee on Industrial Agents.

- L. M. Camarinha-Matos. Member of the Technical Committee on Computer Supported Cooperative Work in Design, IEEE Society on Systems, Man and Cybernetics (since 2009).

- L. M. Camarinha-Matos. Project evaluator for Estonian Science Foundation, Sep 2010.

- L. M. Camarinha-Matos. Member of the evaluation panel of the national student prize on Artificial Intelligence (APPIA), 2007.

- L. M. Camarinha-Matos. IEEE Student Branch Counselor of the IEEE Student Branch at UNL.

- T. Cardoso. Member of the Fairness Committee and Judge at the worldwide finals of the Microsoft contest Imagine Cup in the editions of: 2007 (Seoul – Korea), 2008 (Paris – France), 2009 (Cairo – Egypt) and 2010 (Warsaw – Poland). Judge at the national finals of 2010.

Program Chairman of International Events

- L. M. Camarinha-Matos. Program Committee chair or co-chair of:
  - PRO-VE'07 – 8th IFIP Working Conference on Virtual Enterprises, Guimarães, Portugal, 10-12 Set 2007.
  - BASYS'08 – 8th IFIP International Conference on Information Technology for Balance Automation, Porto, Portugal, 23-25 Jun 2008 (co-chair).
  - PRO-VE'08 – 9th IFIP Working Conference on Virtual Enterprises, Poznan, Poland, 8-10 Sep 2008.
  - PRO-VE'09 – 10th IFIP Working Conference on Virtual Enterprises, Thessaloniki, Greece, 7-9 Oct 2009.
  - AGEmap Workshop on Roadmaps towards a strategic research agenda for ICT in active ageing, 22 Mar 2010, Munich, Germany.
  - DoCEIS'10 – 1st Socolnet/IFIP/IEEE Doctoral Conference on Computing, Electrical and Industrial Systems, Costa de Caparica, Portugal, 22-24 Feb 2010.
  - BASYS'10 – 9th IFIP International Conference on Information Technology for BALANCED AUTOMATION, Valencia, Spain, 21-23 Jul 2010 (co-chair).

- PRO-VE'10 – 11th IFIP Working Conference on Virtual Enterprises, St. Etienne, France, 11-13 Oct 2010.
- MCPL 2010 – IFAC Conference on Management and Control of Production and Logistics, Coimbra, Portugal, 8-10 Sep 2010 (Vice-chair).

Collaboration

The Research Group has enlarged collaboration with other organizations at national and international level, for instance, joint publications in international conferences and journals, member of consortia of international and national projects, joint preparation of special issues in journals and organization of conferences and workshops, joint research projects, etc.

Moving beyond a classical team. In fact the group has been exploring the challenges and opportunities of collaborative networks to guide its own operation in interaction with the international CN research community. By exploring notions such as collaboration breeding environments, self-organizing teams, fluid and boundaryless teams, the group has acquired agility and critical mass as part of a large distributed and interconnected community. In this way, and in spite of the CTS decision of splitting the group (a sub-group is now forming the new group B1), CoDIS kept and increased its dynamics and results.

Internationally:

1. Collaboration in joint projects with:
    a. *Research institutions*: University of Amsterdam (NL) [5 projects], VTT (FI), JSI (SI), BIBA (DE), Czech Technical University (CZ), Federal University of Santa Catarina (BR), Monterrey Tech (MX), Queens University (UK), University of Tasmania (AU)
    b. *Companies*: SKILL (ES) [2 projects], Software AG (ES), Siemens (AT), France Telecom (FR), Logica CMG (NL), Grupo Formula (IT), TXT (IT), TES (IT), Enicma (DE), Comarch (PL), Whiteloop (UK), CSSC (IT), Trilateral Research (UK), Global Security (UK), CAS (DE), iPLON (DE), Steinbeis (DE), Komix (CZ), Prolon (DK)
    c. *Enterprise networks*: Virtuelle Fabrik (CH), ISOIN (ES), CeBeNetwork (DE), Orona (ES), Swiss Microtech (CH), Supply Network Shannon (IE)
    d. *Other*: AIESEC (NL), Edinform (IT), Joensuu Science Park (FI), SECOT (ES)

2. Collaboration in joint publications with:
    a. University of Amsterdam, Netherlands (39 joint publications)
    b. VTT, Finland (5)
    c. Federal University of Santa Catarina, Brazil (3)
    d. Monterrey Tech, Mexico (3)
    e. Josef Stefan Institute, Slovenia (3)
    f. TXT, Italy (3)
    g. EPFL, Switzerland (2)
    h. École Nationale Superieure des Mines – St. Etienne, France (2)
    i. SKILL, Spain (2)
    j. Poznan University of Economics, Poland (1)
    k. South-East European Research Centre, Greece (1)

3. Collaboration in joint organization of conferences with:
    - University of Amsterdam, Netherlands
    - South-East European Research Centre, Greece
    - Poznan University of Economics, Poland
    - Polytechnic University of Valencia, Spain
    - École Nationale Superieure des Mines – St. Etienne, France
    - Federal University of Santa Catarina and AXIA Supply Chain (Brazil)

4. 2 PhD co-supervisions with Eastern Mediterranean University (North Cyprus) and University of Amsterdam (Netherlands), in addition to the current PhD students hosted in the group.

5. Coordination of SOCOLNET (Society of Collaborative Networks), pursuing with the reinforcement of this community of researchers, currently involving more than 250 researchers in 42 countries.

Nationally:

1. Collaboration in joint projects with: 30 organizations

2. Collaboration in international events organization with:
    - University of Minho
    - University of Porto
    - University of Coimbra
    - University of Algarve

3. Collaboration with national associations of senior professionals: SHARE, APCS, on active ageing.

Outreach

Impact on the CN community

During the considered period CoDIS group has played a relevant role in the organization and coordination of the international research community on Collaborative Networks. This is reflected in:

- Coordination of SOCOLNET: During this period, the membership of the society increased substantially, reaching more than 250 members in 42 countries. A periodic newsletter was launched. The society also sponsored several international conferences and supported the preparation of various special issues of journals. The fact that 3 members of CoDIS were re-elected for the management bodies of the society (including the presidency) during the general assembly held in 2009 in Thessaloniki, Greece, is a recognition of the work done.
- Coordination of the Steering Committee of PRO-VE series of conferences (nowadays recognized as the most focused series of events on collaborative networks), which gives the group a high visibility in this community.
- Membership on the steering committee of other relevant conference series on collaborative networks (CTS - International Symposium on Collaborative Technologies and Systems, based in USA, ICE - International Conference on Concurrent Enterprising, based in Europe).

Citations

- L. M. Camarinha-Matos:
    - Harzing's Publish or Perish: Citations: 3939, h-index: 27, g-index: 49
    - ISI: Citations: 642, h-index: 13
- A. Abreu.
    - Harzing's Publish or Perish: Citations: 84, h-index: 6, g-index: 8
    - ISI: Citations: 30, h-index: 4

Scientific / Technical Program Committees

- L. M. Camarinha-Matos. Member of the Program Committee of:
    - SAINT'07 - International Symposium on Applications and the Internet, 15-19 Jan 2007, Hiroshima, Japan.
    - COA 2007 - 8th IFAC Symposium on Cost Oriented Automation Affordable Automation Systems, Ciudad de la Habana, Cuba, Feb 12 - 14, 2007.
    - CSCWD 2007 - The 11th International Conference on CSCW in Design, Melbourne, Australia, April 26-28, 2007.
    - ICINCO 2007 - 4th International Conference on Informatics in Control, Automation and Robotics, Angers, France, 9-12 May 2007.
    - IRMA 2007 – International Conference on Managing Worldwide Operations and Communications with Information Technology, 19-23 May 2007, Vancouver, British Columbia, Canada.

- CTS 2007 - International Symposium on Collaborative Technologies and Systems, Orlando, Florida, USA, May 21-25, 2007.
- IESM'07 - International Conference on Industrial Engineering and Systems Management, Beijing, China, 30 May – 2 Jun 2007.
- ICE 2007 - 13th International Conference on Concurrent Enterprising, Sophia-Antipolis, France, 4-6 Jun 2007.
- TEAR 2007 – Workshop on Trends in Enterprise Architecture Research, June 6-8, 2007, St. Gallen, Switzerland.
- ISC 2007 - 5th Annual Industrial Simulation Conference, June 11-13, 2007, Delft, Netherlands.
- ICEIS 2007 - 9th International Conference on Enterprise Information Systems will be held at Funchal, Madeira, Portugal, 12 to 16, June 200.
- INES 2007 – 11th IEEE International Conference on Intelligent Engineering Systems, Budapest, Hungary, June 29 – July 2, 2007.
- ICABS'2007 - International Conference on Adaptive Business Systems, Chengdu, China, 22-24 Jul 2007.
- DEXA 2007 - 18th International Conference on Database and Expert Systems Applications, Regensburg, Germany, September 3-7, 2007.
- HoloMAS 2007 - 3nd International Conference on Industrial Applications of Holonic and Multi-Agent Systems, September 3 - 5, 2007, Regensburg, Germany.
- APMS 2007 - Advances in Production Management Systems International Working Conference 2007, 17 - 19 September 2007, Linköping, Sweden.
- DET 2007- 4th CIRP Digital Enterprise Technology Conference, Bath, UK, 19-21 Sep 2006.
- SOAS 2007 - 3rd International Conference on Self-Organization and Autonomous Systems in Computing and Communications, September 24-27, 2007, Leipzig, Germany.
- CEA'07 – IFAC Conference on Cost Effective Automation in Networked Product Development and Manufacturing, 2-5 Oct 2007, Monterrey, Mexico.
- PRO-VE'07 – 8th IFIP Working Conference on Virtual Enterprises, Guimarães, Portugal, 10-12 Set 2007.
- BAOSW07 - 2nd Workshop on Building and Applying Ontologies for the Semantic Web, 3-7 Dec 2007, Guimarães, Portugal.
- ICEGOV2007 - International Conference on Theory and Practice of Electronic Governance, Macau, 10-13 Dec 2007
- ICDCIT2007 – 4th International Conference on Distributed Computing and Internet Technology, Bangalore, India, 17-20 Dec 2007.
- IPAS 2008 – 4th International Precision Assembly Seminar, Chamonix, France, 10-13 Feb 2008.
- INES 2008 – 12th International Conference on Intelligent Engineering Systems, 25-29 Feb Sep 2008, Miami, Florida, USA.
- CSCWD2008 - 12th International Conference on Computer Supported Cooperative Work in Design, Xi'an, China, April 16-18, 2007.
- ICINCO 2008 - 5th International Conference on Informatics in Control, Automation and Robotics, Funchal, Madeira, Portugal, 11-15 May 2008.
- FAVO 2008 - Formal Aspects of Virtual Organisations, 26 May 2008, Aabo Akademi University, Turku, Finland.
- BASYS'08 – 8th IFIP International Conference on Information Technology for Balance Automation, Porto, Portugal, 23-25 Jun 2008.
- ICEIS 2008 - 10th International Conference on Enterprise Information Systems, 12 - 16, June 2008, Barcelona, Spain.
- CTS 2008 - International Symposium on Collaborative Technologies and Systems, 19-23 May 2008, Irvine, California, USA.

- ICE 2008 - 14th International Conference on Concurrent Enterprising, Lisbon, Portugal, 23-25 Jun 2009.
- ABS'08: International Conference on Adaptive Business Systems, 21-24 July 2008, Glasgow, UK.
- SAINT 2008 - International Symposium on Applications and the Internet, Turku, FINLAND, 28 Jul - 1 Aug 2008.
- DEXA 2008 - 19th International Conference on Database and Expert Systems Applications, Turin, Italy, 1-5 Sep 2008.
- PRO-VE'08 – 9th IFIP Working Conference on Virtual Enterprises, Poznan, Poland, 8-10 Sep 2008.
- APMS 2008 - International Conference on Advances in Production Management Systems: INNOVATIONS IN NETWORKS, 14-17 Sep 2008, Espoo, Finland.
- TEAR 2008 – 3rd Workshop on Trends in Enterprise Architecture Research, 1-5 Dec 2008, Sydney, Australia.
- ICEGOV2008 - 2nd International Conference on Theory and Practice of Electronic Governance, 1 - 4 Dec 2008, Cairo, Egypt.
- ISSS 2009 - First International Symposium on Services Science, 23-25 Mar 2009, Leipzig, Germany.
- ABIS09 – 3rd International Conference on Adaptive Business Information Systems, Leipzig, Germany, 23-25 Mar 2009.
- CSCWD2009 - 13th International Conference on Computer Supported Cooperative Work in Design, Santiago, Chile, April 22-24, 2009.
- ICEIS 2009 - 11th International Conference on Enterprise Information Systems, 6 – 10 May 2009, Milan, Italy.
- CTS 2009 - International Symposium on Collaborative Technologies and Systems, 18-22 May 2009, Baltimore, Maryland, USA. [advisory committee]
- INCOM 2009 – 13th IFAC Symposium on Information Control Problems in Manufacturing, Moscow, Russia, 3-5 Jun 2009.
- ICE 2009 - 15th International Conference on Concurrent Enterprising, Sophia-Leiden, Netherlands, 22-24 Jun 2009.
- ICINCO 2009 - 6th International Conference on Informatics in Control, Automation and Robotics, Milan, Italy, 2-5 July 2009.
- SAINT 2009 - 9th IEEE/IPSJ Symposium on Applications and the Internet, Seattle, USA, 20 - 24 July 2009.
- DEXA 2009 - 20th International Conference on Database and Expert Systems Applications, Linz, Austria, August 31 - September 04, 2009.
- HoloMAS 2009 – 4th International Conference on Industrial Applications of Holonic and Multi-Agent Systems, Linz, Austria, August 31 - September 04, 2009.
- Net09 - 1st International Workshop on Technologies for the Networked Enterprise, Linz, Austria, August 31 - September 04, 2009.
- APMS 2009 - International Conference on Advances in Production Management Systems, 19-23 Sep 2009, Bordeaux, France.
- PRO-VE'09 – 10th IFIP Working Conference on Virtual Enterprises, Thessaloniki, Greece, 7-9 Oct 2009.
- EPIA 2009 – 14th Portuguese Conference on Artificial Intelligence, Aveiro, Portugal,12-15 Oct 2009.
- SWIIS2009 - IFAC Workshop on Supplementary Ways for Improving International Stability, Bucharest, Romania, 28-30 Oct 2009.
- EI2N'2009 – 4th International Workshop on Enterprise Integration, Interoperability and Networking, November 3nd-4rd, 2009, Vilamoura, Portugal.
- ICEGOV2009 – 3rd International Conference on Theory and Practice of Electronic Governance, 10-13 Nov 2009, Bogota, Colombia.
- FAVO 2009 – 2nd Workshop on Formal Aspects of Virtual Organisations, 26 Nov 2009, Eindhoven, the Netherlands.

- ICDS 2010 - Fourth International Conference on Digital Society, St. Maarten - Netherlands Antilles, February 10-15, 2010.
- IPAS 2010 – 5th International Precision Assembly Seminar, Chamonix, France, 14-17 Feb 2010.
- DoCEIS'10 – 1st Socolnet/IFIP/IEEE Doctoral Conference on Computing, Electrical and Industrial Systems, Costa de Caparica, Portugal, 22-24 Feb 2010.
- AGEmap Workshop on Roadmaps towards a strategic research agenda for ICT in active ageing, 22 Mar 2010, Munich, Germany.
- CSCWD2010 - 15th International Conference on Computer Supported Cooperative Work in Design, 14-16 Apr 2010, Shanghai, China.
- CTS 2010 - International Symposium on Collaborative Technologies and Systems, 17-21 May 2010, Chicago, Illinois, USA. [advisory committee]
- ICEIS 2010 - 12th International Conference on Enterprise Information Systems, Funchal, Madeira, 8-12 Jun 2010.
- ICINCO 2010 - 7th International Conference on Informatics in Control, Automation and Robotics, Funchal, Madeira, 15-18 Jun 2010.
- i-Society 2010 - International Conference on Information Society, London, UK, 28-30 Jun 2010.
- IMS'10 - 10th IFAC Workshop on Intelligent Manufacturing Systems (IMS'10), Lisbon, Portugal, 1-2 Jul 2010.
- SAINT 2010 - 10th IEEE/IPSJ Symposium on Applications and the Internet, Seoul, Korea, 19-23 Jul 2010.
- BASYS'10 – 9th IFIP International Conference on Information Technology for BALANCED AUTOMATION, Valencia, Spain, 21-23 Jul 2010.
- DEXA 2010 - 21th International Conference on Database and Expert Systems Applications, Bilbao, Spain, August 30 - September 03, 2010.
- MCPL 2010 – IFAC Conference on Management and Control of Production and Logistics, Coimbra, Portugal, 8-10 Sep 2010.
- ISSS 2010 - Second International Symposium on Services Science, 30 Sep 2009, Leipzig, Germany.
- PRO-VE'10 – 11th IFIP Working Conference on Virtual Enterprises, St. Etienne, France, 11-13 Oct 2010.
- ICEGOV 2010 – 4th International Conference on Theory and Practice of Electronic Governance, 25-28 Oct 2011, Beijing, China.
- EI2N'2010 – 5th International Workshop on Enterprise Integration, Interoperability and Networking, 25-29 Oct, Hersonissou, Crete, Greece.
- SWIIS 2010 - IFAC Workshop "Supplemental Ways for Improving International Stability", Oct 27-29, 2010, Prishtina, Kosovo.
- 3PGCIC-2010 – 5th International Conference on P2P, Grid, Cloud and Internet computing, Fukuoka, Japan, 4-6 Nov 2010.
- IBERSENSOR 2010 – 7th Ibero-American Congress on Sensors, 9-11 Nov 2010, Lisboa, Portugal.
- Research Seminar Series on "Interdisciplinary Contributions to Theory of Collaborative Networks", University of the West of Scotland, 15-16 Nov 2010.
- ICIT-SSST 2011 – Joint IEEE International Conference on Industrial Electronics (ICIT) & Southeastern Symposium on System Theory (SSST), Auburn, Alabama, USA, 14-17 Mar 2011.
- Southeastern Symposium on System Theory (SSST), Auburn, Alabama, USA, 14-17 Mar 2011.
- CTS 2011 - International Symposium on Collaborative Technologies and Systems, 23-27 May 2011, Philadelphia, Pennsylvania, USA. [advisory committee]
- CSCWD2011 - 15th International Conference on Computer Supported Cooperative Work in Design, 8-10 Jun 2011, Lausanne, Switzerland.

- ICEIS 2011 - 13th International Conference on Enterprise Information Systems, Beijing, China, 8-11 Jun 2011.
- LISS 2011 – 1st International Conference on Logistics, Informatics and Service Sciences, Beijing, China, 8-11 Jun 2011.
- ViNOrg'11 - 1st International Conference on Virtual and Networked Organizations Emergent Technologies and Tools, 6-8 Jul 2011, Ofir, Portugal.
- SAINT 2011 - 11th IEEE/IPSJ Symposium on Applications and the Internet, Munich, Germany, 18-22 Jul July 2011.
- DEXA 2011 - 22th International Conference on Database and Expert Systems Applications, Toulouse, France, August 29 - September 02, 2011.
- HoloMAS 2011 – 5th International Conference on Industrial Applications of Holonic and Multi-Agent Systems, Toulouse, France, August 29 - September 02, 2011.
- ICEGOV 2011 – 5th International Conference on Theory and Practice of Electronic Governance, 26-28 Sep 2011, Tallinn, Estonia.
- EPIA 2011 – 15th Portuguese Conference on Artificial Intelligence, Lisboa, Portugal,10-13 Oct 2011.
- INCOM'12 - 14th IFAC Symposium on Information Control Problems in Manufacturing, Bucharest, Romania, 23-25 May 2012.

- A. Abreu. Member of the Program Committee of:

  - PRO-VE'08 - 9th IFIP Working Conference on Virtual Enterprises, Poznam – Poland, 8-10 Sep 2008.
  - PRO-VE'09 – 10th IFIP Working Conference on Virtual Enterprises, Thessaloniki, Greece, 7-9 Oct 2009.
  - CIB W102 – 5th Conference on Information and Knowledge Management, 17-19, Jun 2009, Rio de Janeiro, Brazil.
  - PRO-VE'10 - 11th IFIP Working Conference on Virtual Enterprises, Saint-Etienne, France, 11-13 Oct 2010.
  - MCPL'2010 - 5th Conference on Management and Control of Production and Logistics, Coimbra, Portugal 8-10 Sept 2010.
  - PRO-VE'11 - 12th IFIP Working Conference on Virtual Enterprises, São Paulo, Brazil, 17-19 Oct 2011.

Other organizing activities

- Organization of:
  - ECOLEAD Workshop on Reference Models for Collaborative Networked Organizations, Valencia, Spain, 14-15 March 2007.
  - ECOLEAD Workshop - Reference models, decision making and computational intelligence for future CNOs, Brussels, Belgium, May 2007.
  - ECOLEAD Workshop on Collaborative Networked Organizations (in association with BASYS'08), Portugal, 23 Jun 2008.
  - ePAL Workshop / Consensus Building Event on Roadmap for extending Professional Active Life, 17 Jun 2009, Porto, Portugal.
  - Special track on Collaborative Networks for Active Ageing, PRO-VE'09 conference, Thessaloniki, Greece, 7 Oct 2009.
  - DoCEIS'10 – 1st Socolnet/IFIP/IEEE Doctoral Conference on Computing, Electrical and Industrial Systems, Costa de Caparica, Portugal, 22-24 Feb 2010.
  - AGEmap Workshop on Roadmaps towards a strategic research agenda for ICT in active ageing, 22 Mar 2010, Munich, Germany.
  - Collaboration in the organization of PRO-VE'07 (Guimarães, Portugal), PRO-VE'08 (Poznan, Poland), PRO-VE'09 (Thessaloniki, Greece), PRO-VE'10 (St. Etienne, France).

Education & Training

- 6 PhD Students ongoing (1 enrolled in 2010).

- 3 PhD Students finished (2007, 2008, 2010).

- L. M. Camarinha-Matos. Coordinator of the PhD Program on Electrical and Computer Engineering at FCT-UNL.

- New course design: Scientific Research Methodologies and Techniques (L. M. Camarinha-Matos), 1 semester course for the PhD Program on Electrical and Computer Engineering.

- New course design: Doctoral Conference (L. M. Camarinha-Matos), a hands-on course on planning and organizing international scientific conferences, for the PhD Program on Electrical and Computer Engineering. As a result, two editions of the DoCEIS – Doctoral Conference on Computing, Electrical and Industrial Systems were organized (2009/2010, 100 submissions from 15 countries; 2010/2011, 122 submissions from 22 countries). Proceedings published as a book by Springer and indexed in the ISI Web of Science. Sponsored by Socolnet, IFIP and IEEE IES.

- New course design: Advanced Topics on Collaborative Networks (L. M. Camarinha-Matos), 1 semester course for the PhD Program on Electrical and Computer Engineering.

- Training: supervision of Irina Lolu (Polytechnic University of Bucharest, Romania) during an internship of 8 months at UNINOVA, which was part of the requirements of her PhD Degree in Robotics and Manufacturing.

- Elaboration of a reference curriculum for education in collaborative networks, published as a book chapter by Springer (2008).

- Research results fed into the curriculum of the Master program on Electrical and Computer Engineering of FCT-UNL, course on Virtual Enterprises (L. M. Camarinha-Matos, J. Rosas).

- Introduction of a "Virtual Enterprises" module in the MTP & Lean Management course at ISEL. Introduction of a "Virtual Enterprises" module in the Advanced Management of Processes and Operations course at the Polytechnic Institute of Setúbal (A. Abreu).

Facilities

4 offices with computer facilities and 1 lab with computational and robotics infrastructure.

Strategy

1. Continue to develop research supported by R&D international projects, mainly in the collaborative networks area, covering both the industrial manufacturing and elderly support sectors to strengthen the role of the group as reference experts in the area.
2. Contribute to the establishment of a sound theoretical foundation for collaborative networks, in line with international efforts to consolidate this new discipline.
3. Encourage the technology transfer of the research work with the aim of creating products and services with impact in society. We already got two projects, one national and one European, with this aim (for the period 2011-2013).
4. Continue the effort to attract PhD candidates to improve the group publication record as well as the research projects. Special effort will be on attracting foreign students, in order to enrich the cultural and work experiences of the group.
5. Reinforce national and international cooperation emphasizing interdisciplinary work, primarily with Ambient Assisted Living and Service-enhanced products development networks;
6. Encourage all staff and Ph.D. students to disseminate their research results priory in journals with major 5-Years impact factors and in leading international conferences (accordingly to the DEE Publishing Reference List).

Plans for the Future

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

- Consolidate the group with the integration of those members that finished their PhD as post-docs (namely training them to acquire and lead new projects).

- Further focus the research on the behavioural aspects in collaborative networks, leading to a new (expanded) version of the ARCON model.

- Further tune the publication policy towards better journals, and major conferences, continuing the shift started in the last period.

- Increase the number of PhD students considering the additional supervision capability resulting from the addition of new doctors to the group, but always guaranteeing that enough high quality supervision and resources can be provided to these students.

- Keep the past rates of international projects thus competing for adequate international grants, and internationalisation of young researchers.

- Keep the leading role and involvement in the international research community of collaborative networks and involve young doctors in such initiatives. Increasing the membership of SOCOLNET and the participation in related

events is part of this goal.

- Succeed in transferring to society results from research and apply them to the development of new services, products, and organizational structures.

Production

International Book

1. L. M. Camarinha-Matos, H. Afsarmanesh. Collaborative Networks: Reference Modeling, Springer: New York, 2008. ISBN 978-0-387-79425-9.

International Book Chapters

<u>**Total 2007-2010:**</u> **16**

1. L. M. Camarinha-Matos, Collaborative networks in industry – Trends and foundations, in *Digital enterprise technology – Perspectives and challenges* (P. Cunha, P. Maropoulos, Ed.s), Springer, ISBN 978-0-387-49863-8, pp 45-56, 2007. ***Indexed ISI WoS***.
2. L. M. Camarinha-Matos, A. I. Oliveira, Contract negotiation wizard for VO creation, in *Digital enterprise technology – Perspectives and challenges* (P. Cunha, P. Maropoulos, Ed.s), Springer, ISBN 978-0-387-49863-8, pp 333-342, 2007. ***Indexed ISI WoS***.
3. L. M. Camarinha-Matos, H. Afsarmanesh, Concept of Collaboration, in *Encyclopedia of Networked and Virtual Organizations*, Edited by Goran D. Putnik and Maria Manuela Cunha (Idea Group), ISBN: 978-1-59904-885-7, Jan 2008.
4. L. M. Camarinha-Matos, H. Afsarmanesh. Classes of Collaborative Networks, in *Encyclopedia of Networked and Virtual Organizations*, Edited by Goran D. Putnik and Maria Manuela Cunha (Idea Group), ISBN: 978-1-59904-885-7, Jan 2008.
5. A. Abreu, L. M. Camarinha-Matos, Fair Distribution of Collaboration Benefits – The Shapley value, in *Encyclopedia of Networked and Virtual Organizations*, Edited by Goran D. Putnik and Maria Manuela Cunha (Idea Group), ISBN: 978-1-59904-885-7, Jan 2008.
6. L. M. Camarinha-Matos, H. Afsarmanesh, M. Ollus, ECOLEAD and CNO base concepts, in *Methods and tools for Collaborative Networked Organizations*, pp 3-32, Springer: New York, 2008.
7. H. Afsarmanesh, L.M. Camarinha-Matos, E. Ermilova, VBE Reference Framework, in *Methods and tools for Collaborative Networked Organizations*, pp 35-68, Springer: New York, 2008.
8. L. M. Camarinha-Matos, A. I. Oliveira, D. Demstar, M. Sesana, A. Molina, F. Baldo, T. Jarimo,VO Creation assistance services, in *Methods and tools for Collaborative Networked Organizations*, pp 155-190, Springer: New York, 2008.
9. A. I. Oliveira, L.M. Camarinha-Matos, Agreement negotiation wizard, in *Methods and tools for Collaborative Networked Organizations*, pp 191-218, Springer: New York, 2008.
10. L. M. Camarinha-Matos, H. Afsarmanesh, T. Cardoso, E. Klen, A reference curriculum for education in collaborative networks, in *Methods and tools for Collaborative Networked Organizations*, pp 491-511, Springer: New York, 2008.
11. L. M. Camarinha-Matos, Emerging collaboration forms and further research needs, in *Methods and tools for Collaborative Networked Organizations*, pp 513-528, Springer: New York, 2008.
12. A. Abreu, L. M. Camarinha-Matos (2008). A Benefit analysis model for collaborative networks. In *Collaborative Networks: Reference Modelling*. Boston: Springer, pp 253-276.
13. J. Rosas, L. M. Camarinha-Matos (2008). Modeling collaboration preparedness assessment. In *Collaborative Networks: Reference Modelling.* Boston: Springer, pp 227-252.
14. P. Macedo, L. M. Camarinha-Matos (2008). An approach in value systems modeling. In *Collaborative Networks: Reference Modelling*. Boston: Springer, pp 277-296.
15. H. Afsarmanesh, E. Ermilova, S. Msanjila, L.M. Camarinha-Matos, Modeling and Management of Information Systems Supporting Functional Dimension of Collaborative Networks, in *Transaction*

on Large-Scale Data- and Knowledge- Centered Systems I, LNCS 5740, pp 1-37, 2009. **Indexed ISI WoS**.

16. N. Mehandjiev, H. Afsarmanesh, L. M. Camarinha-Matos, L. Kutvonen, A. Norta, Comparable approaches to IVE, in: *Advanced Information and Knowledge Processing* (N. Mehandjiev, P Grefen, Editors), Springer, pp 199-242, 2010.

Refereed Articles in Journals

NOTE: This section does not include editorial articles and includes papers already accepted in 2010

Total 2007-2010: 23

1. L.M. Camarinha-Matos, H. Afsarmanesh, Results assessment and impact creation in collaborative research - An example from the ECOLEAD project, *TECHNOVATION - International Journal of Technological Innovation, Entrepreneurship and Technology Management* (Elsevier), vol. 27(1-2), pp 65-77, 2007. **Indexed ISI WoS**

2. L.M. Camarinha-Matos, H. Afsarmanesh, A framework for virtual organization creation in a breeding environment, *IFAC Journal Annual Reviews in Control (Elsevier)*, Volume 31, Issue 1, 2007, pp 119-135. **Indexed ISI WoS**

3. Luis M. Camarinha-Matos, António Abreu, Performance indicators for collaborative networks based on collaboration benefits, *Journal of Production Planning and Control, Vol. 18, Issue 7, 2007, pp* 592 – 609. **Indexed ISI WoS**

4. L.M. Camarinha-Matos, H. Afsarmanesh,A comprehensive modeling framework for collaborative networked organizations, *Journal of Intelligent Manufacturing, Volume 18, Number 5 / October, 2007, pp 527-615*. **Indexed ISI WoS**

5. A. Abreu, L.M. Camarinha-Matos, On the role of value systems to promote the sustainability of collaborative environments, *International Journal of Production Research,* Online Publication Date: 01 January 2007, Printed version: Volume 46, Issue 5 March 2008, pages 1207 – 1229*. **Indexed ISI WoS**

6. H. Afsarmanesh, L.M. Camarinha-Matos, Enhancing performance in industrial collaborative networks, (short article) *International Journal of Production Research, Vol. 46, No. 5, 1 March 2008, 1203–1205. **Indexed ISI WoS**

7. L.M. Camarinha-Matos, H. Afsarmanesh, On reference models for collaborative networked organizations, *International Journal Production Research, Vol 46, Nº 9, May 2008, pp 2453 – 2469. **Indexed ISI WoS**

8. J. Barata, L. M. Camarinha-Matos, G. Cândido, A multiagent-based control system applied to an educational shop floor, *Journal of Robotics & Computer Integrated Manufacturing,* Volume 24, Issue 5, pp 597-605, Oct 2008. **Indexed ISI WoS**

9. A. L. Osório, Luis M. Camarinha-Matos, Distributed process execution in collaborative networks, *Journal of Robotics & Computer Integrated Manufacturing,* Volume 24, Issue 5, pp 647-655, Oct 2008. **Indexed ISI WoS**

10. L.M. Camarinha-Matos, H. Afsarmanesh, N. Galeano, A. Molina. Collaborative Networked Organizations - Concepts and practice in Manufacturing Enterprises, *Journal of Computers & Industrial Engineering, vol. 57 (2009), pp 46–60*. Published online 7 Dec 2008. **Indexed ISI WoS**

11. Hamideh Afsarmanesh, Luis M. Camarinha-Matos, On the classification and management of Virtual Organisation Breeding Environments, *International Journal of Information Technology & Management,* Vol. 8, No. 3, pp 234 – 259, 2009.

12. J. Rosas, L. M. Camarinha-Matos. An approach to assess collaboration readiness, *International Journal of Production Research, Vol 47, Issue 17 (2009), pp 4711 – 4735. **Indexed ISI WoS**

13. L. M. Camarinha-Matos, A. I. Oliveira, M. Sesana, N. Galeano, D. Demsar, F. Baldo, T. Jarimo. A framework for computer-assisted creation of dynamic virtual organizations, *International Journal of Production Research, Vol 47, Issue 17 (2009), pp 4661 – 4690. **Indexed ISI WoS**

14. A. Abreu, P. Macedo, L. M. Camarinha-Matos. Elements of a methodology to assess the alignment of core-values in collaborative networks, *International Journal of Production Research, Vol 47, Issue 17 (2009), pp 4907 – 4934. **Indexed ISI WoS**

15. L. M. Camarinha-Matos. Collaborative Networked Organizations: Status and Trends in Manufacturing, *Annual Reviews in Control, Vol. 33, Issue 2, pp 199–208, 2009*. **Indexed ISI WoS**

16. H. Afsarmanesh, L. M. Camarinha-Matos. On Management of 2nd Generation Virtual Organizations Breeding Environments, *Annual Reviews in Control, Vol. 33, Issue 2, pp 209–219, 2009*. **Indexed ISI WoS**

17. P. Macedo, A. Abreu, L. M. Camarinha-Matos. A method to analyse the alignment of core-values in collaborative networked organizations, *Journal of Production Planning and Control, Vol. 21, No. 2, March 2010, 145–159.* **Indexed ISI WoS**

18. A. I. Oliveira, L. M. Camarinha-Matos, M. Pouly. Agreement negotiation support in VO creation – an illustrative case, *Journal of Production Planning and Control, Vol. 21, No. 2, March 2010, pp 160–180.* **Indexed ISI WoS**

19. L. M. Camarinha-Matos P. Macedo. A conceptual model of value systems in collaborative networks, *Journal of Intelligent Manufacturing*, vol. 21, issue 3, Jun 2010, pp 287 – 299. **Indexed ISI WoS**

20. H. Afsarmanesh, L. M. Camarinha-Matos, S. S. Msanjila, Models, Methodologies, and Tools Supporting Establishment and Management of Second-Generation VBEs, accepted to *IEEE Transactions on Systems, Man and Cybernetics – C (already available online)*. **Indexed ISI WoS**

21. H. Afsarmanesh, S. S. Msanjila, Luis M. Camarinha-Matos, Technological research plan for active ageing, accepted to *Information Systems Frontiers (already available online)*. **Indexed ISI WoS**

22. J. Rosas, P. Macedo, L. M. Camarinha-Matos, Extended Competencies Model for Collaborative Networks, accepted to *Journal of Production Planning & Control.* **Indexed ISI WoS**

23. A. L. Osorio, H. Afsarmanesh, L. M. Camarinha-Matos, A Service Integration Platform for Collaborative Networks, accepted to *Studies in Informatics and Control.* **Indexed ISI WoS**

Refereed International Conferences

Total 2007 and following: 35

2007

1. L. M. Camarinha-Matos, H. Afsarmanesh, Collaborative networks in industry and services: Research scope and challenges, in *Proceedings of COA 2007 - 8th IFAC Symposium on Cost Oriented Automation Affordable Automation Systems*, Ciudad de la Habana, Cuba, Feb 12 - 14, 2007.

2. H. Afsarmanesh, L. M. Camarinha-Matos, Towards a semi-typology for virtual organization breeding environments, in *Proceedings of COA 2007 - 8th IFAC Symposium on Cost Oriented Automation Affordable Automation Systems*, Ciudad de la Habana, Cuba, Feb 12 - 14, 2007.

3. L. M. Camarinha-Matos, A. I. Oliveira, R. Ratti, D. Demsar, F. Baldo, T. Jarimo, A computer-assisted VO creation framework, *Proceedings of PRO-VE'07 - Establishing the foundation of collaborative networks*, pp 165-178, Guimarães, Portugal, 10-12 Sep 2007. **Indexed ISI WoS**

4. L. M. Camarinha-Matos, P. Macedo, Towards a conceptual model of value systems in collaborative networks, *Proceedings of PRO-VE'07 - Establishing the foundation of collaborative networks*, pp. 53-64, Guimarães, Portugal, 10-12 Sep 2007. **Indexed ISI WoS**

5. H. Afsarmanesh, L. M. Camarinha-Matos, Virtual Organizations Breeding Environments: Key results from ECOLEAD, *Proceedings of IFAC Conference on Cost Effective Automation in Networked Product Development and Manufacturing*, Monterrey, Mexico, 2-5 Oct 2007.

6. L. M. Camarinha-Matos, Collaborative Networked Organizations in manufacturing, (**invited keynote**), *Proceedings of IFAC Conference on Cost Effective Automation in Networked Product Development and Manufacturing*, Monterrey, Mexico, 2-5 Oct 2007.

2008

7. L. M. Camarinha-Matos, Advances in collaborative networked organizations, (**invited keynote**), *Proceedings of BASYS'08, 23-25 Jun 08, Porto, Portugal, Innovation in Manufacturing Networks (A. Azevedo, Ed.)*, Springer, pp. 3-16. **Indexed ISI WoS**

8. A. Abreu, P. Macedo, L. M. Camarinha-Matos, Towards a methodology to measure the alignment of value systems in collaborative networks, *Proceedings of BASYS'08, 23-25 Jun 08, Porto, Portugal,*

Innovation in Manufacturing Networks (A. Azevedo, Ed.), Springer, pp. 37-46. **Indexed ISI WoS**

9. J. Rosas, L. M. Camarinha-Matos, A collaboration readiness assessment approach, *Proceedings of BASYS'08, 23-25 Jun 08, Porto, Portugal, Innovation in Manufacturing Networks (A. Azevedo, Ed.)*, Springer, pp. 77-86. **Indexed ISI WoS**

10. L. M. Camarinha-Matos, P. Macedo, A. Abreu, Analysis of core-values alignment in collaborative networks, *Proceedings of PRO-VE'08, Pervasive Collaborative Networks,* Springer, pp.53-64. **Indexed ISI WoS**

11. A. I. Oliveira, L. M. Camarinha-Matos, M. Pouly, Agreement negotiation support in VO creation, *Proceedings of PRO-VE'08, Pervasive Collaborative Networks,* Springer, pp.107-118. **Indexed ISI WoS**

12. Tenera, A.,; Abreu, A. – A TOC perspective to improve the management of collaborative networks, *Proceedings of PRO-VE'08, Pervasive Collaborative Networks,* Springer, pp.53-64. **Indexed ISI WoS**

13. Tenera, A.; Abreu, A. - A critical chain perspective to support management activities in dynamic production networks, *Proceedings of IEEE IEMC – Europe 2008 – International Engineering Management Conference on Managing Engineering, Technology and Innovation for Growth*, Estoril, Portugal.

2009

14. L. M. Camarinha-Matos, H. Afsarmanesh, Collaborative mechanisms for a new perspective on active ageing, in *Proceedings of DEST 2009 – IEEE Int Conf on Digital Ecosystems and Technologies (**Best Paper Award**), 31 May – 3 Jun 2009, Istanbul, Turkey, pp 475-480.* **Indexed ISI WoS**

15. H. Afsarmanesh, L. M. Camarinha-Matos, Management of Information Supporting Collaborative Networks, in *Proceedings of DEXA'09 - 20th International Conference on Database and Expert Systems Applications (**Invited Keynote**), 31 Aug- 4 Sep 2009, Linz, Austria. Lecture Notes in Computer Science 5690, pp 1-6.* **Indexed ISI WoS**

16. J. Rosas, P. Macedo, L. M. Camarinha-Matos, An Organization's Extended (Soft) Competencies Model, *Proceedings of PRO-VE'09, 7-9 Oct 09, Thessaloniki, Greece, Leveraging knowledge for innovation in Collaborative Networks*, Springer, pp. 247-258. **Indexed ISI WoS**

17. L. M. Camarinha-Matos, H. Afsarmanesh, The Need for a Strategic R&D Roadmap for Active Ageing, Proceedings *of PRO-VE'09, 7-9 Oct 09, Thessaloniki, Greece, Leveraging knowledge for innovation in Collaborative Networks*, Springer, pp. 669-680. **Indexed ISI WoS**

18. H. Afsarmanesh, L. M. Camarinha-Matos, S. Msanjila, A Well-conceived Vision for Extending Professional Life of Seniors, *Proceedings of PRO-VE'09, 7-9 Oct 09, Thessaloniki, Greece, Leveraging knowledge for innovation in Collaborative Networks*, Springer, pp. 681-692. **Indexed ISI WoS**

19. A. del Cura, L. M. Camarinha-Matos, F. Ferrada, P. del Cura, New Organizational Forms to Extend the Professional Active Life, *Proceedings of PRO-VE'09, 7-9 Oct 09, Thessaloniki, Greece, Leveraging knowledge for innovation in Collaborative Networks*, Springer, pp. 721-732. **Indexed ISI WoS**

20. H. Afsarmanesh, L. M. Camarinha-Matos, Towards Modeling a Collaborative Environment for Extension of Professional Active Life, *Proceedings of PRO-VE'09, 7-9 Oct 09, Thessaloniki, Greece, Leveraging knowledge for innovation in Collaborative Networks*, Springer, pp. 681-692. **Indexed ISI WoS**

21. L. M. Camarinha-Matos, Collaborative networks contribution to sustainable development, *Proceedings of SWIIS 2009 – IFAC Workshop on Supplementary Ways for Improving International Stability (**invited**)*, Bucharest, Romania, 28-30 Oct 2009.

2010

22. P. Macedo, L.M. Camarinha-Matos, Applying causal reasoning to analyze value systems, Proceedings of DoCEIS'10 – Emerging Trends in Technological Innovation, IFIP AICT 314, Springer, pp 3-13. **Indexed ISI WoS**

23. J. Rosas, L.M. Camarinha-Matos, Assessment of the willingness to collaborate in enterprise networks, Proceedings of DoCEIS'10 – Emerging Trends in Technological Innovation, IFIP AICT 314, Springer, pp 14-23. **Indexed ISI WoS**

24. D. Romero, A.I. Oliveira, L.M. Camarinha-Matos, A. Molina, The virtual enterprise from a governance perspective, Proceedings of DoCEIS'10 – Emerging Trends in Technological Innovation,

IFIP AICT 314, Springer, pp 73-82. *Indexed ISI WoS*

25. A. I. Oliveira, L.M. Camarinha-Matos, Negotiation and contracting in collaborative networks, Proceedings of DoCEIS'10 – Emerging Trends in Technological Innovation, IFIP AICT 314, Springer, pp 83-92. *Indexed ISI WoS*

26. T. Cardoso, L.M. Camarinha-Matos, Pro-active asset entities in collaborative networks, Proceedings of DoCEIS'10 – Emerging Trends in Technological Innovation, IFIP AICT 314, Springer, pp 93-102. *Indexed ISI WoS*

27. L.M. Camarinha-Matos, H. Afsarmanesh, A. del Cura, J. Playfoot, ePAL Roadmap for Active Ageing: A Collaborative Networks Approach to Extending Professional Life, Proceedings of Pervasive Health 2010 - 4th International ICST Conference on Pervasive Computing Technologies for Healthcare 2010 / AGEmap workshop, 22-25 Mar 2010, Munich, Germany. *Indexed IEEE Xplore*

28. H. Afsarmanesh, S. Msanjila, L.M. Camarinha-Matos, On Technological Aspects of Active Ageing, Proceedings of Pervasive Health 2010 - 4th International ICST Conference on Pervasive Computing Technologies for Healthcare 2010 / AGEmap workshop, 22-25 Mar 2010, Munich, Germany. *Indexed IEEE Xplore*

29. L.M. Camarinha-Matos, H. Afsarmanesh, F. Ferrada, Collaborative Networks Approach to Active Ageing, Proceedings of Pervasive Health 2010 - 4th International ICST Conference on Pervasive Computing Technologies for Healthcare 2010 / AGEmap workshop, 22-25 Mar 2010, Munich, Germany. *Indexed IEEE Xplore*

30. A. Luis Osório, Hamideh Afsarmanesh and Luis M. Camarinha-Matos, Open Services Ecosystem Supporting Collaborative Networks, Proceedings of BASYS'10, Balanced Automation Systems for Future Manufacturing Networks, IFIP AICT Series 322/2010, Springer, pp 80-91. *Indexed ISI WoS*

31. A. Abreu and L. M. Camarinha-Matos, Understanding Social Capital in Collaborative Networks, Proceedings of BASYS'10, Balanced Automation Systems for Future Manufacturing Networks, IFIP AICT Series 322/2010, Springer, pp 109-118. *Indexed ISI WoS*

32. L.M. Camarinha-Matos, H. Afsarmanesh, X. Boucher, The Role of Collaborative Networks in Sustainability, , *Proceedings of PRO-VE'10, 11-13 Oct 10, St.-Etienne, France, Collaborative Networks for a Sustainable World*, IFIP AICT Series 336/2010, Springer, pp. 1-16. *Indexed ISI WoS*

33. L.M. Camarinha-Matos, H. Afsarmanesh, Active Ageing Roadmap – A Collaborative Networks Contribution to Demographic Sustainability, *Proceedings of PRO-VE'10, 11-13 Oct 10, St.-Etienne, France, Collaborative Networks for a Sustainable World*, IFIP AICT Series 336/2010, Springer, pp. 46-59. *Indexed ISI WoS*

34. T. Cardoso, L. M. Camarinha-Matos, Pro-Active Service Entity Framework for a Better Mapping between Business and Software, *Proceedings of PRO-VE'10, 11-13 Oct 10, St.-Etienne, France, Collaborative Networks for a Sustainable World*, IFIP AICT Series 336/2010, Springer, pp. 451-460. *Indexed ISI WoS*

35. A. L. Osório, H. Afsarmanesh, L. M. Camarinha-Matos, Towards a Reference Architecture for a Collaborative Intelligent Transport System Infrastructure, *Proceedings of PRO-VE'10, 11-13 Oct 10, St.-Etienne, France, Collaborative Networks for a Sustainable World*, IFIP AICT Series 336/2010, Springer, pp. 469-477. *Indexed ISI WoS*

Book Edition

Total 2007 and following: 6

1. Establishing the foundation of collaborative networks, (L.M. Camarinha-Matos, H. Afsarmanesh, P. Novais, C. Analide, Editors), ISBN: 978-0-387-73797-3, IFIP Vol. 243, *Springer*, 2007.
2. Methods and tools for Collaborative Networked Organizations, (L.M. Camarinha-Matos, H. Afsarmanesh, M. Ollus, Editors), ISBN 978-0-387-79423-5, *Springer*: New York, 2008.
3. Pervasive Collaborative Networks, (L.M. Camarinha-Matos, W. Picard, Editors), Springer, New York, 2008.
4. Leveraging Knowledge for Innovation in Collaborative Networks, (L.M. Camarinha-Matos, I. Paraskakis, H. Afsarmanesh, Editors), IFIP AICT 307, *Springer*, 2009.
5. Emerging Trends in Technological Innovation, (L.M. Camarinha-Matos, P. Pereira, L. Ribeiro,

Editors), IFIP AICT 314, *Springer*, 2010.
6. Collaborative Networks for a Sustainable World, (L.M. Camarinha-Matos, X. Boucher, H. Afsarmanesh, Editors), IFIP AICT Series 336/2010, *Springer*.

Special issues of journals Edition

Total 2007 and following: 5

1. <u>Journal of Intelligent Manufacturing</u> (Springer), Special Issue: on Modeling approaches and frameworks for collaborative networks, L. M. Camarinha-Matos (Guest editor), Volume 18, Number 5 / October, 2007.
2. <u>International Journal of Production Research</u>, Special issue on Enhancing Performance in Industrial Collaborative Networks–a Selection of Papers from the PRO-VE'06 Conference, H. Afsarmanesh, L. M. Camarinha-Matos (Guest editors), Volume 46 Issue 5 2008.
3. <u>Journal of Robotics and Computer-Integrated Manufacturing</u>, Special issue on multi-agent and holonic systems in manufacturing, Weiming Shen, Luis M. Camarinha-Matos and Robert Brennan (Guest editors), Volume 24, Issue 5, Oct 2008.
4. <u>International Journal of Information Technology and Management (IJITM)</u>, Special issue on Information Management for Collaborative Networks, X. Boucher, L.M. Camarinha-Matos and H. Afsarmanesh (Guest editors), Volume 8, Issue 3, 2009.
5. <u>Journal of Intelligent Manufacturing</u> (Springer), Special Issue on Trust, Value Systems and Governance in Collaborative Networks, L.M. Camarinha-Matos and Arturo Molina (Guest Editors), Volume 21, Number 3 / June, 2010.

Doctoral Advising

Doctoral candidates, completed

- António Feliciano Abreu [Mar 2007] [Contribuição para o desenvolvimento de uma teoria das redes de colaboração] (Contribution for the development of a theory of collaborative networks), FCT/UNL.
- L. Octavio Castolo [Apr 2008] [Collaborative networks in elderly care – A mobile agents approach], FCT/UNL.
- João Rosas [Jun 2010] [Assessing organizations collaboration readiness – A behavioral approach], FCT/UNL.

Doctoral candidates, current (FCT/UNL + EMU)

- Patricia Macedo (to finish in 2011) [Value systems in collaborative networks].
- Tiago Cardoso (to finish in 2011) [Pro-active services].
- Filipa Ferrada (since 2008) [Self-healing in collaborative networks].
- Ana Inês Oliveira (since 2008) [Negotiation in collaborative networks].
- Hadi Nateg (since Dec 2010)
- Reza Vatankhah (since 2009) [Virtual enterprises in manufacturing], co-supervision with Eastern Mediterranean University, North Cyprus.

Group C2: Interoperability and Complex Systems

Research Group Coordinator

- Ricardo Luís Jardim Gonçalves, email: rg@uninova.pt

Doctoral Research Team

- Adolfo Steiger Garção (ASG), Full Professor, email: asg@uninova.pt (50% sharing with Microelectronics research line)
- Ricardo Luís Jardim Gonçalves (RJG), Auxiliar Professor, email: rg@uninova.pt

PhD students

- Pedro Maló, pmm@uninova.pt
- Carlos Agostinho, ca@uninova.pt
- João Sarraipa, jfss@uninova.pt
- Ruben Costa, rddc@uninova.pt
- Carlos Coutinho, Carlos.Coutinho.PhD@gmail.com
- Gonçalo André Canha de Castro, ga.castro@gmail.com
- Edgar Miguel Felício Oliveira da Silva, edgar_m_silva@msn.com
- Ricardo Wolffensperger Ferreira, ricardowf@gmail.com (Co-Supervision)
- Aneesh Zutshi, aneesh84@gmail.com (Co-Supervision)

Collaborators, as research engineer

- Bruno Almeida, bma@uninova.pt
- Fernando Ferreira, flf@uninova.pt
- Miguel Beça, mfb@uninova.pt
- Marco Delgado, mad@uninova.pt (External)

MSc Students

- Ségio Onofre
- David José Gonçalves
- Tiago Gaspar
- Filipe Correia
- Francisco Cavaco
- Diogo Figueiredo
- Aleksandar Todorov
- Pedro Manuel Henriques
- João Vasco Vaz
- Marcio Filipe Caetano Mateus
- Tiago Andre Rolo Teixeira
- Henrique Baeta

Summary

Main indicators and achievements:

This report mainly summarizes research activities undertaken from 2007 until 2010 (evaluation period).

These activities are concentrated in the area of Interoperability of Systems and Applications for Complex Systems, which has led to an extensive list of publications and research (journals and conferences), as well as the authorship of a book and two conference proceedings in book form (all with ISBN). Furthermore we have served as guest editor of four international journals, and another scheduled for publication in 2011.

We have authored seven book chapters and ten articles in refereed journals, four of which are publications in leading journals (A+/A) in ISI WoS IF. Those publications have been cited 201 times for 2007-2010. Between 2007 and 2010 a total of forty four refereed publications have resulted, 57% being in WoS/IEEE/ASME conferences. The two PhD researchers have index *h* =8, *g*-=12 (RJG) and h=11, g=17(ASG) . Citations scores are, 342 and 594 respectively. A significant effort was made to increase the quality either of the publications or the addressed journals and conferences. The construction of a publication reference document was an important instrument for planning this strategy.

(Publication *Reference document: Electrical Engineering Department, Research focus and reference publication channels, 2010, page 19, section 4.1.1 – "3) Interoperability and Integration of Complex Systems"; and Table in page 20 section "Interoperability and Integration of Complex Systems"*).

UNINOVA-GRIS has been active in ten international research projects, and three national – with a total budgets of 3,458,012 Euros and has permanent research cooperation with an extended number of international partners. Recently, we have assumed the Scientific Committee Chair position of INTEROP-VLab and the Directorship of the Committee for the Scientific Foundations of Future Internet Enterprise Systems (European Commission).

We contributed as member of the Editorial Board of eight international journals, and have served as reviewer for 24 international journals (46% ISI WoS). We have organized a significant number of scientific events, acting as General Conference Chair (1) and Co-Chair (1), Organizing Chair (4) as well as being Session Chair in many conferences and workshops.

In the referred period three PhD candidates have attained their degree, nine more are ongoing. Seven MSc students have concluded their degrees, and there are another seven in progress

We have prepared two all-new courses on Interoperability and system's integration issues, for an Integrated Masters programme in Electronic and Computer Engineering (MIEEC) for the FCT/UNL, and for the European Master in IT for Construction. Also another (existing) course for the MIEEC was redesigned. The course design and selection of teaching materials for these various courses has included the texts and all ancillary reading and eLearning materials. The eLearning materials were organized in six areas, for a total of 21 lessons (English), and are posted online on the MOODLE and Blackboard platforms of the *Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa* (FCT/UNL). A method tool for adapting the eLearning material to the individual student profiles was designed. This eLearning material is currently used by the FCT/UNL and by three other universities (Université Henri Poincaré – France, Universidade Federal de Santa Catarina – Brasil, Technische Universität Dresden). Twenty one invitations for Keynote Speaker (4) and principal addresses (17) were performed in

specialized conference sessions. Evaluation/assessment of an extended number (+100) of national and international projects and research centres (100+) were done.

We have been involved in an enlarged number of activities with professional organizations and committees for establishing norms and standards, including those of the ISO and CEN, and many other technical bodies. Twenty nine ISO International Standards were published.

UNINOVA-GRIS has the coordination of the European project UNITE, developing ICT excellence by strengthening cooperation between research teams in an enlarged Europe. Also, in response of the European Commission EU Information Society and Media Directorate-General call, it takes the coordination for establishing the fundamental foundations for the Interoperability Science by defining the methodological approach on how to gradually develop the Science Base and by delivering a set of its initial components.

As a result of the so far described activities, four awards were conceded by the international community.

Summary Tables

	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	7	10	4,7	6,7
Journals A/A+	2	4	1,3	2,7
Conferences	54	44	36,0	29,3
Conferences A/A+	24	25	16,0	16,7
MSc Theses	4	7	2,7	4,7
PhD Students	3	8	2,0	5,3
PhD Theses	3	4	2,0	2,7
Teams PhD	1,5	1,5		

Global data

C2: Interoperability and Complex Systems
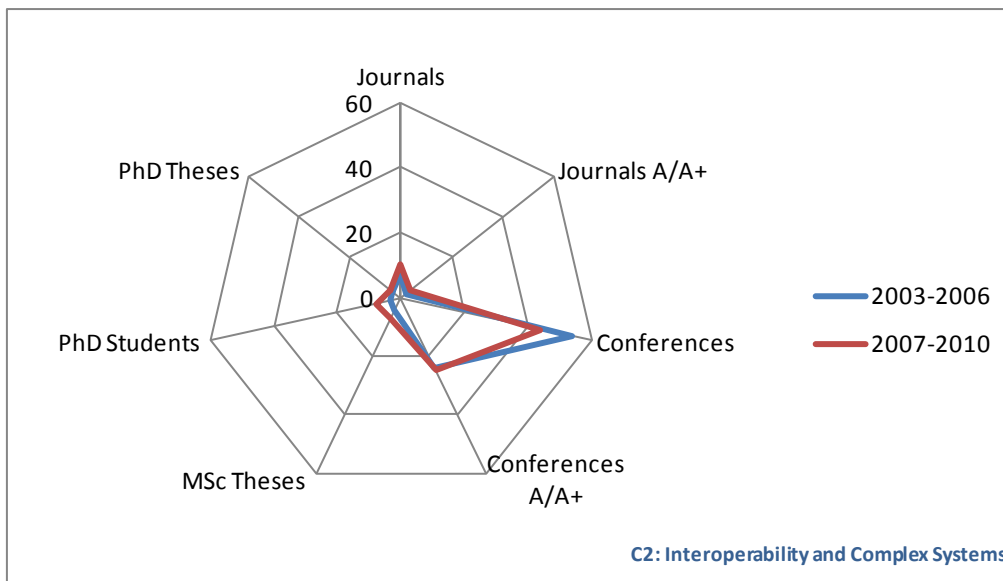
PhD		MSc		Projects		
Final	OnGo	Final	OnGo	Resp	Collab	Patent/Prize/Stds
3	7+2 (CoSup)	7	7	15	23	34

Journals		Conferences		Books		Cites		
Total	A+/A	Total	A+/A	Editor	Chapter	Total	h-idx	g-idx
10	4	44	25	1+2	7	342	8 & 11	12 & 17

Journals

Rank	Journal	(2003-2006)	(2007-2010)	Total (2003-2006)	Total (2007-2010)
A+/A	Communications of the ACM			2	4
	Computers in Industry	1			
	Automation in Construction (AutoCon)		3		
	Journal of Intelligent Manufacturing (JIM)	1	1		
B	International Journal Advances in Engineering Software (IJAES)		1		3
	International Journal of General Systems		1		
	International Journal of Computer Integrated Manufacturing (IJCIM)		1		
C	International Journal of Technology Management (IJTM)	2		2	
	Total	*4*	*7*		
	Total Others	*5*	*3*		
	Grand Total	*9*	*10*		
	Cites	**103**	**68**		

Conferences

Rank	Conference	(2003-2006)	(2007-2010)	Total (2003-2006)	Total (2007-2010)
A+/A	I-ESA: Interoperability-Enterprise, Systems and Applications	2	6	26	25
	IEEE-IS - IEEE Intelligent Systems	4	4		
	CE - Concurrent Engineering: Research and Applications	12	4		
	ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference	4	3		
	SMC - IEEE International Conference on Systems, Man and Cybernetics		1		
	eChallenges - eChallenges Conference & Exhibition	4	2		
	IEEM - IEEE International Conference on Industrial Engineering and Engineering Management		2		
	WCC - IFIP World Computer Congress		1		
	CIRP Design Conference		1		
	OTM - On The Move Conference		1		
B	ECPPM - European Conference on Product and Process Modelling in the Building and Related Industries	4		4	
ISI WoS	Others ISI WoS				
	Grand Total	*30*	*25*		

Introduction

A research domain [1]

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. 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

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[1] 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

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.

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.

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.

Research

<u>**Research topics:**</u>

1) **Information Modeling for Complex Systems integration and Interoperability**
   a) Advanced methods and Methodologies, Distributed Modeling, Meta-Modelling, Requirements for integration and interoperability, Synchronization of models, Model-morphisms and transformation of models

2) **Knowledge Management for Complex Systems integration and Interoperability**
   a) Intelligent methods, knowledge management in networked systems, applications analysis and semantic elicitation, reasoning methods and tools for model transformation and data reconciliation, semantic mediation and enrichment of knowledge models

3) **Platforms for Complex Systems integration and Interoperability**
   a) Architectures and Frameworks, Enterprise Application Integration, Model Driven Architectures, Service Oriented Architectures, Intelligent infrastructure and automated methods for system integration, Complex System in the Internet of the Future, Open platforms supporting collaborative activities

<u>**Characterization of Area:**</u>
As information systems evolve and become more complex, the need for interoperable operations automated data interchange and coordinated seamless knowledge and behavior of large scale infrastructures becomes highly critical. Lack of interoperability would disturb creation of networked systems and networked objects, that, apart from being a technical issue, interoperability challenges also appear in the users at organizational and semantic level, underlying the need for patterns and solutions that support the seamless cooperation among ICT systems, information and knowledge, organizational structures and people.

The Interoperability and Integration of Complex Systems is recognized as a high-impact productivity factor both within the private and the public sector, affecting the overall quality, yield time and cost of transactions, design and manufacturing operations or digital public services. However, up to now the principal tools for targeting the above challenges appear as the various standards that try to govern information systems development and operation, whilst such standards are usually linked with specific market sectors, application areas or technology trends, thus having a limited time span, a static nature and quite often different interpretations by technology vendors and users.

Interoperability and Integration of Complex Systems research area suggests seamless interoperation throughout research on how removing barriers to interoperability, fostering novel systems networked culture, by transferring and applying the research results in industrial sectors, within the scientific domains of systems complexity, network science, information theory and web science, distributed systems, shared data and knowledge, evolutive applications, dynamics and adaptation of networked organizations on a global scale. Those are all directly related with rapid evolution of technology and applications, plug and play instruments, self monitoring capabilities,

benchmarking and evaluation of degrading processing, automatic or on demand reprocessing, recompiling or fixing of components or processes. Moreover, to achieve a steady stable interoperable environment in a global scale there is the need for human assisted supervising systems supported by embedded supervising systems with learning capabilities.

Hence, to reach globalization objectives for Interoperability and Integration of Complex Systems, it must be worked out robust feedback mechanisms aimed to receive input from implementers, interested communities and from the market in order to assure a dynamic improving and standards maintenance. Scientific methods to assess the suitability, impact and the extension of the adoption and relevance of such standards, i.e., based on statistical methods, must be tightly adopted. Thus, the science work to develop must be well specified and global, completely unambiguous, designed to be flexible, robust and predicable in the universal context, refraining from dependencies on technology and usage, permitting advanced adaptation and optimization of systems, e.g., supporting their maintenance processes by the use of technologies suitable for generalized knowledge representation applied to the Model Management (MoM) domain, namely dynamic models-morfisms (DynamicMoMo).

The adoption of advanced techniques for meta-modeling and automatisms for model and data transformations, will enable to have the engine for interoperability not embedded directly in the systems coding, but through proper adaptative techniques get a suitable characterization of the actual status of the system's morphisms, supporting predictive system evolution, and analysis of its complexity in the dynamics of the network, including the respective transients and systems responsive behavior. 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 analyze the semantically features in the domain of the system models, and take better decisions in the advent of uncertainty.

Recently the EC identified a need of more consistent and scientific approaches to deal with interoperability in complex systems. We were invited (European Commission) and assumed the directorship of the Committee for the Scientific Foundation of Future Internet Enterprise Systems

Ongoing research themes:

1- ***Intelligent reconfiguration of components, for sustainability of interoperability of evolutive networked systems (2 PhD finished; 2 PhD ongoing)***
   a. Learning and adaptability: After indentified 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. This includes definition of formal models for model-driven interoperability.

b. <u>Transient analysis</u>: 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.

c. <u>Adaptative services for knowledge management</u>: Knowledge is the basis for seamless interoperability of the integrated global network. Adaptative 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. Models for management of operational efficiency through tacit knowledge and intangible assets.

2- ***Conformance testing and Interoperability checking for complex systems interoperability assessment (1 PhD Ongoing)***

d. <u>Discovery and Notification</u>: 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.

e. <u>Conformance checking</u>: 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.

f. <u>Interoperability checking</u>: 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.

3- ***Harmonization of ontological structures to support the application dynamics and enable adaptability of users semantic specifications (2 PhDs finished; 2 PhD ongoing)***

g. <u>Mutation of ontologies supported by stochastic methods</u>: Mutation of ontologies using stochastic method to support the updates in the representation of concepts and its instances.

h. <u>Harmonization of ontologies and semantical adaptability</u>: Semantic harmonization, and adaptative mapping in dynamic environments, with mediation of semantic conflicts according to the interactions and evolution with the systems which it interacts.

i. <u>Automatized categorization of ontological structures</u>: Automatized 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.

4- ***Internet-connected objects (1 PhD ongoing)***

j. <u>Open networked architecture for Internet-connected objects</u>: Conceal the heterogeneity of underlying network technologies required to support the multiplicity of communication requirements across objects in the physical world, and be resilient to disruption of these technologies, and optimally manage a large population of resource constrained devices and end-to-end characteristics. Context-aware, reliable, energy-efficient and secure distributed networks of cooperating sensors actuators and other smart devices and objects, to cope with the heterogeneity of the underlying technologies, and to enable integration of the novel set of supported services in systems and applications. Architectures supporting self-management, self-configuration and self-healing properties as well as scalable look up and discovery of resources/objects and services and their subsequent mapping onto entities of the real world towards a new range of Internet enabled services based on truly interconnected physical and virtual objects.

k. <u>Maximization of interoperability across providers and consumers of information and services</u>: Allow for re-use of object entities in the physical world across several application domains, and provide a coherent framework with open interfaces to manage the physical entities. Consider the mobility of objects and multiplicity of applications contexts. Efficient integration of the objects into the service layer of the network (e.g., Internet, others), in particular for moving intelligence and service capabilities for filtering, pattern recognition, machine learning and decision making towards the very edges of the network, up to users' terminals and objects.

l. <u>Adaptive software for seamless data and knowledge acquisition</u>: Seamless data and knowledge acquisition from a large number of sensors, providing integration with mainstream business platforms and components. Interpretation of the environmental and context information, detection of information related to human intentions and behaviours, enable human-like inferences and interactions.

5- ***Cloud computing and internet of services (2 PhD ongoing)***

m. <u>Interoperability of cloud resources</u>: Intelligent integration and management of cloud resources. Implications of Cloud Computing paradigm on complex systems networks. Scalable data management strategies, agile elastic scalability, heterogeneity, seamless understanding, consistency, availability. Interoperability amongst different clouds, portability, and control of data distribution in context-aware applications.

n. <u>Frameworks for cloud computing</u>: Architectures supporting integration of computing and networking environments. Infrastructure virtualization. Platforms for easy and controlled development and deployment of value added services through innovative service front-ends. Cross platforms execution for service composition and orchestration across multiple, heterogeneous and dynamic environments, autonomous management of hardware and software resources. Energy efficiency and sustainability for software and services on the cloud.

o. <u>Internet of Services</u>: Methods and tools supporting development for seamless Internet of Services. Meta-services for seamless integration of real and virtual worlds. Strategies for scalability, self-management, verification, validation and fault localization for software-based services. Methods and tools to manage life cycle of resilient Internet-scale applications from requirements to run-time and their adaptive evolution over time. Methodologies for combine and use value added services through significant advances in cloud computing technologies and standardized and open interfaces.

Projects

Ongoing projects on 2007 and thereafter

Total budget: 115,636,175 Euros
Uninova budget: 2,658,012 Euros

ATHENA - Advanced Technologies for Interoperability of Heterogeneous Enterprise Networks and their Applications - 2004/ 2007.
> *Partners*: AIDIMA (ES); TROUX (NO); CR-FIAT (IT); DFKI (DE); EADS-CCR (FR); ESI (ES); FORMULA (IT); FHG IPK (DE); IBM (GB); IC-FOCUS (GB); INSEAD; INTRACOM (GR); ITREC (FR); LEKS (IT); SAP AG (DE); SIEMENS (DE); SINTEF (NO); TXT (IT); University Bordeaux I (FR); UNINOVA (PT); IWI-HSG; CAS Software; AIAG.
> *Global Budget*: 14,399,999.00 €
> *Uninova Budget*: 564,400.00 €

VIVACE - Value Improvement through a Virtual Aeronautical Collaborative Enterprise - 2004/2007.
> Partners: Airbus France; Airbus Deutschland GmbH; Airbus SAS; Airbus UK Ltd; Ajilon Engineering; Alenia Aeronautica S.p.A.; ARTTIC; 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; Inbis Limited; 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 Moteurs; Techspace Aero SA; Thales Avionics; Thales Avionics Electrical Systems SA; 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 Aérospatiales; 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; Luleaa 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.
> *Global Budget*: 43,299,803.00 €
> *Uninova Budget*: 167,600.00 €

CoSpaces - Innovative Collaborative Work Environments for Individuals and Teams in Design and Engineering – 2006 – 2010.
> *Partners*: The Open Group; University of Salford; Consultores de Automatizacion y Robotica; University of Nottingham; Fraunhofer Gesellschaft zur Förderung der angewandten Forschung; University of Stuttgart; Telematica Instituut; University of Cologne; National Technical University of Athens; Frietuna; UNINOVA; Associazione ESOCE Net; COWI Rådgivende Ingeniører; Airbus CIMPA; Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique; Virtual Dimension Centre; Varinex Informatics; Technology Application Network; Finanziaria Laziale di Sviluppo; Pragmasis - Sistemas de Informacao.
> *Global Budget*: 8,000,000.00 €
> *Uninova Budget*: 365,080.00 €

STAND-INN - Integration of performance based building standards into business processes using IFC standards to enhance innovation and sustainable development – 2006 - 2009.

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 Alliance for Interoperability/European chapter, with sub-contractors; 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.
Global Budget: 11,260,102.00 €
Uninova Budget: 28,503.00 €

INOVATION–INNOVAfun - Apply open standards to innovate furniture business processes – 2006 - 2009.
Partners: AIDIMA; UNINOVA; UEA; FIRA; DESIGNMARKET; FEDERMOBILI; FCVRE; UHP NANCY I.
Global Budget: 799,996.00 €
Uninova Budget: 250,439.00 €

CuteLoop - Customer in the Loop: Using Networked Devices enabled Intelligence for Proactive Customers Integration as Drivers of Integrated Enterprise
Partners – ATB, UniBonn, UNINOVA, TOG, ETSI, TraceTracker, EuroTeleServ, Euro Pool, CAPEB
Total Budget: 2,495,436.00 €
Uninova Budget: 325,800.00 €

iSURF - An Interoperability Service Utility for Collaborative Supply Chain Planning across Multiple Domains Supported by RFID Devices – Duration: 2008 – 2010.
Partners: Metu; Srdc; Fraunhofer Ipa; Intel; Txt; Uninova; Piacenza
Global Budget: 1,997,340.00 €
Uninova Budget: 278,240.00 €

CRESCENDO - Collaborative and Robust Engineering using Simulation Capability Enabling Next Design Optimisation – Duration: 2009-2012.
Partners: Airbus Sas, Association Française De Normalisation, Airbus Deutschland Gmbh, Airbus France Sas, Airbus Uk Limited, Aircelle Sa, Alenia Aeronautica Spa, Altran Technologies Sa, Arttic, Associazione Esoce Net European Society Of Concurrent Engineering Net, Avio Spa20, Brandenburgische Technische Universitat Cottbus, Centre Europeen De Recherche Et De Formation Avancee En Calculscientifique, Centre Internacional De Mètodes Numèrics En Enginyeria, Cranfield University, Dassault Systèmes Sa, Deutsches Zentrum Fuer Luft - Und Raumfahrt Ev, Empresarios Agrupados Internacional Sa, Eurocopter Sas, Eurostep Ab, Fluorem, Free Field Technologies Sa, Fujitsu Systems Europe, Institut National Des Sciences Appliquees De Toulouse, International Research Institute For Advanced Systems, Intespace, Isight Software Eurl, Israel Aerospace Industries Ltd, Linköpings Universitet, Lulea Tekniska Universitet, Msc Software Gmbh, Mtu Aero Engines Gmbh, National Technical University Of Athens, Office National D'etudes Et De Recherches Aerospatiales, Paragon Etairia Meleton Erevnas Kai Emporiou Proionton

Proigmenis Technologias Epe, Politecnico Di Torino, Pyramis, Queen's University Belfast, Rolls-Royce Deutschland Ltd & Co Kg, Rolls Royce Plc, Saab Aktiebolag, Samtech Sa, Scuola Superiore Isufi – Università Del Salento, Short Brothers Plc (Bombardier Aerospace Belfast), Siemens Product Lifecycle Management Software Sas, Snecma Sa, University Of Southampton, Stichting Nationaal Lucht- En Ruimtevaarrtlaboratorium, Thales Avionics Sa, Transcendata Europe Limited, Turbomeca Sa, Uninova - Instituto De Desenvolvimento De Novas Tecnologias, The Chancellor, Masters And Scholars Of The University Of Cambridge, University Of Limerick, Vinci Consulting, Volvo Aero Corporation Ab, Lms Imagine Sa, Eads France Sas (Innovation Works), Ansys France Sas
Global Budget: 55,294,805.00 €
EC funding: 32,483,499.00 €
UNINOVA Budget: 657,950.00 €

PLAGE (Portuguese Project, QREN) - Plataforma electrónica para a contratualização e a gestão integrada e sustentável de projectos ou empreendimentos – Duration: 2009-2011
Partners: Vortal, Porto de Lisboa, FCT/UNL, IST, Microfil, Primavera Software, Administração do Porto de Lisboa, Instituto Portuário e dos transportes marítimos, Top Inov.
Global Budget: 1,000,000.00 €
UNINOVA Budget: 20,000.00 €

UNITE - Upgrading ICT excellence by strengthening cooperation between research teams in enlarged Europe. Duration: 2010-2013.
Partners: UNINOVA (Coordinator), Interop-VLab, NIS-SU, JSI, UPB
Global Budget: 499,998.00 €
EC funding: 499,998.00 €
UNINOVA Budget: 378,000.00 €

ENSEMBLE - Envisioning, Supporting and Promoting Future Internet Enterprise Systems Research through Scientific Collaboration. Duration: 2010-2012
Partners: NTUA, CNR-IASI, Conventry Univ., Intrasoft
Global Budget: 689,991.00 €
EC funding: 689,991.00 €
UNINOVA Budget: 137,870.00 €

ISOFIN (Portuguese Project, QREN) - Cloud-Interoperabilidade in Financial Software (Portuguese Project, QREN) – Duration 2010-2012
*Partners***:** I2S, CCG/ZGDV, Universidade do Minho, UNINOVA, INOV, Promosoft.
Global Budget: 1,200,000.00 €
UNINOVA Budget: 30,000.00 €

InterSisCom (Portuguese Project, FCT, Programa Pessoa 2010-11): Interoperabilidade of complex systems, focused on integrating systems of eco-durable product manufacturing, Université de Nancy (France) - Centre De Recherche En Automatique De Nancy (CRAN UMR), UNINOVA / FCT-UNL
Global Budget: 10,000,000.00 €
UNINOVA Budget: 5,000.00 €

Business Interoperability for Collaborative Platforms with Axiomatic Design Theory for Lean, Agile, Resilient and Green Industrial Ecosystems (Portuguese Project, FCT, R&D Programme: PTDC/EME-GIN/115617/2009), FCT-UNL, UNINOVA
Global Budget: 111,131.00 €
UNINOVA Budget: 7,000.00 €

Recognition

1 – International Awards:

1.1: Scientific excellence of SMART-fm IMS project, 2007, awarded by Intelligent Manufacturing Systems (www.ims.org).

1.2: Member of the network STAND-INN, awarded by European Commission's "EC award for Network of the Year", 2008.

1.3- Lawrence D. Eicher award for leadership and innovation, 2007, awarded by International Organization of standardization (ISO).

2 – Membership of the Planning and Policy Committee of the International Organization for Standardization (ISO) TC184/SC4 and Coordination of the Portuguese delegation, recipient of the Lawrence D. Eicher award for leadership and innovation, 2007.

3 – Chair in international scientific events (e.g., General Conference Chair (4), General Conference Co-Chair (2), Scientific Chair (2), Program /Advisory Chair (2), Organizing chair(4)).

4 – Keynote/Invited speaker in International Conferences (4).

5 – Evaluator and Reviewer (expert and coordinator of panel) in 100+ National and International research projects, e.g., European Commission, Bulgarian National Science Foundation, National Research Program: QREN.

Collaboration

The Research Group GRIS has enlarged collaboration of ongoing research activities with other organizations at national and international level, i.e., joint publications in international conferences and journals, member of consortia of international and national projects, joint preparation of special issues in journals and organization of conferences and workshops, joint training activities, development of eLearning material, etc.

Outreach

Books (with ISBN)

- The Road for SEEM. A Reference Framework Towards a Single European Electronic Market (Hardcover), by Ricardo Jardim-goncalves (Editor), Flavio Bonfatti (Editor), Taylor & Francis; 1 edition (September 2, 2008), ISBN-13: 978-0415419956, 2008

Conference Proceedings in Book Form
Total: 2

- Enterprise Interoperability II: New Challenges and Approaches, editors: Ricardo Gonçalves, Joerg Muller, Martin Zelm, Kai Mertins, Springer Verlag Publishers, ISBN-13: 978-1846288579, 2007
- A new wave of innovation in collaborative networks, editors: Klaus-Dieter Thoben, Kulwant Pawar, Ricardo Goncalves, Published by the Centre for Concurrent Enterprising, ISBN 978 0 85358 244 1, University of Nottingham – UK, 2008.

Guest Editor (International Journals)

Total: 5

2007

- International Journal of Product Life Cycle Management, IJPLM, V2 N2, 2007, special issue on Challenging interoperability for PLM, Inderscience.

2009

- JIM - Journal of Intelligent Manufacturing, Springer, ISSN: 0956-5515, Special issue on IMS: strategies for global manufacturing, 2009 (ISI WoS IF: 1.018)

2010

- Automation in Construction Journal, Special Issue on "BIM and Collaborative Working Environments", guest editors Ricardo Goncalves and Antonio Grilo, AUTCON, Elsevier, 2009 (ISI WoS IF: 1.664)
- Automation in Construction Journal, Special Issue on "Building Information Model and Interoperability", Volume 19, Num 4, guest editors Antonio Grilo and Ricardo Goncalves, AUTCON, Elsevier, 2009 (ISI WoS IF: 1.664)

Forthcoming, 2011

- Computers in Industry, special issue on Interoperability, Ricardo Goncalves, 2011, (ISI WoS IF: 2.014)

General Conference Chair

- International Conference on Interoperability for Enterprise Software and Applications, I-ESA07, IFIP, IFAC, ASME, Portugal, 26-30 March 2007

- (General Conference Co-Chair) International Conference on Concurrent Enterprising, ICE2007, "Concurrent Innovation: an emerging paradigm for Collaboration & Competitiveness in the extended enterprise", 4-6 June, 2007, Sophia-Antipolis, France
- International Conference on Concurrent Enterprising, ICE2008, "A new wave of innovation in Collaborative Networks", 23-25 June, 2008, Caparica, Portugal
- (General Conference Co-Chair) International Conference on Concurrent Enterprising, ICE2009, ""Collaborative Innovation: Emerging Technologies, Environments and Communities", 22-24 June, 2009, Leiden, The Netherlands.
- (General chair), Science Foundation Working Group for Future Internet Enterprise Systems, European Commission, since 2010

Scientific, Programme, Advisory Chair

- Local Organizing Chair, 11th International Symposium on Distributed Objects, Middleware, and Applications (DOA'09), Portugal, 2009
- Local Organizing Chair, 8th International Conference on Ontologies, DataBases, and Applications of Semantics (ODBASE 2009), Portugal, 2009
- Local Organizing Chair, CoopIS = 17th International Conference on Cooperative Information Systems (CoopIS 2009), Portugal, 2009
- Local Organizing Chair, The 4th International Symposium on Information Security (IS'09), Portugal, 2009

Other organizing activities

- Organização das reuniões internacionais do International Organisation for Standardisation (ISO) / TC 184 (Industrial automation systems and integration) / SC4 (Industrial data), Portugal, 2007.
- Track organizer on "Systems", International Conference on Concurrent Engineering, CE 2007 Brazil, 2007
- Workshop chair, "Enterprise interoperability and Concurrent Innovation for Collaboration and Competiveness in the Extended Enterprise", International Conference on Concurrent Enterprising ICE2007, France, 2007
- Session Chair, I-ESA 2008 - International Conference Interoperability for Enterprise Software and Applications, Berlin, Germany, 2008
- Workshop chair, " Scientific Workshop on Enterprise Interoperability. Topic 6: Science Base for Enterprise Interoperability (EI),", I-ESA2008, Germany, 2008
- Workshop organizer, iSURF: An Interoperability Service Utility for Collaborative Supply Chain Planning, eChallenges 2008, Sweden, 2008
- Workshop organizer "Knowledge Oriented Enterprise Collaboration", eChallenges2008, Sweden, 2008
- Session organizer, "Interoperability of systems and applications", IASTED International Conference on Advances in Computer Science and Technology, ACST 2008, Malaysia, 2008
- Co-chair, AMCIS Mini-track: "Worldwide Advances in eGovernment Interoperability", Americas Conference on Information Systems, AMCIS 2009, USA, 2009
- Session chair, CIRP DESIGN (International Academy for Production Engineering) Conference – Competitive Design, UK, 2009.
- Workshop chair, "Spreading awareness about Enterprise Interoperability Applications potential in Industry and Society", International Conference on Concurrent Enterprising, ICE 2009, Leiden, Netherlands.
- Workshop chair, "Logistics Industry – Radical Service Innovation through strategic application of RFID and Galileo", International Conference on Concurrent Enterprising, ICE 2009, Leiden, Netherlands.
- Session organizer "Towards a Scientific Foundation for Interoperability", The European Future Technologies Conference, Science beyond fiction, FET09, Czech Republic, 2009
- Session Chair I-ESA'09: T4-2 Service Oriented Architectures for Interoperability, Beijing, China, 2009.
- Track chair in European Concurrent Engineering Conference (ECEC'2009), Track: "Supporting Technologies", Belgium, 2009.

- Track organizer, Challenging Collaboration with RFID integrated IS, IFIP TC9 – Mediterranean Conference on Information Systems, Information Society Research, Education, Policy and Practice in the Mediterranean Region, MCIS 2009, Greece, 2009.
- Workshop Organizer on Enterprise Interoperability, International Conference on Software, Services and Semantic Technologies, S3T'2009, Bulgaria, 2009.
- Session organizer, International Workshop on Interoperability for Administrations and Enterprises, eChallenges Conference, Istanbul, Turkey, 2009
- Co-chair, AMCIS Mini-track: "Worldwide Advances in eGovernment Interoperability", Worldwide Advances in eGovernment Interoperability, Americas Conference on Information Systems, AMCIS 2010, USA, 2010
- Steering Committee member I-ESA'10, Coventry, UK, 2010.
- Co-chair, AMCIS Mini-track: "Worldwide Advances in eGovernment Interoperability", Americas Conference on Information Systems, AMCIS 2010, Peru, 2010
- IPC member at workshop titled 'Standardisation - a foundation for interoperability', at the I-ESA 2010, UK, 2010
- IPC member at workshop titled Use of MDI/SOA concepts in Industry, at the I-ESA 2010, UK, 2010
- IPC member International Workshop on Enterprise Integration, Interoperability and Networking (EI2N'2009), co-sponsored by IFAC TC 5.3 "Enterprise Integration and Networking", IFIP TC 5 WG 5.12 "Architectures for Enterprise Integration", INTEROP V-Lab for Enterprise Interoperability, Greece, 2010
- IPC member International Conference "Challenges in Higher Education and Research in the 21st Century", Science days of TU-Sofia, CHER 2010
- Workshop organizer and chair: "The future internet: New opportunities for e-training in education and research", International Conference "Challenges in Higher Education and Research in the 21st Century", Science days of TU-Sofia, CHER 2010, Bulgaria
- Session Chair IEEE – IS 2010, IEEE Intelligent Systems Conference, UK (ISI WoS, IEEE), 2010.
- Session organizer ASME 2010, Track 4 Design and Manufacturing, 4-7 Information Based Design and Manufacturing, 4-7-4 Ontology, Design Information, 2010, Canada
- Session chair, World Computer Congress, IFIP International Conference Network of the Future, Enterprise Architecture, Integration, Interoperability and Networking, IFIP AICT, 2010, Australia.
- Workshop organizer "Future of Internet in an Enlarged Europe" in 3rd Future Internet Symposium 2010 (Berlin)
- Workshop "Future of Internet in an Enlarged Europe", eChallenges 2010 (Warsaw)

Editorial Boards and referee of Books and Journal Articles

Total: 4

- Member of Editorial Board, International Journal on Information and Communication Technologies for the Advanced Enterprise - ICT'AE, since 2008

- Editorial Advisory Board for book: "Encyclopedia of Networked and Virtual Organizations", ISBN: 978-1-59904-885-7, 2008.

- Editorial Advisory Board for book: "Interoperability in Digital Public Services and Administration: Bridging E-Government and E-Business", IGI Global, 2010.

- Editorial Advisory Board for book "Electronic Business Interoperability:, Concepts, Opportunities, and Challenges", IGI Global, 2010.

Reviewer/Referee for books and articles in international journals

Total to present: 24 (11 are ISI WoS IF references)

- "Computers in Industry" International Journal, since 1999. (ISI WoS IF: 2.014)

- International Journal of Computer Applications in Technology (IJCAT), since 1999.
- International Transactions in Operational Research (ITOR), since 2000.
- ITcon - Electronic Journal of Information Technology in Construction, since 2000
- International Journal of Electronic Business (IJEB), since 2002.
- Journal of Advanced Engineering Informatics (JAEI), since 2004.
- Book "Ontologies in the Context of Information Systems", ISBN 0-387-37019-6, Springer, 2005
- International Journal of Production Research (IJPR) Special Issue in Concurrent Engineering, 2006 (ISI WoS IF: 0.774)
- Book "Trends in Supply Chain Design and Management: Technologies and Methodologies", ISBN: 1846286069, Springer, 2006.
- Book "Collaborative Design and Planning for Digital Manufacturing", ISBN: 978-1-84882-286-3, Springer, 2006.
- Journal Integrated Computer-Aided Engineering (ICAE), since 2006
- Special issue of journal Artificial Intelligence for Engineering Design, Analysis and Manufacturing (AIEDAM) on "Developing and Using Engineering Ontologies, 2007.
- Reviewer for Journal of Engineering Design, since 2007. (ISI WoS IF:0,812)
- Journal ACM DataBase for Advances in Information Systems, since 2007
- AUTOCON: Journal Automation in Construction, since 2008 (ISI WoS IF: 1.664)
- Journal of Engineering Design, since 2008 (ISI WoS IF: 0.812)
- International Journal of Intelligent Manufacturing Systems (IJIMS), since 2009. (ISI WoS IF: 1.018)
- International Journal of Information Technology and Management (IJITM), since 2009. (ISI WoS IF: 0.526)
- Book: "Information and Communication Technology Standardization for E- Business Sectors: Integrating Supply and Demand Factors", ISBN 978-1605663203, 2009
- Advances in Engineering Software Journal (AESJ), since 2009 (ISI WoS IF: 1.176)
- Telematics and Informatics Journal (TIJ), since 2009
- IEEE Transactions on Systems, Man, and Cybernetics--Part C: Applications and Reviews, since 2009 (ISI WoS IF:2.342)
- European Journal of Information Systems, since 2010. (ISI WoS IF: 1.534)
- Enterprise Information Systems, Taylor and Francis, since 2010 (ISI WoS IF: 3.085)

Keynote/Invited speaker

- International Conference on Advanced Research in Virtual and Rapid Prototyping, VRAP2007, Portugal, September, 2007
- European Day of the Enterpreneur, under the theme: "Fostering economic growth through innovations and technology transfer", presenting "European practices of academy-industry cooperation, Bulgaria, October 2008
- Encontro Nacional de Interoperabilidade (National Interoperability Conference), ODF Open Document Format Alliance Portugal, IBM, SUN, IFILP, Lisboa, September 2009.
- S3T, Bulgaria, "Interoperability and the software, services and semantic technologies challenges in the future of internet", September 2010.

Evaluation and Review Boards

- *International expert reviewer* for the EPSRC - Engineering and Physical Sciences Research Council (UK Government's leading funding agency for research and training in engineering and the physical sciences), 2008
- Evaluator for EPSRC (UK) of the Innovative Manufacturing & Construction Research Centre (IMCRC), Wolfson School of Mechanical & Manufacturing Engineering, Loughborough University (UK), 2008
- External Expert for research projects for the Bulgarian National Science Foundation, 2008.
- Member of the evaluation committee for projects of the QREN (*Quadro de Referência Estratégico Nacional*), 2008-2010
- External Expert for R&D for the European Commission, NMP Programme, 2009.
- External Expert for research projects for the *Bulgarian National Science Foundation*, 2009.
- External Expert for R&D for the European Commission, NMP Programme, 2010.
- Coordinator of the review panels for the QREN (Quadro de Referência Estratégico Nacional) projects, 2010

- External Expert for R&D for the European Commission, NMP Programme, 2011.
- External Expert for R&D for the European Commission, Systems Security programmes, 2011.
- Member of Scientific Committe of magazine "Quero Saber", "How It Works", (http://www.howitworksdaily.com), 2010
- Member of Scientific Comite of ISOFIN project, 2010

Standardization Bodies

- Expert for the development of the CEN standard: Requirements for establishing enterprise interoperability in manufacturing-enterprise processes and their models Part 1, Interoperability Framework, 2007
- Member of ISO TC184/SC4 Planning and Policy Committee (PPC), desde 2008.
- Member of the liaison committee between ISO TC184/SC4 PPC and Implementors Forum, Outreach and Education, 2009
- Member of the liaison committee between ISO TC184/SC4 PPC and ISO TC154, 2008
- Consultant to the committee for normalization of DIN: Deutsches Institut fur Normung e. V., German Institute for Standardization, 2009
- Member ISO TC184/SC4 Validation Team Member for "Development and maintenance of standards in database format", 2009.
- Member of WG 9 "BIM guidance" and specialist in ISO TS/12911 Framework for Provision of Guidance on Building Information Modelling
- OMG: Object Management Group. Specialist for the development of Reference Metamodel for the EXPRESS Information Modeling Language.
- Member of the Board of Experts in TC 59/SC 13/WG 9, 2009

Scientific / Technical organizations

- Charter member of IFIP SIG EI Members, IFIP Technical Committee 5 "IT Applications" Special Interest Group " Enterprise Interoperability" of IFIP, 2007
- Expert for the IMS (Intelligent Manufacturing Systems) streamline of research: "Manufacturing Interoperability and Standard", 2007.
- International Society for Productivity Enhancement (ISPE), member of the board for Scientific Affairs, 2007
- Member of the Experts Advisory Board of Interop-VLab: The International Virtual Laboratory for Enterprise Interoperability, 2007
- Member of IEEE Technical Committee on (CSCWD) Computer Supported Cooperative Work in Design, 2008
- Member of the Board of PAM: Portuguese Aliance for Manufacturing, with Fraunhofer, 2008
- European Representative to IMS (Intelligent Manufacturing Systems) - Manufacturing Technology Platform on "Standards and Manufacturing Interoperability", 2008.
- Member of the European Commission Task Force: "A science base for EI", since 2008
- External expert for the European project 7FP SISTER (Strengthening the IST Research Capacity of Sofia University, Sofia (Bulgaria), since 2008.
- Member of IEEE Systems, Man, and Cybernetics Society, Technical Committee on Computer Supported Cooperative Work in Design, desde 2008.
- Member of the EuroAfrica-ICT network, 2008.
- Member of European "Enterprise Collaboration and Interoperability" COIN Testimonials, i.e., recognised experts of the Enterprise Interoperability or Enterprise Collaboration area who support the COIN vision, 2008
- International Society for Productivity Enhancement (ISPE), member of the executive board, 2010

Education & Training

- Coordinator FCT/UNL eLearning lab (cf. Despº. 66, 72 e 76 de 2007).

- New courses design: 4.1. European Master in IT: New course in Data Integration and Retention. 4.2. FCT/UNL: New course: AIS. 4.3. Restructure: FCT/UNL SAD, SL1 and SL. Development of eLearning material for teaching courses. The eLearning material is organized into six areas for a total of 21 lessons

- Coordinator Professor (from DEE) for Erasmus/Socrates program.

- Coordination of Doctoral and Post-doc Exchange: Coordination of the European Programme UNITE (Upgrading ICT excellence by strengthening cooperation between research teams in an enlarged Europe), calling for exchange among approximately 120 European Universities and Research Institutes.

Facilities

One lab, with computational infrastructure for the development of the research foreseen.

Strategy

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.
- To 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.

Production

Books (with ISBN)

- The Road for SEEM. A Reference Framework Towards a Single European Electronic Market (Hardcover), by Ricardo Jardim-Goncalves (Editor), Flavio Bonfatti (Editor), Taylor & Francis; 1 edition (September 2, 2008), ISBN-13: 978-0415419956, 2008

Conference Proceedings in Book Form
Total: 2

- Enterprise Interoperability II: New Challenges and Approaches, editors: Ricardo Gonçalves, Joerg Muller, Martin Zelm, Kai Mertins, Springer Verlag Publishers, ISBN-13: 978-1846288579, 2007
- A new wave of innovation in collaborative networks, editors: Klaus-Dieter Thoben, Kulwant Pawar, Ricardo Goncalves, Published by the Centre for Concurrent Enterprising, ISBN 978 0 85358 244 1, University of Nottingham – UK, 2008.

Guest Editor (International Journals)

Total 2007 and following: 4 + 1 at press (4 are ISI WoS IF references), annual average: 1.25

2007

1. International Journal of Product Life Cycle Management, IJPLM, V2 N2, 2007, special issue on Challenging interoperability for PLM, Inderscience.

2009

2. JIM - Journal of Intelligent Manufacturing, Springer, ISSN: 0956-5515, Special issue on IMS: strategies for global manufacturing, 2009 (ISI WoS IF: 1.018)

2010
3. Automation in Construction Journal, Special Issue on "BIM and Collaborative Working Environments", guest editors Ricardo Goncalves and Antonio Grilo, AUTCON, Elsevier, 2009 (ISI WoS IF: 1.664)
4. Automation in Construction Journal, Special Issue on "Building Information Model and Interoperability", Volume 19, Num 4, guest editors Antonio Grilo and Ricardo Goncalves, AUTCON, Elsevier, 2009 (ISI WoS IF: 1.664)

Forthcoming, 2011

- Computers in Industry, special issue on Interoperability, Ricardo Goncalves, 2011, (ISI WoS IF: 2.014)

Refereed Book Chapters

__NOTE__: __Not included__ here are articles and addresses presented at conferences, published only in the conference's proceedings/minutes, even when these are published in book form (with ISBN).

Total 2007-2010: 7, annual average: 1.2

2007

1. Developing interoperability in mass customization information systems, Ricardo Jardim-Goncalves, Antonio Grilo, Adolfo Steiger-Garcao, in book Mass Customization Information Systems in Business, ISBN-10: 1599040395, IRM Press, 2007.
2. A Standards-Compliant framework to support complete integrated product life cycle information management and electronic commerce for furniture manufacturing industry in advent of smart enterprises, Ricardo Jardim-Goncalves, Maria José Nuñez, in book: Global Solutions to Challenges in Manufacturing, 2007, ISBN: 978-89-92592-34-5, 2007.

2008

3. funStep: better interoperability in smart organizations, R. Goncalves, M. J. Nunez, A. Togores, A. Steiger, in book Encyclopedia of Networked and Virtual Organizations, Information Science Reference, ISBN: 978-1599048857, 2008.
4. An Interoperable Environment to Assist Integrating One-off Production using BIM, Jardim-Goncalves, R., Farinha, F. and Steiger-Garcao, in book Building Information Model e Competitividade do Sector da Construção, OPET, ISBN 978-989-95697-3-7, 2008

2009

5. The role of the CIO in the development of interoperable information systems in healthcare organizations, António Grilo, Luís Lapão, Ricardo Jardim-Gonçalves, Virgilio Cruz-Machado, in book Handbook of Business and Information Systems, World Scientific Publishing, chapter 2, pp. 25-46, ISBN: 978-981-283-605-2, 2009.
6. Operational efficiency management tool placing resources in intangible assets, Claudelino Martins Dias Junior, Osmar Possamai and Ricardo Goncalves, in book Handbook of Business Information Systems, World Scientific Publishing, chapter 19, pp. 457-486, ISBN: 978-981-283-605-2, 2009.

2010

7. Towards a Scientific Foundation for Interoperability, Yannis Charalabidis, Ricardo Jardim Gonçalves, Keith Popplewell, in book Interoperability in Digital Public Services and Administration: Bridging E-Government and E-Business, pp. 355-373, IGI-Global book, ISBN: 978-1-61520-887-6, 2010

Refereed Articles in Journals

NOTE: This section does not include editorial articles.

Total 2007 and following: 10 (7 are ISI WoS IF references), annual average: 1.65

2007

1. Integration of cooperative production and distributed design in AEC, F. Farinha, R. Jardim-Gonçalves, A. Steiger-Garção, International Journal Advances in Engineering Software, Special issue, 2007, ISSN: 0965-9978, ELSEVIER. (ISI WoS IF: 1.188, Cites: 2)
2. Harmonizing Technologies in Conceptual Models Representation, Ricardo Jardim-Goncalves, Carlos

Agostinho, Pedro Malo, Adolfo Steiger-Garcao, International Journal on Product Lifecycle Management, IJPLM. (Cites: 6)

3. Product Data Exchange, Sharing and Retention in Aeronautic: interoperability enabled by STEP and Semantic Web, Nicolas Figay, Ricardo Goncalves, International Journal on Product Lifecycle Management, IJPLM.

2008

4. A utilização de ativos intangíveis como agentes de melhoria do desempenho organizacional (Using intangible assets as agents for addressing organizational challenges), Claudelino Martins Dias Junior, Osmar Possamai, and Ricardo Gonçalves, Rev. Portuguesa e Brasileira de Gestão, vol.7, no.1, p.24-32. ISSN 1645-4464, 2008.

2009

5. SOA4BIM: Putting the building and construction industry in the Single European Information Space, R. Jardim-Goncalves, A. Grilo, Automation in Construction, 2009, doi:10.1016/j.autcon.2009.11.009, (ISI WoS IF: 1.664, Cites:2)

6. Value proposition of interoperability on BIM and collaborative working environments, António Grilo; Ricardo Jardim-Goncalves, Journal Automation in Construction AUTOCON, Special issue, doi:10.1016/j.autcon.2009.11.003, 2009. (ISI WoS IF: 1.664, Cites:1)

7. Knowledge Framework for Intelligent Manufacturing Systems, Ricardo Jardim-Goncalves, Joao Sarraipa, Carlos Agostinho, Hervé Panetto, International Journal of Intelligent Manufacturing, doi: 10.1007/s10845-009-0332-4, 2009 (ISI WoS IF: 1.018, Cites:1)

2010

8. MENTOR: An Enabler for Interoperable Intelligent Systems, João Sarraipa, Ricardo Jardim-Goncalves, Adolfo Steiger Garcao, International Journal of General Systems, Volume 39 Issue 5, pp. 557, ISSN: 0308-1079, 2010 (ISI WoS IF: 0.826, Cites:1)

9. Manufacturing Systems Integration in the Advent of the Single Electronic Market: A Social and Organizational Semiotics Perspective, Ricardo Jardim-Goncalves, Antonio Grilo, Tarek Hassan, Adolfo Steiger-Garcao, International Journal of Computer Integrated Manufacturing, ISSN: 0951-192X, 2010 (ISI WoS IF: 0.914)

10. Challenging electronic procurement in the AEC sector: BIM-based integrated perspective, António Grilo, Ricardo Jardim-Goncalves, Journal Automation in Construction AUTOCON, 2010. (ISI WoS IF: 1.664) (in publication)

Refereed International Conferences

Total 2007 and following: 44, annual average: 11 (42% = ISI WoS/IEEE/ASME)

2007 – **Total: 9**

1. EXPRESS to OWL morphism: making possible to enrich ISO10303 Modules, Carlos Agostinho, Moisés Dutra, Ricardo Jardim-Gonçalves, Parisa Ghodous, and Adolfo Steiger-Garção, CE2007, Brazil, 2007. (ISI WoS, Springer, Cites: 1)

2. Applying TTCN to enhance B2B Conformance testing frameworks, S. Onofre, C. Agostinho, R. Jardim-Gonçalves, and A. Steiger-Garção, I-ESA07, Madeira-Portugal (ISI WoS, Springer, Cites 1)

3. Integrated solution to support enterprise interoperability at the business process level on e-Procurement, Ruben Costa, Oscar Garcia, Maria José Nuñez, Pedro Maló and Ricardo Gonçalves, I-ESA07, Madeira-Portugal. (ISI WoS, Springer)

4. Enhancing STEP-based Interoperabity Using Model Morphisms, C. Agostinho1, J. Sarraipa1, F. D'Antonio2, and R. Jardim-Gonçalves, I-ESA07, Madeira-Portugal (ISI WoS, Springer)

5. Systematic for Increase of the Operational Efficiency from the Allocation of Resources in Intangible Assets, Claudelino Martins Dias Junior, Osmar Possamai, Ricardo Gonçalves, CE2007, Brazil, 2007. (ISI WoS, Springer)

6. Innovation in the Public Administration: The Interoperability Challenge, António Grilo, Ricardo Jardim-Goncalves, António Pais, the International Society for Professional Inovation and Management Conference, ISPIM 2007, New Delhi, Índia, Jan 2007.

7. Annotation for enterprise information management traceability, Joao Sarraipa, Nabila Zouggar, David Chen, Ricardo Jardim-Goncalves, ASME 2007 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, September 4-7, 2007, Las Vegas, Nevada, USA (WoS ISI, ASME, Cites: 5)

8. A methodology using Domain Ontology and SOA for better interoperability in AEC mass customization, Antonio Grilo, Ricardo Jardim-Goncalves, Adolfo Steiger-Garcao, CIB W78 2007, Maribor, Slovenia, June 2007.

9. Using Organizational Intangible Assets for Better Levels of Operational Efficiency, Dias Junior, C., Possamai, O., Jardim-Goncalves, R., In: European Ideas for Business Erima, 2007, Biarritz (França). Symposium ERIMA 07': European Symposium on Innovative Management Practices, 2007.

2008 – **Total: 12**

10. Advanced training in Engineering Management focusing on the Colaboration dimension, Pedro Malo, Joao Sarraipa, Ricardo Jardim-Goncalves, Adolfo Steiger, IEMC – Europe 2008, International Engineering Management Conference, IEEE, 2008 (ISI WoS, IEEE)

11. Open visualization of product data: a model morphism framework, Almeida, B., Agostinho, C. ; Nuñez-Ariño, M. J. ; Jardim-Goncalves, R . IEEE – IS 2008, Varna (ISI WoS, IEEE).

12. MENTOR – A methodology for enterprise reference ontology development, Sarraipa, J.; Silva, J. P. M. A.; Jardim-Goncalves, R.; Monteiro, A. A. C., IEEE – IS 2008, Varna (ISI WoS, IEEE, Cites: 8).

13. Managing Engineering and Technology with Better Interoperability in Smart Organizations, Ricardo Jardim-Goncalves, Maria Jose Nunez, Amparo Roca-Togores, A. Steiger-Garcao, PICMET (Portland International Conference on Management of Engineering and Technology): "Technology Management for a Sustainable Economy", University of Pretoria, July 27 - 31, 2008, Westin Grand Cape Town Arabella Quays, Cape Town, South Africa. (ISI WoS)

14. How to make a reality the implementation of ISO-10303 Standards in SME-based Environments, M. Delgado, C. Agostinho, M. J. Nuñez-Ariño and R. Jardim-Gonçalves, Special Session Standards for Interoperability – How?, at the I-ESA'2008, Germany, 2008 (Cites: 1)

15. O desafio de um ambiente eLearning (The challenge of an eLearning environment): Mestrado Europeu em Tecnologias de Informação na Construção (European Masters in IT for Construction), Fátima Farinha and Ricardo Jardim-Gonçalves, CLME 2008, Maputo (Maçambique)

16. The CoSpaces Training System, Pedro Maló, João Sarraipa, Ricardo Jardim-Gonçalves, Adolfo Steiger-Garção, ICE 2008, Portugal

17. Inter-enterprise collaboration throughout ontological orchestration, J. Sarraipa, S. Onofre, P. Malo, R. Jardim-Goncalves, eChallenges 2008, Sweden October 2008.

18. Evaluation and Testing as support for a consistent Architecture development, Hugo Miguel Vieira, Fernando Luís Ferreira, John Kennedy, Ricardo Jardim-Goncalves, eChallenges 2008, Sweden October 2008.

19. Using an Inference Engine to Detect Conflicts in Collaborative Design, Moisés Dutra, Parisa Ghodous, Ricardo Gonçalves, ICE2008, Lisbon, June 2008.

20. A Contribution for the Development of Performance Indicators of the Organization Intangible Assets, Claudelino Martins D. Junior, Osmar Possamai, Ricardo Gonçalves, Celson Lima, ICE2008, Lisbon, June 2008.

21. Resolving Collaborative Design Conflicts Through an Ontology-based Approach, Moisés Dutra, Catarina Ferreira, Parisa Ghodous, Ricardo Gonçalves, CE2008, Springer-Verlag, Dublin, August 2008.

2009 – **Total: 13**

22. Challenges for the development of interoperable information systems in healthcare, António Grilo , Ricardo Jardim-Goncalves, Luís Velez Lapão, Virgilio Cruz-Machado, Adolfo Steiger-Garção, I-ESA'09, Beijing – China. (ISI WoS)

23. Semantic Enrichment of Standard-based Electronic Catalogues, João Sarraipa, Carlos Agostinho, Hervé Panetto, Ricardo Jardim-Goncalves, 13th IFAC Symposium on Information Control Problems in Manufacturing, INCOM '09, Moscow, June 2009. (Cites: 2)

24. Analysis of interoperability value proposition on the AEC sector, Antonio Grilo, Ricardo Jardim-Goncalves, IEEE IEEM - International Conference on Industrial Engineering and Engineering Management, Hong-Kong, 2009. (IEEE)

25. VALTE – Methodology for VALidation and TEsting of Supply Chain Software Components, Hugo Vieira, Ricardo-Jardim Goncalves, ICE 2009, Holland, June 2009. (Cites: 1)

26. Towards EI as a science: Considerations and points of view, Ricardo-Jardim Goncalves, Adolfo Steiger Garcao, ICE 2009, Holland, June 2009.

27. Application of SQuaRE and Generalized Nets for extended validation of CE systems, Ricardo Jardim-Goncalves, V. Taseva, ICE 2009, Holland, June 2009.

28. iSurf: RFID enabled collaborative supply chain planning environment, Asuman Dogac, et.al., MCIS 2009, IFIP TC9 - 4th MEDITERRANEAN CONFERENCE ON INFORMATION SYSTEMS, Conference Theme: "Information Society Research, Education, Policy and Practice in the Mediterranean Region.

29. Interoperability and Standards : the way for innovative design in networked working environments, C.Agostinho, B.Almeida, M.J.Nunez-Arino, R.Jardim-Goncalves, Paper ID: CIRP-Design-173, CIRP Design Conference 2009, Cranfield UK.

30. Analysis of Interoperability Value Proposition in the Architectural, Engineering and Construction Sector, António Grilo, Ricardo Jardim-Goncalves, V. Cruz Machado, IEEM09-P-0570, IEEE International Conference on Industrial Engineering and Engineering Management, Hong Kong, December 2009 (IEEE)

31. Methodology for Seamless Supply Chain Planning, João Sarraipa, Hugo Vieira, Carlos Agostinho and Ricardo Goncalves, S3T conference, Bulgaria, October 2009 (Cites: 1)

32. Towards ontology harmonization of mechanical manufacture constraints through PLC, João P.M.A. Silva, João Sarraipa, António A.C Monteiro, Ricardo Jardim-Gonçalves, COBEM 2009 Conference.

33. Dynamic Business Networks: A Headache for Sustainable Systems Interoperability, Carlos Agostinho, Herve Panetto, Ricardo Jardim-Goncalves, Lecture Notes in Computer Science, Book: On the Move to Meaningful Internet Systems: OTM 2009 Workshops, Springer, ISSN 0302-9743, IFAC/IFIP Workshop on Enterprise Integration, Interoperability and Networking (EI2N '09), On The Move Conference: OTM'2009, Portugal, 2009. DOI: 10.1007/978-3-642-05290-3_30. (ISI WoS)

34. Integration of industrial collaborative environments through guided imagery by the models, Almeida B, Malo P, Delgado M, Jardim-Goncalves R, Information Technologies and systems: Iberian conference on information systems and technologies, ISBN: 978-989-96247-0-2, Portugal, 2009

2010 – **Total: 10**

35. Developing a Science Base for Enterprise Interoperability, Yannis Chalabaris, Ricardo Goncalves, I-ESA 2010, UK

36. Sustainable Systems' Interoperability: A reference model for seamless networked business, Ricardo Jardim-Goncalves, Carlos Agostinho, Adolfo Steiger-Garcao, IEEE International Conference on Systems, Man and Cybernetics, IEEE SMC 2010, Turkey (IEEE)

37. Semantic harmonization for seamless networked supply chain planning in the future of internet, Ricardo Jardim-Goncalves, Joao Sarraipa and Adolfo Steiger-Garcao, IFIP International Conference Network of the Future, IFIP AICT 326, pp. 78--89. IFIP International Federation for Information Processing, 2010, Australia. (IFIP)

38. Collaborative Ontology Building using Qualitative Information Collection Methods, Sarraipa, J.; Gaspar, T.; Jardim-Goncalves, R., IEEE – IS 2010, IEEE Intelligent Systems Conference, UK (ISI WoS, IEEE).

39. Interoperability of Complex Business Networks by Language Independent Information Models, Carlos Agostinho, Filipe Correia and Ricardo Jardim-Goncalves, CE 2010, Poland, 2010

40. An efficient Inter-Organizational approach to Industrial Training Development, Joao Sarraipa, Diogo Figueiredo, Pedro Maló, Ricardo Jardim-Goncalves, Collaborative Knowledge Management - CKM2010 at the KGCM2010, USA, 2010

41. Ontology-Based Content Development in Collaborative Environments with Semantic Services, Boyan Bonchev, Ricardo Jardim-Goncalves, IADIS Multi Conference on Computer Science and Information Systems, MCCSIS 2010, Germany

42. Sustainable reference ontology development in the mechanical engineering domain, Ricardo Jardim-Goncalves, Joao Sarraipa, Joao Mendonca Silva, ASME 2010, Canada. (ASME)

43. Methodology for the development of sustainable reference ontology in the mechanical engineering domain Joao Sarraipa, Ricardo Jardim-Goncalves, Joao Mendonca Silva, ASME 2010, Canada. (ASME)

44. Collaborative Ontology Development with Inheritance Support, Boyan Bontchev, Ricardo Gonçalves, S3T conference, 2010, Bulgaria.

Doctoral and Post-doc Advising

Doctoral candidates, completed

- Claudelino Dias Júnior, "Modelo de gerenciamento da eficiência operacional a partir da alocação de recursos em ativos intangíveis", 2008. (FCT/UNL)
- Moisés Lima Dutra, "An ontology-based approach to deal with conflicts in collaborative design", 2009 (FCT/UNL)
- João Pedro Mendonça, "Automatic and intelligent integration of manufacture standardized specifications to support Product Life Cycle – an ontology based methodology", 2009 (Universidade do Minho)

Doctoral candidates, current (FCT/UNL)

- João Filipe dos Santos Sarraipa, since July 2008, expected completion in 2011.
     Research Area: Harmonization of ontological structures to support the application dynamics and enable **adaptability** of user's semantic specifications

- Carlos Manuel de Melo Agostinho, since July 2008, expected completion in 2011
     Research area: Learning and adaptability of intelligent reconfiguration of components, for sustainability of interoperability of evolutive networked systems

- Carlos Eduardo Dias Coutinho, since October 2004, expected completion in 2012
     Research Area: Interoperability of cloud resources in the Internet of Services

- Gonçalo André Canha de Castro, since September 2010
     Research Area: Conformance testing and Interoperability checking for complex systems interoperability assessment

- Edgar Miguel Felício Oliveira da Silva, since September 2010
     Research Area: Open networked architecture for Internet-connected objects

- Pedro Maló, since March 2006
     Research Area: A formal model for model-driven interoperability

- Ruben Costa, since July 2008
     Research Area: Knowledge management in interoperable environments

- Ricardo Wolffensperger Ferreira, since September 2010 (Co-advisor)
     Research Area: Intelligent integration and management of cloud resources

Masters advising

Masters, completed (pre-Bologna)

- João Filipe dos Santos Sarraipa, "Uma solução para a interoperabilidade semântica, em ambientes globais de negócios", *Departamento de Engenharia Informática, Faculdade de Ciências e Tecnologia* of the *Universidade Nova de Lisboa*, 2006
- Hugo Miguel Pinho Vieira, "Arquitectura para execução de processos de negócio baseados em planos parametrizáveis de serviços", *Departamento de Engenharia Informática*, *Faculdade de Ciências e Tecnologia* of the *Universidade Nova de Lisboa*, 2006
- Carlos Manuel de Melo Agostinho, "Plataforma para a adopção e implementação de modelos conceptuais normalizados ISO10303", *Departamento de Engenharia Informática, Faculdade de Ciências e Tecnologia* of the *Universidade Nova de Lisboa*, 2006
- Sérgio Onofre, "Plataforma para testes de conformidade de sistemas baseados em módulos conceptuais STEP", *Faculdade de Ciências e Tecnologia* of the *Universidade Nova de Lisboa*, 2007
- Ruben Costa, "A Framework to support Interoperability for Collaborative Business Processes in e-Procurement", *Faculdade de Ciências e Tecnologia* of the *Universidade Nova de Lisboa*, 2008
- Marco Delgado, "Harmonisation of STEP and MDA conceptual models using Model Morphisms", *Faculdade de Ciências e Tecnologia* of the *Universidade Nova de Lisboa*, 2008

Masters, completed (Bologna)

- Bruno Almeida, "Integração de ambientes industriais colaborativos através da visualização orientada pelos modelos", *Faculdade de Ciências e Tecnologia* of the *Universidade Nova de Lisboa*, 2009

List of 25 selected journal, classified based on "5 Year Impact Factor" criteria (A+>2 / Q1, A>1.5/Q1, B>1/Q2, C>0,5):

Rank	Journal Title	ISSN	2008 Journal Total Cites	ImpactFactor	5-Year ImpactFactor	Cited Half-Life	Eigenfactor Score	Article Influence Score	Classif
1	ACM Computing Surveys	0360-0300	3273	9,92	14,672	9,1	0,00648	4,795	A+
2	MIS Quartely	0276-7783	5684	5,183	11,586	9,7	0,01138	3,541	A+
3	Proceedings IEEE	0018-9219	17993	4,613	6,824	>10	0,0346	2,391	A+
4	ACM Transactions on Information Systems	1046-8188	1455	1,472	6,306	7,7	0,00335	1,776	A+
5	Communications of ACM	0001-0782	12617	2,646	3,175	>10	0,01794	0,949	A+
6	IEEE Transactions on Industry Applications	0093-9994	9001	2,058	2,812	9,6	0,01237	0,622	A+
7	IEEE Transactions on Industrial Informatics	1551-3203	227	2,356	2,565	2,6	0,00069	0,364	A+
8	Advanced Engineering Informatics	1474-0346	354	1,848	2,431	3,5	0,00152	0,559	A+
9	Computers in Industry	0166-3615	1647	2,014	2,338	6,1	0,00322	0,439	A+
10	Information Systems	0306-4379	949	1,66	2,261	6,1	0,00266	0,603	A+
11	Journal of Strategic Information Systems	0963-8687	519	1,484	2,012	6,8	0,00076	0,398	A+
12	IEEE Transactions on Systems, Man and Cynernetics - C (Applications and Reviews)	1094-6977	1169	1,375	1,823	5,9	0,00279	0,398	A
13	Computers and Industrial Engineering	0360-8352	2389	1,057	1,637	9	0,00438	0,437	A
14	International Journal of Cooperative Information Systems	0218-8430	267	0,714	1,585	5,4	0,00087	0,416	A
15	Automation in Construction (AutoCon)	0926-5805	844	1,664	1,569	4,1	0,00211	0,285	A
16	IEEE Transactions on Education	0018-9359	1035	1,4	1,417	6,6	0,00176	0,246	A
17	International Journal of Production Research	0020-7543	5900	0,774	1,38	9	0,01042	0,36	A
18	Journal of Intelligent Manufacturing (JIM)	0956-5515	782	1,018	1,3	6,7	0,00147	0,256	A
19	Industrial Management and Data Systems	0263-5577	720	0,945	1,237	5	0,00179	0,228	A
20	Open Systems and Information Dynamics	1230-1612	228	1,13	1,031	3,7	0,00205	0,582	A
21	Journal of Systems and Software	0164-1212	1570	1,241	1,312	5,3	0,00509	0,354	B
22	International Journal Advances in Engineering Software (IJAES)	0965-9978	897	1,188	1,048	6,4	0,00269	0,321	B
23	International Journal of General Systems	0308-1079	628	0,826	0,933	>10	0,0009	0,247	B
24	International Journal of Computer Integrated Manufacturing (IJCIM)	0951-192X	534	0,722	0,914	5,8	0,00152	0,227	B
25	International Journal of Technology Management (IJTM)	0267-5730	731	0,526	0,684	7	0,0015	0,152	C

List of 12 selected conferences, classified based on indexing, sponsors, indexing and interest/impact for the community in the scientific area

Rank	Conference	Title	Sponsors	Indexing	Class
1	I-ESA	I-ESA: Interoperability-Enterprise, Systems and Applications	IFIP	WoS ISI	A+
2	IEEE-IS	IEEE Intelligent Systems	IEEE	WoS ISI, IEEE	A+
3	CE	Concurrent Engineering: Research and Applications	ISPE	WoS ISI	A
4	ASME-IDETC	ASME: International Design Engineering Technical Conferences & Computers and Information in Engineering Conference	ASME	WoS ISI, ASME	A
5	IEEE-SMC	IEEE International Conference on Systems, Man and Cybernetics	IEEE	WoS ISI, IEEE	A
6	eChallenges	eChallenges Conference & Exhibition	IEEE	WoS ISI	A
7	IEEE-IEEM	IEEE International Conference on Industrial Engineering and Engineering Management	IEEE	WoS ISI, IEEE	A
8	IFIP-WCC	IFIP World Computer Congress	IFIP	Wos ISI	A
9	CIRP-Design	CIRP Design Conference	CIRP	WoS ISI, CIRP	A
10	OTM	On The Move Conference		WoS ISI	A
11	ICSCI	Conference on Systemics, Cybernetics and Informatics		WoS ISI	B
12	ECPPM	European Conference on Product and Process Modelling in the Building and Related Industries		WoS ISI	B

Advisors:

- Prof. Guy Doumeingt (Franca)
- Prof. Kamelia Stefanova (Bulgaria)

Group C3: Decision Based Systems

Research Group Coordinator

Rita Almeida Ribeiro (rar@uninova.pt)

Doctoral Research Team

- Rita Almeida Ribeiro (RAR) Invited Associate Professor , email: rar@uninova.pt
- José Manuel Fonseca (JMF), Assistant Professor,   email: jmf@uninova.pt
- Isabel Lopes Nunes (IMN), Assistant Professor,   email: imn@fct.unl.pt

Associated Post-Docs

- Ivan Dorotevic (ID) (2009-) and (scientific advisor 2007-2009) email: id@uninova.pt
- Carlos del Burgo (CdB) (2009-) ,   email: cburgo@uninova.pt

PhD students

- André Damas Mora (finished)   email: atm@uninova.pt
- Ana Sofia Fachada Fernandes (finished)   email: asff@uninova.pt
- Tiago Simas,   email: tms@uninova.pt
- Abel Pinto,   email: abel.fnpinto@gmail.com
- Ehsan Shahamatnia   email: ehsan.shahamat@gmail.com

Collaborators, as research engineers

- António Falcão, ESA Project   email: ajf@uninova.pt
- Tiago Pais (finished)
- Margarida Gomes (finished)
- Luis Simões ESA Project (finished)
- Afonso Pimentel, EU project (finished)
- Fernando Miguel Moitinho, FCT project (finished)
- Carlos Figueira, internal project (finished)
- Luis Teixeira, ESA Project   email: lst@uninova.pt
- Miguel Gomes, ESA Project   email: mdg@uninova.pt
- Bruno Miranda ESA Project (finished)

Collaborators (small percentage of their time, 10%)

- Pedro Sousa, Assistant Professor (10%)
- João Pimentão, Assistant professor (10%)

Summary

Main indicators and achievements:

This report mainly summarizes research activities undertaken from 2007 until 2010 (evaluation period) of the Computational Intelligence research group of CTS (www.uninova.pt/ca3/) .

The activities of this group are concentrated in the area of Computational intelligence particularly applied to Space related problems. This research has led to an extensive list of publications (journals and conferences) as well as to be awarded several international projects and 2 patents.

We have co-authored 10 international book chapters, 19 papers in A/A+ journals and 13 in other international refereed journals. A significant effort was made to increase the quality of the publications in Journals and conferences, as can be seen in the summary tables below.

We were also awarded several national and international projects, being 6 financed by ESA (European Space Agency).

Highlights of achievements (since 2007)

1. Definition of a new evolutionary process for dynamic decision making under uncertainty that proved quite efficient for spacecraft landing site selection. 2 projects were awarded, 7 papers published and our algorithm was selected for the ESA Lunar Lander mission phase B (design).

2. Definition of an unsupervised clustering algorithm capable of handling large data sets (order of 10^9) denoted MK-means. Its application in the GAIA mission (ESA) is being assessed. We also succeed in getting financing for exploring this subject further with an ESA project.

3. Establishment of our research group as a specialist in Computational intelligence applied in the Space domain (6 projects approved by ESA and we were registered as official supplier of EADS- Astrium).

4. Continuation of the research related with the ERGO_X, which resulted in the FAST ERGO_X tool for workplace ergonomic auditing and work-related musculoskeletal disorders prevention.

5. Collaboration with industry in the development of Risk Analysis for work accidents, for instance Paper Transformation Industry.

6. Collaboration in the development of PREVENTOR – a multimedia application for the dissemination of ergonomic recommendations

7. We managed to secure 2 Post-doc positions financed by the FCT to hire 2 Astrophysics specialists. This collaboration is proving to have a synergetic effect and is opening new research opportunities. From one post-doc we already have 10 publications in A/A+ journals in the period 2009-2010, on the research areas of cool dwarfs and extrasolar planets, debris disks, galaxy evolution and conceptual design of PHASES.

8. In the Astrophysics research one post-doc (CdB) is co-I of international observing programs: DUNES (granted 140 hours using the ESA's Herchel Observatory); FOGO (granted 25+25 observing nights in 2008-2010) which is a La Palma observatory international Time project. Also there is a collaboration with the Coma Cluster Hubble Space Telescope Treasury Survey.

9. An impressive number of master thesis were concluded during this period (25!)

10. We are also proud of reporting that two patents were obtained by our group:

   a. Nunes, Isabel L. (2009) Método de Análise Ergonómica de Postos de Trabalho (Workstation Ergonomic Analysis Method). National patent n. 103446

   b. José Manuel Fonseca, André Damas Mora, Carlos Figueira and Carlos Gameiro (2008). Armazém Seguro de Cartões de Identificação Personalizados" (Safe Personalized Identification Card Warehouse). Accepted 10th July 2008.

Summary Tables

The next two figures (Figure 1 and 2) and table 1 represent the production of the C3-decision group considering the same parameters as the other groups of CTS. As can be observed in Figure 2 and table 1, the total amount of publications more than doubled in this period. Moreover, we are proud about the effort to publish in A/A+ journals paid off and we passed from 3 to 19 (with the post-docs contributing with 12)! Also an effort of submitting papers to A/A+ conferences paid off and we have 16 more in this period. Another impressive fact is the increase in training since we passed from 4 Msc thesis to 25!

Figure 1 presents the ratios regarding the number of papers in conferences and journals divided by the number of PhDs in the group, as well as the number of PhD and Msc thesis of the research group and includes papers accepted in 2010 but not yet published, according to Table 1 . Table 1 depicts the comparison of the previous period (2004-06) with this period (2007-2010) and the figures reflect these numbers.

	Global data		Global data by PhDs	
	2003-2006	**2007-2010**	**2003-2006**	**2007-2010**
Journals	8	30	1,6	7,1
Journals A/A+	3	19	0,6	4,5
Conferences	46	63	9,2	15,0
Conferences A/A+	12	28	2,4	6,7
MSc Theses	4	25	0,8	6,0
PhD Students	3	5	0,6	1,2
PhD Theses	1	2	0,2	0,5
Teams PhD	*5*	*4,2*		

Global data
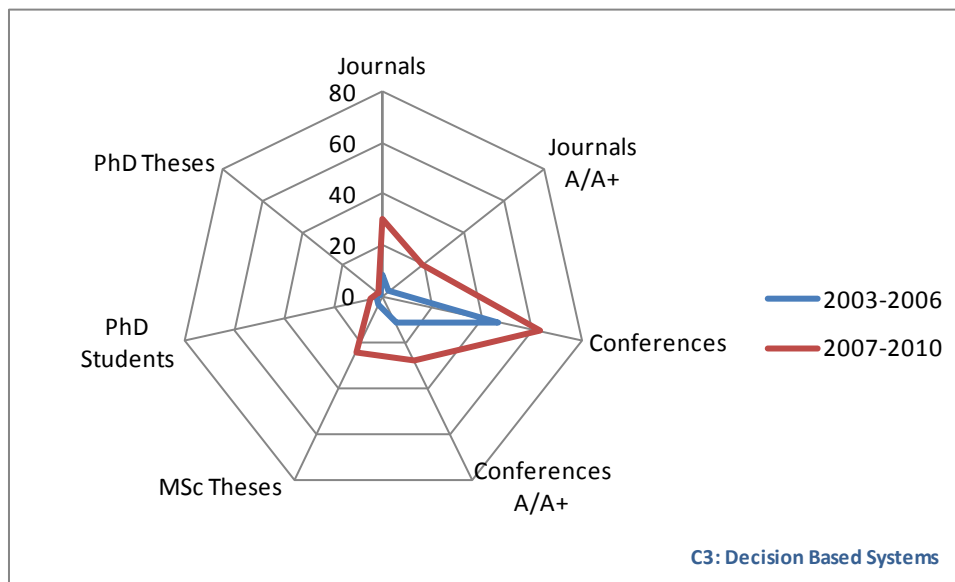
C3: Decision Based Systems

Now, if we look at the global production in terms of publications these also include publications in book chapters and also other conference papers published in proceedings. Table 2 provides the complete publication record for the CA3- decision group.

TABLE 2: *Total publication record production of CA3 conferences*

	2003/06	2007/10
Journals	8	32
Journals A/A+	3	19
Conferences A/A+	12	28
Book Chapters	13	12
Conferences B/C	28	35
	0	0
TOTAL publications	*64*	*126*
Total per PhD	*12.8*	*30*

Observing Table 2, it is impressive to note that we passed from an average of 12.8 to 30 publications per PhD (almost 2.5 times!), which means an average of around 7 publications per year for each researcher of this group. Furthermore, we now have more than 1 paper in A/A+ journals per each PhD (4.5/4years) , an impressive achievement when compared with the previous period.

In summary the most relevant publications in A and B journals are:

	Publications in A and B ranked Journals	2003-06	2007-10
A+	Astronomy and Astrophysics		5
A+	The Astrophysical Journal		2
A+	Monthly Notices of the Royal Astronomical Society		1
A+	Physical Review		1
A+	The Astrophysical Journal Supplement Series		1
A	Journal of Instrumentation		1
B	Int. Journal on Knowledge Engineering and Soft Data Paradigms		1
A	International Journal of Biomedical Imaging		1
A	International Journal of Uncertainty, Fuzziness and knowledge-based Systems		1
B	A Journal of Prevention, Assessment, & Rehabilitation		1
A	Cellulose		1
B	Autosoft- Intelligent Automation and Soft Computing		2
A	Human Factors and Ergonomics in Manufacturing		1
	Total		19
	Total others		13

Introduction

This group followed the advice of previous evaluation panels regarding dispersion of topics and it is now focused on user-centred systems to support and suggest solutions for decision-making tasks. Its main research topics are three-folded: knowledge-based systems, visualization and image processing systems and ergonomics. In addition since our main application area is in the Space domain we created a fourth sub-topic on Astrophysics.

During this period we improved our fundamental and applied research in the mentioned areas, developing novel solutions and algorithms within the computational intelligence topic. Particularly, we concentrated our research in developing decision support systems and not automation systems. Moreover we increased considerably our publication level in international journals passing from average of 2 publications per PhD /yearly to 5 publications per year/PhD. We also continued to succeed in establishing our group has a recognized CI specialist in the Space sector (6 projects awarded by the European Space Agency (ESA)), besides other international and national projects approved.

Research

The research of our group focuses on developing concepts, models, algorithms and techniques, within our areas of interest, and obviously there are synergies from overlaps on the type of systems developed:

Knowledge-based systems
- Decision support systems
- Fuzzy decision making
- Reinforcement operators for decision making
- Evolutionary optimization
- Inference systems
- Intelligent Fault detection and monitoring systems
- Social networks
- Knowledge discovery/clustering
- Survival prognostic for breast cancer patients

Visualization/Image processing
- Retinal Image Analysis
- Vehicle Detection
- Image Segmentation
- Optical Character Recognition
- Image Registration
- Ship Monitoring
- PET scan image processing
- Visualization of large data sets.

Ergonomics
- Development of methodologies/tools dedicated to ergonomic evaluation of workplaces and risk factors for work accidents.
- Development of models concerning lean manufacturing and ergonomics/ safety.
- Study of joint influences of route familiarity and navigation system reliability on driving performance, performed on a driving simulator.
- Development of a Fuzzy Decision Support System to model the uncertainty associated with disturbances occurrences and its effects on the Supply Chain.

Astrophysics
- Development of optical and near-infrared instrumentation.
- Characterization of properties of cool dwarfs, debris disks and search for extrasolar planets.
- Study of the dynamics and stellar population in galaxy clusters and fossil groups.
- Study of Solar activity and Space Weather regarding its influence on aircraft and Earth.

Research Area characterization:

Knowledge-based systems
Within this topic we continue to develop models, algorithms and software systems that lead to several publications in prestigious journals and conferences. In the Space domain, solid evidence of our expertise and technological achievements within this topic relate with 6

contracts awarded by ESA to continue the research on dynamic decision support systems, space weather information systems and knowledge discovery for large data sets. We highlight that a novel approach for hazard avoidance landing site selection in planets was successfully incorporated in the simulator of ASTRIUM EADS Space and Transportation, and recently it was selected to be included in the Lunar Lander mission phase B1 (ESA).

Visualization systems
Within this field we performed research in data exploration and analysis to enable visualization and exploration of large data sets. We also developed other image processing related activities, particularly applied to the medical sector. This research resulted in an significant publication record with 3 journal papers and 5 conference papers just in the year 2009.

Ergonomics
In the area of ergonomics we continue our research on improving ergonomic tools for Work-Related Musculoskeletal Disorders Prevention (denoted Fast Ergo_X) and also quality assessment methods for safety in the construction industry (a PhD is on-going on this latter subject). Also research on the relation between Lean Production Systems and Ergonomics is on-going (one PhD student) as well as research on a driving simulator (Isabel L. Nunes was on a sabbatical leave at Old Dominium University, Virginia, USA).

Astrophysics
In this area we continue research in the areas of interest: Solar activity, characterization of cool dwarfs (using high-resolution near-infrared spectra and infrared photometry), extrasolar planets (RoPACS), debris disks, development of instrumentation (simulations and conceptual optical design of NAHUAL and preliminary optical design and simulations of PHASES, participation in CARMENES) and galaxy evolution (FOGO, Coma cluster). The results of this research have been published in prestigious peer-reviewed journals and leading international conferences.
Significant efforts are dedicated to the training of students as a way to reinforce national and international collaboration, which requires synergies between astrophysics and engineers of different areas (software, optics, electronics, mechanics).

Ongoing research themes:

5- *Learning algorithms for identification of Space Weather variables (1 PhD and 1 Master ongoing)*

- Automatic machine learning algorithms to identify climate variables with Solar influence: In Space Weather, solar flares and CME have a huge impact on human activities like the polar routes, communication and electrical power, among the others. To be able to predict these events, in advance, is the challenge of this research. In a preliminary phase we will deal with forecasting in large distributed datasets. As a pre-processing stage a feature selection algorithm for multiple data sources, using Swarm Intelligence and Rough Set Theory will be developed. Moreover, a new classification algorithm to predict new instances in distributed contexts will also be proposed. Both algorithms will deal with Distributed Data Mining challenges as data privacy. Validations, from a theoretical point of view, will be carried out with published datasets like UCI Machine Learning Repository. As future work we will use the results of this preliminary work in the identification of climate variables with Solar influence.
- Automatic and efficient detection of correlated parameters in Space Weather time series: Time series are present in many areas of our daily lives - areas as diverse as astronomy, geophysics, economics, medicine, among others. Information technologies currently have the ability to generate large amounts of data, in part represented as

time-series. Analyzing the huge amount of generated data is a task that is exceeding human capabilities. Studies have shown that in 2005, the amount of information generated in the world was in the order of 150 exabytes. For 2010 it has been estimated to be 1200 exabytes. To extract information, and therefore generate knowledge from this vast amount of data, it is necessary to use techniques to automate the analysis of these data efficiently. This research aims to contribute specifically to the analysis of non categorical time-series from Space weather (i.e., real numeric values), with a set of tools that aid in the detection of correlations among multiple time series, and the detection of frequencies associated to them. Variants of known correlation methods were also developed for specific types of parameters, achieving very positive results.

6- Dynamic multi-criteria decision making (DMCDM) (ongoing work and 1 PhD started)

- Dynamic multi-criteria decision making: Decision making many times involve dynamic, evolving, interactive and adaptive processes with multiple criteria and in changeable spaces. This research focus on defining a general dynamic mathematical model capable of dealing with problem where both sets of alternatives and criteria can change (be delete, or added) and also "adapt" by using past information (feedback from previous interactions)

- Reinforcement operators for DMCDM. Reinforcement operators for MCDM problems are being investigated to assess their flexibility and adaptability in dynamic decision making processes, particularly in the Space related problems (selection of best landing site for spacecraft). Several publications have been produced within this topic and we also have been investigating new operators for weighting criteria based on the satisfaction of criteria.

- Evolutionary search algorithms. Memetic algorithms (e.g. particle swarm optimization) are being investigated to assess their applicability to improve the efficiency of dynamic decision processes/ dynamic optimization processes, as well as to assess their flexibility for performing knowledge discovery in the Space domain.

7- Intelligent Fault detection and monitoring (ongoing work, 2 master thesis finished and 1 PhD started)

- Intelligent Fault detection: A major indicator of the suitability of fuzzy logic for monitoring and fault detection problems is the way in which the parameters of the problem are defined since it is capable of capturing highly non-linear systems and models. In this scenario, the major obstacle is how to automatically "learn" from past behaviours to allow the automatic construction of linguistic variables and then how to optimize the set of rules produced by building a complete search space (combination of all variables). Moreover, the reasoning scheme used should take into account the level of efficiency and autonomy desired by the decision maker. The goal is to define an automatic process to build fault detection systems that are based on historic behaviours detected by sensors.

- Approximate reasoning schemes. A novel inference scheme based on the Choquet integral has been devised and its efficiency was tested in a Space application with success. We plan to improve this work by combining this work with the intelligent fault detection research and then test it in other applications to access the generality of this

approach in any monitoring problem based on sensors data.

8- *Medical Image Processing (1 PhD finished)*

Ophthalmologic image analysis - Drusen are common features in the ageing macula and are associated with exudative Age-Related Macular Degeneration. They are visible in retinal images and their quantitative analysis is important in the follow up of this Disease. However, their evaluation is fastidious and difficult to reproduce when performed manually. The automatic quantification of drusen using digital image processing techniques will help clinicians to study this disease progression. The research was to develop new image processing algorithms that could automate this process. The methodology developed includes image pre-processing to correct the uneven illumination and normalize the intensity contrast, and a detection and modeling algorithm to quantify drusen. A clinical validation of the tool is ongoing.

9- *Ergonomic and Safety at Work (2 PhD ongoing and 1 Master finished)*

- Lean Management and Ergonomics: The successful introduction of new production paradigms, such as lean manufacturing, depends among others on a human factors oriented approach. Changes on the working conditions (e.g., reduction of work cycle times and task variety) may lead to increased job demands and low job control situations. High strain jobs present high risks for musculoskeletal disorders and psychological load, and lead to company losses. Research on decision support tools, namely, ergonomic risk assessment methods and computer-based simulation can have a major contribution for the design of lean manufacturing systems, allowing the application and integration of ergonomic and safety design principles

- Safety in Construction Industry: Because of the hazardous nature of construction work, occupational safety is a serious problem in the construction industry. When making safety assessments for construction sites, there is often inadequate data or imprecise information available because of the nature of construction work. On-site inspections generally use linguistic expressions rather than metrics to assess the risks of workers at a construction site. Additionally legal records, statistical data and documentation produced by companies are generally insufficient for determining risk. This fact increases the uncertainty of the job site atmosphere. Research on methods for assessment of the risks that workers are exposed to at construction sites using a fuzzy sets theory to deal with uncertain and insufficient data is on-going.

- Aging at Work (1 Master finished): Aging is associated with progressive decreases in aerobic power, thermoregulation, reaction speed and acuity of the special senses. These changes can reduce productivity, particularly in self-paced activities where the physical or mental input of the individual worker is the rate-limiting step in production. Many potential problems can be corrected by worksite modification, employee wellness programmes and retraining. Given these facts a study on a Portuguese company was performed.

10- *Astrophysics (3 Msc and 1 PhD thesis on-going)*

- **Simulations and Image Processing for the PHASES Explorer Spectrometer: tracking detector** *(1 Msc student):* simulations of images as seen by the "tracking" detector and the problem of achieving a high pointing stability for PHASES. Development of techniques to generate those images and extract the relevant information that must be sent to the Attitude Control System of the satellite to perform pointing corrections.

- **<u>The design of the opto-mechanical support structures for the PHASES instrument for use in low earth orbit</u>** **(1 PhD on-going, transfer from Msc to PhD to be done in February 2011)***:* Work is being developed on the mechanical design of PHASES. The work involves the design of the mountings and the selection of the appropriate materials required to locate and support the three aspheric mirrors, the CCD and the chassis to house the instruments. Three different design concepts based on single and multicomponent materials (with detailed analysis of their thermal expansion coefficients) have been generated. Mechanical modeling and finite element analysis has been carried out on all three conceptual designs.

- <u>Study of stellar variability and transit systems from space-borne ultraprecise observations and Transit spectrophotometry of exoplanets from space</u>. These studies started in late 2010 as support of PHASES project.

Projects

Ongoing projects on 2007 and thereafter

1. SIMORG - Swarm Intelligence Modelling Of Root Growth - 2009/ 2010.
Funding: ESA
Participants*:* FFCUL
Development of a root growth simulator with evolutionary algorithms, modelled from a swarm intelligence perspective, where root apexes are autonomous agents sensing and acting on their local conditions. The viability of applying the developed (and evolved) algorithms on Collective Robotics for Scouting tasks is explored.
Global Budget : 27,9 K€
    CTS Budget: 20,5K€

2. GAIA – Portuguese participation on the DPAC GAIA mission - 2007/ 2010.
Funding: FCT (PT)
Participants: Uninova, CAAUL, CAUP, GAUC, INETI
The Gaia mission objective is to create the largest and most precise 3D chart of our galaxy for about one billion stars. The objective of the DPAC (Data Processing Consortium) is to prepare the data analysis mechanisms for future telemetry from Gaia. Specifically UNINOVA-CA3 will participate on providing expertise for knowledge discovery (non-supervised algorithms) for variable objects and implementation of bias estimation algorithms.
    Global Budget: 264 K €
    CTS Budget: 44,2 k€

3. SEISOP - Space Environment Information System OPerational - 2008/ 2010.
Funding: ESA
Participants: DEimos Space (SP), Deimos eng (PT), INTA, (SP VEGA (D), Holos (PT), UNINOVA (PT)
Operational tool that integrates 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.
    Global Budget : 400 K€
    CTS Budget: 80 k€

4. IPSIS – Intelligent Planetary Site Selection - 2008/ 2009.
Funding: ESA
Participants *:* Astrium Space Transportation
Development and implementation of an autonomous, dynamic and adaptable multi-criteria model to choose the best landing site for a spacecraft. The solution implemented must obey critical constraints of descent time and computer power on-board spacecrafts, which led to the use of evolutionary algorithms for optimizing the process.
    Global Budget : 150 K€
    CTS Budget: 80 k €

5. IMPACTED – Intelligent Mathematical Processing for Autonomous & Consistent Trajectory Elaboration & Decision - 2008.
Funding: Astrium Space Transportation
Participants*:* UNINOVA
Development of an autonomous, dynamic and adaptable fuzzy multi-criteria model to choose the best candidate landing site for a spacecraft.
    Global Budget : 33 K€
    CTS Budget: 33 k€

6. MODI-CCN – Simulation of Knowledge Enabled Monitoring and Diagnosis Tool for Mars Lander Payloads – 2007-2008.

Funding: ESA

Participants: UNINOVA

Prototype for intelligent monitoring of the drill device for the ExoMars mission Rover also capable of detecting Mars terrain hardness.

Global Budget : 100 K€

Uninova Budget: 100 k€

7. TC WE 2009-05. WE-09-05: Summary, discussion and conclusions of reports in the road transport sector – 2009

Funding: European Agency for Safety and Health at Work.

Description: a) WE-09-05b: Summary, discussion and conclusions of cases to prevent risks to drivers of road haulage vehicles. B) WE-09-05c: Summary, discussion and conclusions of cases to prevent risks to drivers of passenger transport vehicles

8. TC WE 2008. OSHA/WE/2008/TCWE-01 – 2008

Funding: European Agency for Safety and Health at Work

Description: Usability of the Agency's website for those looking for good practice (Task number 4.3.1)

CTS Budget: €

9. European Project IP-2007–01- European Week 2008 - Assessing OSH Risk assessment - 2007

Funding: European Agency for Safety and Health at Work

Description: a) Case study: Teaching OSH risk assessment in tertiary education. B) Improving access to web information c) Article: Checklist for the prevention of manual handling risks

10. Usabilidade - Avaliação das Interfaces do Sistema SINGRAR, Projecto com Escola Naval (Mar – Nov 2008)

Funding: Escola Naval

12. Gestão lean, ágil, resiliente e verde da Cadeia de Abastecimento (Lean, Agile, Resilient & Green Supply Chain Management - LARGeSCM), Projecto nº MIT-Pt/EDAM-IASC/0033/2008 - Improved Automotive Supply Chain (Jun 2009 - Mai 2012)

Funding: Fundação para a Ciência e Tecnologia, programa MIT

Participants UNIDEMI (Coordenador Professor Cruz Machado, Secção Gestão Industrial/DEMI da FCT/UNL)

13. Gestão da cadeia de abastecimento: concepção de sistemas resilientes, Projecto nº PTDC/EME-GIN/68400/2006 (Jun 2007 - Nov 2010)

Funding: Fundação para a Ciência e Tecnologia

Participants: UNIDEMI (FCT/UNL)

CTS Budget: 2400 €

14. Network of Excellence "BIOPATTERN - Computational Intelligence for BioPattern Analysis to Support eHealth" FP6-2004-IST-2-508803 Sixth Framework Programme. (2004 – 2008).

Funding: EU

Participants: 31 European partners

Global Budget : 6.4M€
CTS Budget: 320 k€

15. Detecção automática de Drusas em imagens de retinografia, POCTI/SAU-ESP/57592/2004. (2005 – 2009)

Funding: FCT
Participants: Fundação FCT/UNL, Faculdade de Ciências Médicas da UNL
Global Budget : 63 k€
CTS Budget: 38 k€

16. SINAIS – Sistema de apoio à navegação baseado em sinais AIS (2008-2010)

Funding: TRANSTEJO/SOFTLUSA Group
Participants: TRANSTEJO and SOFTLUSA
Global Budget : 10 k€
CTS Budget: 10 k€

17. ARINCA - Armazém Seguro de Cartões de Identificação Personalizados (2007-2010)

Funding: Gabinete Nacional de Segurança
Participants: Gabinete Nacional de Segurança
Global Budget : 30 k€
CTS Budget: 30 k€

18.   Detección de exoplanetas telúricos con espectrógrafos de muy alta resolución espectral en telescopios de gran diámetro (AYA2007-67458) (2007-2010)

Description: Detection of telluric planets using high-resolution spectrographs attached to big telescopes.
Funding: Ministerio de Educación y Ciencia
Participants: Instituto de Astrofísica de Canarias (IAC), en colaboración con
 Universidad Complutense de Madrid, Universidad de La Laguna, Instituto de Astrofísica de Andalucia (España), DIAS, DIT, NUI-Maynooth (Irlanda), Theringer Landssternwarte Tautenburg (Alemania), Osservatorio Astrofisico de Arcetri – INAF (Italia), Laboratório de Sistemas, Instrumentação e Modelaçao (SIM) (Portugal).
Total funding: 535 kEUR
Number of participants: 23
CTS Budget: travel expenses for 1 post-doc

19. Marie Curie ITN FP7 Network RoPACS: Rocky Planets around Cool Stars (2008-2012)

Funding entity: European Union
Nodes: University of Hertfordshire (UK) (coordinator node), Institute of Astronomy (UK), Instituto de Astrofísica de Canarias (Spain), Max-Planck fuer Extraterrestriche Physik (Germany), Laboratory of Stellar Astronomy and Exoplanets (Spain) and Main Astronomical Observatory (Ukraine), EADS Astrium
Total funding: 3,2 M EUR
Number of participants: 67
CTS Budget: travel expenses for 1 post-doc

20. Contrato para la realización de una alternativa de Diseño Conceptual de un Espectrógrafo de Dispersión Intermedia en el Infrarrojo cercano para el Gran Telescopio de Canarias: NAHUAL conceptual Design Review (Jan 2010 Dec 2010)

Funding entity: GRANTECAN
Participants: Centro de Astrobiología (CAB, Spain) (coordinator node), UNINOVA, Thueringer Landssterwarte Tautenburg (Germany), Osservatorio Astrofísico de Arcetri – INAF (Italy), Laboratório de Sistemas, Instrumentação e Modelaçao (SIM) (Portugal), among others.
Total funding: 100k EUR
Number of participants: 12
CTS Budget: 8,2 k EUR

Recognition

Editorial Boards and Guest Editor

- Rita Ribeiro is Member of the International Editorial Review Board of the International Journal of Decision Support System Technology (IJDSST) since 2009.
- Rita Ribeiro is Co-editor of the special issue of Autosoft- Intelligent Automation and Soft Computing International Journal on "Soft Computing in Space Autonomy", editors: R. A. Ribeiro and E. Tunstel Vol 14, No 3 (2008).
- Isabel L. Nunes: Member of the Editorial Board of The Open Ergonomics Journal (Bentham Science Journals) since 2007
- Isabel L. Nunes: Member of the Editorial Board of The Technology Interface Journal
- José Manuel Fonseca: Member of the Editorial Board of the International Journal Source Code in Biology and Medicine (SCBM) published by BioMed Central, since March 2006

Invited lectures

- Rita Ribeiro. Invited talk on "Soft Computing in Space Applications" presented at the Workshop on "Soft Computing: Where Theory Meets Applications", held in Trojanovice, Czech Republic, December 13-16, 2009.
- R. A. Ribeiro, T. C. Pais. "Reinforcement Operators in Spacecraft Landing". In: proceedings of the 5th workshop on Preferences and Decisions, Trento, Italy 6-8 April, 2009. URL: http://events.unitn.it/en/trento2009/proceedings
- Rita Ribeiro. "Data availability and integrity for European Space Agency spacecraft – examples from monitoring projects", Invited talk at INFOSEK-conference on data security. Nova Gorica, Slovenia, November, 2007.
- Rita Ribeiro. "Fuzzy Space Monitoring Applications" Seminar at the University of South Florida (USF), Tampa, USA, February, 2007.
- José Manuel Fonseca. Research & Development: from theory to the practice. 2nd Young Research Forum (YRF 2010), integrated on the 7th Ibero-American Congress on Sensors, November 9th-11th 2010, Lisbon, Portugal
- José Manuel Fonseca. Ferramentas informáticas para registar a intervenção farmacêutica. I Jornadas Atlânticas (Norte de Portugal-Galiza) de Cuidados Farmacêuticos organized by Secção Regional do Porto da Ordem dos Farmacêuticos, Alfândega do Porto, 23-24 April 2010
- José Manuel Fonseca. Green IT no Campus da Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa. Conference "Green Business" organized by IDC Portugal, Centro Cultural de Belém, 14th April 2010
- José Manuel Fonseca. Processamento e Síntese de Imagem. JORTEC 2008 - Jornadas Tecnológicas da Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, 5th May 2008
- José Manuel Fonseca. Actividade na área da Engenharia Biomédica. Conference BioEng2006, Reitoria da Universidade Nova de Lisboa, Lisboa, 9th June 2006
- José Manuel Fonseca. Despiste Automático de Exsudados Moles. "1as Jornada de Anatomia", Faculdade de Ciências Médicas da UNL, Lisboa, Portugal, 17th May 2006
- Isabel L. Nunes. Trust and Usability, Invited talk on Human Factors Panel IIE Conference Jun 6-9 Canxun-México (2010)

- Isabel L. Nunes. FAST ERGO_X - uma ferramenta para a prevenção das LMERT, Invited talk on Conferência sobre "Lesões músculo-esqueléticas relacionadas com o trabalho (LMERT)", Centro de Congressos Olga Cadaval, Sintra-Portugal, 15-16 Out (2007)
- Isabel L. Nunes. Etiologia multifactorial das lesões músculo-esqueléticas relacionadas com o trabalho, Invited talk on Seminário sobre "Lesões músculo-esqueléticas ligadas ao trabalho", Lisboa-Portugal, 13 Set (2007)
- Isabel L. Nunes. Ergonomics & Usability - key factors in knowledge society, Invited talk on Conference on "Foresight Studies on Work in the Knowledge Society", Caparica-Portugal, 19-20 Out (2006)

Scientific / Technical organizations

- Rita Ribeiro. Evaluator: 7th framework (EU) on Security
- Rita Ribeiro. Vice-chairman of the EWG-DSS (Euro Working Group on Decision Support Systems)
- Rita Ribeiro. Member of the ECSA (European Centre for Space Applications)
- Rita Ribeiro. Member of the APDIO (National association of Operational Research)
- Rita Ribeiro representative from Uninova as Member of CIM (National Centre of Mathematical Research)
- Isabel L. Nunes. Evaluator: SESAR Joint Undertaking (EU) since 2010
- Isabel L. Nunes. Evaluator: Agência da Inovação, since 2006
- Isabel L. Nunes. Evaluator: IAPMEI - no âmbito do QREN, since 2008
- C. del Burgo has been co-PI and Project Scientist of the high-resolution near-infrared spectrograph NAHUAL.
- C. del Burgo is PI of the project PHASES, aimed at developing a space-borne ultra-precise spectrophotometer.

Collaboration

The Research Group has enlarged collaboration with other organizations at national and international level, for instance, joint publications in international conferences and journals, member of consortia of international and national projects, joint preparation of special issues in journals and organization of conferences and workshops, joint research projects, etc.

<u>Internationally:</u>

6. Official supplier of EADS- Astrium Space Transportation (Fr);

7. Collaboration in joint publications and projects with:
    a. Univ. Lancaster (UK), TU Delft (NL),
    b. Geneva Observatory (SW),
    c. Hurbanovo Observatory (SK),
    d. Deimos (SP), INTA (SP),
    e. SAP (D), Siemens (D), Astrium S&T (FR), VEGA (D)
    f. Universidade Federal de Santa Catarina (Br),
    g. University of Hertfordshire (UK),
    h. Instituto de Astrofísica de Canarias (La Laguna, Spain),
    i. Centro de Astrobiología (Madrid, Spain),
    j. Dublin Institute of Technology (Dublin), NUI Maynooth and NUI Galway (Ireland).
    k. University of Wisconsin (USA)
    l. University of Indiana (USA)

8. PhD supervision with Liverpool John Moore University (UK), MSc supervision with Tampere University of Technology (FL).

<u>Nationally:</u>

4. Faculdade de Ciências, Univ. Lisboa (joint papers and workshops organization)
5. Deimos Eng (projects)
6. Ministério da Defesa Nacional
7. Gabinete Nacional de Segurança (project & patent)
8. Grupo TRANSTEJO/SOFTLUSA (project)
9. Hospital de Dona Estefânia (project)
10. NGNS – Ingenious Solutions (project)

Outreach

Scientific, Programme, Advisory Chair on conferences

- Rita Ribeiro. Member of the international program committee: 15th IFIP WG 8.3 International Conference on Decision Support Systems (DSS2010);
- Rita Ribeiro. Member of the international program committee: International Fuzzy Systems Association World Congress & EUSFLAT (IFSA 2009);
- Rita Ribeiro. Member of the international program committee: 15th Operational Research National Congress, 2009 (in Portuguese).
- José Manuel Fonseca. Member of the International Program Committee of The Second IASTED International Conference on Computational Bioscience - CompBio 2011 - July 11 – 13, 2011, Cambridge, United Kingdom
- José Manuel Fonseca. Member of the International Program Committee of The IASTED International Conference on Imaging and Signal Processing in Healthcare and Technology - ISPHT 2011 - May 16–18 2011, Washington DC, USA
- José Manuel Fonseca. Member of the Program Commission of the International Conference DOCEIS 2011, 2nd Doctoral Conference on Computing, Electrical and Industrial Systems, to be held 21-23 February 2011, Costa da Caparica, Lisboa, Portugal
- José Manuel Fonseca. Member of the International Program Committee of HEALTHINF 2011, International Conference on Health Informatics , to be held 26-29 January, Roma, Italy
- José Manuel Fonseca. Member of the International Program Committee of IBERSENSOR 2010, 7th Ibero-American Congress on Sensors, to be held 9-10 November 2010, Lisboa, Portugal
- José Manuel Fonseca. Member of the International Program Committee of HEALTHINF 2010, International Conference on Health Informatics, 20- 23 January, Valencia, Spain
- José Manuel Fonseca. Member of Program Commission of DOCEIS 2010, Doctoral Conference on Computing, Electrical and Industrial Systems, 22-24 February 2010, Costa da Caparica, Portugal
- José Manuel Fonseca. Member of the International Program Committee of BIOMED 2010, Seventh IASTED International Conference on Biomedical Engineering, 17-18 February 2010, Innsbruck, Austria
- José Manuel Fonseca. Member of the International Program Committee of HEALTHINF 2009, International Conference on Health Informatics, 14-17 January, Porto, Portugal
- José Manuel Fonseca. Member of the Scientific Commission of JETC'08 - Quartas Jornadas de Engenharia de Electrónica e Telecomunicações e de Computadores, 20-21 November 2008
- José Manuel Fonseca. Member of the International Program Committee of HEALTHINF 2008, International Conference on Health Informatics, Funchal, Portugal, 28-31 January 2008
- José Manuel Fonseca. Member of the International Program Committee of BIOMED2008, IASTED International Conference on Biomedical Engineering, Innsbruck, Austria, 13-15 February 2008
- José Manuel Fonseca. Member of the International Steering Committee of CIMED2007 - Third International Conference on Computational Intelligence in Medicine and Healthcare, Sherwell Centre, University of Plymouth, Plymouth, UK, 25-27 July 2007
- José Manuel Fonseca. Member of the International Program Committee of BIOMED2006 - IASTED International Conference on Biomedical Engineering, Innsbruck, Áustria, 15-17 February 2006
- José Manuel Fonseca. Member of the International Program Committee of MEDASP - 2nd European Online Workshop on Medical Data Acquisition Standards and Protocols , 5 December 2005 to 5 January 2006, University of Plymouth, UK
- Isabel L. Nunes. Member of the International Program Committee: International Symposium on Innovations in Natural Computing (INC 09) (http://inc09.cusat.ac.in/committees.html), Cochin - India, 12-13 Dez 2009
- Isabel L. Nunes. Member of the International Program Committee: The World Congress on Nature and Biologically Inspired Computing (NaBIC 2009) (http://www.mirlabs.org/nabic09/), Coimbatore - India, 9-11 Dez 2009

- Isabel L. Nunes. Member of the International Programme Committee: International Conference on Soft Computing and Pattern Recognition (SoCPaR 2009) (http://www.socpar.org/), Malacca- Malásia, 4-7 Dez 2009
- Isabel L. Nunes.Member of the International Program Committee: International ACM conference on *Management of Emergent Digital EcoSystems* (MEDES'09), (http://sigappfr.acm.org/MEDES/09/index.php) hosted by the "Institut National des Sciences Appliquées de Lyon (INSA-Lyon)", Lyon - França 27-30 Out 2009
- Isabel L. Nunes. Member of the Program Committee: The Ninth International Conference on Hybrid Intelligent Systems (HIS 09) (http://bit.kuas.edu.tw/~his09/), Shenyang, LiaoNing- China, 12-14 Agost 2009
- Isabel L. Nunes. Member of the Comissão Científica: 2ª Conferência *Lean Management*, (http://www.leanmanagement2009.com/), Lisboa-Portugal, 4-5 Mai 2009
- Isabel L. Nunes. Member of the Comissão Científica Nacional: Colóquio Internacional de Segurança e Higiene Ocupacionais (SHO 09) (http://sho2009.no.sapo.pt), Escola de Engenharia da Universidade do Minho, Guimarães-Portugal 5 - 6 Fev 2009
- Isabel L. Nunes. Member of the International Program Committee: The 8th International Conference on Intelligent Systems Design and Applications (ISDA 08) (http://bit.kuas.edu.tw/~isda08/), National Kaohsiung, University of Applied Sciences, Kaohsiung- Tailândia, 26-28 Nov 2008
- Isabel L. Nunes. Member of the International Programme Committe da ACM/IEEE Fifth International Conference on Soft Computing as Transdisciplinary Science and Technology (IEEE/ACM CSTST'08) (http://sigappfr.acm.org/cstst08/), Cergy Pointoise-Paris, 27- 31 Out 2008
- Isabel L. Nunes. Member of the Comissão Científica: 1ª Conferência *Lean Management*, (http://www.ipei.pt/index.php?option=content&task=view&id=56), Lisboa-Portugal, 12-13 Mai 2008
- Isabel L. Nunes. Membro da Comissão Científica Nacional: Colóquio Internacional de Segurança e Higiene Ocupacionais (SHO 08) (http://sho2008.no.sapo.pt/), Escola de Engenharia da Universidade do Minho, Guimarães - Portugal, 7-8 Fev 2008
- Isabel L. Nunes. Member of the Comissão Científica da Conferência Engenharias' 07, Inovação e Desenvolvimento, Universidade da Beira Interior, (http://www.confeng.ubi.pt), 21 - 23 Nov 2007
- Isabel L. Nunes. Member of the "International Program Committee" da 7th International Conference on Intelligent Systems Design and Applications (ISDA'07), Rio de Janeiro, Brasil, 22- 24 Oct 2007
- Isabel L. Nunes. Member of the Comissão Organizadora da 4ª Conferência sobre "Factores Humanos e Produtividade: Novos Desafios na Engenharia Industrial", FCT/UNL, 12 Jan 2007
- Isabel L. Nunes. Chair in Lean Enterprise and Ergonomics – IIE Jun 2010
- Carlos Del Burgo. Local Organizing Committee at Conference: "IBERSENSOR 2010", 7th IBERO-AMERICAN CONGRESS ON SENSORS, Lisbon, Portugal. Activity: Date: 9-11 November 2010

Other organizing activities

- Rita Ribeiro. Organization of special session on "Advances in Soft Computing for Spatiotemporal Information Systems", IFSA 2009 World Congress & EUSFLAT 2009.
- José Manuel Fonseca. Member of the Organizing Committee of IBERSENSOR 2010, 7th Ibero-American Congress on Sensors, 9-10 November 2010, Instituto Superior de Engenharia de Lisboa, Lisboa, Portugal
- Isabel L. Nunes. Chair in one session of the 2ª Conferência *Lean Management*, Lisboa-Portugal, 4-5 Mai 2009
- Isabel L. Nunes. Chair in the Higiene e Segurança no Trabalho session, na 4ª Conferência sobre Factores Humanos e Produtividade: Novos Desafios na Engenharia Industrial – Sector dos Serviços. FCT/UNL, 12 Jan 2007
- Isabel L. Nunes. Chair and organizer of the *Fuzzy Logic* session, na Conferência SCRA 2006-FIM

XIII-Thirteenth International Conference of the Forum for Interdisciplinary Mathematical and Statistical Techniques, Tomar-Portugal, 1-4 Set 2006

Referee of Books, Journals and Conference Articles

Reviewer/Referee for books and articles in international journals:

- Rita A. Ribeiro: IEEE Transactions on Systems, Man, and Cybernetics (IEEE-MSC); International Journal of Information Sciences (IJIS); International Journal of Fuzzy Sets and Systems (FSS); Int. Journal of Uncertainty, Fuzziness and Knowledge-Based Systems (IJUKBS); European Journal of Operations Research (EJOR); Journal of Intelligent & Fuzzy Systems (JIFS); Decision Support Systems (DSS); International Journal of Decision Support System Technology (IJDSST); Journal of Decision Systems (JDS); International Journal on Data and Knowledge Engineering (IJDKE);
- José Manuel Fonseca: International Journal on Information Sciences - Informatics and Computer Science Intelligent Systems Applications, Elsevier. IEEE Transactions on Systems, Man, and Cybernetics Part B since 2006
- Isabel L. Nunes: Journal of Biomedicine and Biotechnology; International Journal of Human Factors Modelling and Simulation; Construction Management and Economics
- Carlos Del Burgo: Astrophysical Journal and Astronomy and Astrophysics

Reviewer/Referee for conferences:

- Rita A. Ribeiro : 2010 IEEE World Congress on Computational intelligence (WCCI2010); 15th IFIP WG 8.3 International Conference on Decision Support Systems (DSS2010); World Congress & EUSFLAT (IFSA 2009); The 8th International FLINS Conference on Computational Intelligence in Decision and Control (FLINS2010); (FLINS2008) (FLINS2006); Workshop on Preference Modeling and Applications (EUROFUSE2008);
- Isabel L. Nunes: 3rd Indian International Conference on Artificial Intelligence (IICAI-07), Pune, India, 17-19 Dez 2007; Fourth International Symposium on Neural Networks (ISNN2007), Nanjing, China. 3-7 Jun., 2007 (http://www2.mae.cuhk.edu.hk/~isnn2007/); 2007 Industrial Engineering Research Conference (IERC), Nashville, Tennessee, EUA, 19-23 Mai 2007

Education & Training

8 PhD Students ongoing (7 enrolled in 2010)

2 PhD Students finished

25 MsC students finished

Training: supervision by Carlos del Burgo of Paul McGillion (International Space University, France) during an internship of 12 weeks at UNINOVA (24/05-13/08 2010), which was part of the requirements of his M.Sc. Degree in Space Studies.

Training. Internship (March 2009- Sept 2009) of Hesam Dashti, supervised by Rita A. Ribeiro. This was part of his PhD work at the University of Wisconsin (USA)

Facilities

Two labs with computational infrastructures and 5 post-graduate offices.

Strategy

1. Continue to develop research supported by R&D international projects, mainly in the Space sector niche to establish the group as reference experts in CI applied to the Space domain.

2. Encourage the technology transfer of the research work with the aim of creating commercial, sellable products. We are already enrolled in specialized sites towards this aim.

3. Continue the effort to attract PhD and MSc candidates to improve the group publication record. A strong effort was already made concerning finished MSc thesis and enrollment of new PhD students;

4. Reinforce national and international cooperation emphasizing interdisciplinary work, primarily with Astrophysics and other Space expert companies;

5. Encourage all staff and Ph.D. students to disseminate their research results priory in journals with major 5-Years impact factors and in leading international conferences (accordingly to the DEE Publishing Reference List);

Production

International Book Chapters

_NOTE__: **Not included** here are articles and addresses presented at conferences, published only in the conference's proceedings/minutes, even when these are published in book form (with ISBN)._

Total 2007-2010: 8

1. R. A. Ribeiro, T. C. Pais, L. F. Simões. Benefits of full-reinforcement operators for spacecraft target landing. In: "Preferences and Decisions", S. Greco, R. A. M. Pereira, M. Squillante, R. R. Yager, J. Kacprzyk (Eds.) Studies in Fuzziness and Soft Computing, Volume 257, Springer-Verlag (2010) : 353-367

2. T. C. Pais, R. A. Ribeiro, L. F. Simões. Uncertainty in dynamically changing input data. In: Computational Intelligence in Complex Decision Systems. DaRuan (Ed), Atlantis Computational Intelligent Systems-Vol 2, Chapter 2, World Scientific (2010). ISBN: 978-90-78677-27-7.

3. Fernandes A.S., Bacciù D., Etchells T.A., Jarman I.H., Fonseca J.M., Lisboa P.J.G. Different methodologies for patient stratification using survival data. "Computational Intelligence Methods for Bioinformatics and Biostatistics". Francesco Masulli,Leif E. Peterson and Roberto Tagliaferri (Eds.). Lecture Notes in Bioinformatics 6160, pp. 276-290. Springer-Verlag Berlin Heidelberg 2010

4. Etchells, T.A., Fernandes, A.S., Jarman, I.H., Fonseca, J.M., Lisboa, P.J.G. Stratification of severity of illness indices and out-of-sample validation: a case study for breast cancer prognosis. "Investigating Human Cancer with Computational Intelligence Techniques". Alfredo Vellido and Paulo J.G. Lisboa (Eds.). KES Rapid Research Results Series, 2009. ISBN 978-0-9561516-0-5

5. S. H. Alavi, J. Jassbi, P. Serra, Rita Ribeiro. (2008). Defining fuzzy measures: a comparative study with genetic and gradient descent algorithms. B. Pataki, J. T. Machado, J. Rudas (Eds). Intelligent Engineering Systems and Computational Cybernetics (pp. 427-438). ISBN: 978-1-4020-8678-6. Springer.

6. P. Serra, Rita A. Ribeiro, R. Marques-Pereira, R. Steel, Mark Niezette, A. Donati. (2008). Fuzzy Thermal Alarm System for Venus Express. Frederic Adam, Patrick Humphfreys (Eds). Encyclopedia of Decision Making and Decision Support Technologies (pp. 391-401). ISBN: 978-1-59904-843-7. Information Science Reference.

7. Rita A. Ribeiro, Isabel Nunes. (2008). Interfaces Usability for Monitoring Systems. Frederic Adam, Patrick Humphfreys (Eds). Encyclopedia of Decision Making and Decision Support Technologies (pp. 528-538). ISBN: 978-1-59904-843-7. Information Science Reference.

8. I. S. Brito, F. Vieira, A. Moreira, Rita Ribeiro. (2007). Handling conflicts in aspectual requirements compositions. J. Araujo, E. Baniassad (Eds). Transactions on Aspect-Oriented Software Development III (pp. 144-166). ISBN: 978-3-540-75161-8. Alemanha: Springer Berlin Heidelberg. doi:10.1007/978-3-540-75162-5_6.

National Book Chapters (in Portuguese)
Total 2007-2010: 4

1. Nunes, Isabel L., Ana F. Costa (2009) Envelhecimento e capacidade para o trabalho. Aplicação do Work Ability Index a trabalhadores portugueses, in Riscos Industriais e Emergentes, C. Guedes Soares, C. Jacinto, A.P. Teixeira, P. Antão (Eds), Edições Salamandra, Lisboa (ISBN 9789726892335), Vol 2, pp 1151-1166

2. Pinto, Abel; Ribeiro, Rita A.; Nunes, Isabel L. (2009) Parâmetros qualitativos para a Avaliação dos Riscos na Indústria da Construção, in Riscos Industriais e Emergentes, C. Guedes Soares, C.

Jacinto, A.P. Teixeira, P. Antão (Eds), Edições Salamandra, Lisboa (ISBN 9789726892335), Vol 2, pp 845-860

3. Nunes, Isabel L. (2007) Contributo da Análise e Avaliação de Riscos Ergonómicos para a Saúde e Segurança no Trabalho. O caso do FAST ERGO_X, in Riscos Públicos e Industriais, C. Guedes Soares, A.P. Teixeira, P. Antão (Eds), Edições Salamandra, Lisboa (ISBN 9789726892311), Vol 2, pp. 883-900

4. Nunes, Isabel L., A. F. Costa, A. F. Baptista, M. F. Valério (2007) TPM e a Saúde e Segurança no Trabalho, in Riscos Públicos e Industriais, C. Guedes Soares, A.P. Teixeira, P. Antão (Eds), Edições Salamandra, Lisboa (ISBN 9789726892311), Vol 2, pp. 951-968

Refereed Articles in Journals

NOTE: This section does not include editorial articles and includes papers already accepted in 2010

Total 2007-2010: 30

1. R. Bouaziz, T. Simas, P. Zarate, R. Ribeiro, F. Dargam. A Social-Academic Network Analysis of the EURO Working Group on DSS. International Journal of Decision Support Systems Technology (accepted, forthcoming 2011).

2. A. F. Pinto, I.L. Nunes, R.A. Ribeiro. Risk Assessment in Construction Industry – Overview and Reflection. Safety Science (accepted, forthcoming 2011).

3. R. A. Ribeiro, A.M. Moreira, P. V.D. Broek, A. Pimentel. Hybrid Assessment Method for Software Engineering Decisions. Decision Support Systems (accepted, forthcoming 2011)

4. S. Agostinho, A. M. Moreira, A. Marques, J. Araujo, R. Ferreira, R. Raminhos, R. Ribeiro, I. Brito, P. Chevalley. Aspect-oriented specification: a case study in Space domain. International Journal of Software Engineering and Knowledge Engineering, (accepted forthcoming 2011).

5. Aguerri J. A. L., et al. (including del Burgo C.) 2010, Astronomy and Astrophysics, Fossil Groups Origins: I. RX J105453.3+552102 a very massive and relaxed system (accepted, forthcoming 2011)

6. Peng E., et al. (including del Burgo C.), 2010, ApJ, The HST/ACS Coma Cluster Survey IV. Intergalactic Globular Clusters and the Massive Globular Cluster System at the Core of the Coma Galaxy Cluster (accepted, forthcoming 2011)

7. Hammer D., et al. (including del Burgo C.), ApJS, 191, 143, The HST/ACS Coma Cluster Survey. II. Data Description and Source Catalogs (2010)

8. De Colle F., del Burgo C., Raga A. C. ApJ, 721, 929, Tomographic Reconstruction of the Three-dimensional Structure of the HH30 Jet

9. Liseau R., et al. (including del Burgo C.) Astronomy and Astrophysics Letters, 518, 132, Resolving the cold debris disc around a planet-hosting star. PACS photometric imaging observations of q1 Eridani (HD 10647, HR 506) 2010

10. Eiroa C., et al. (including del Burgo C.) A&A Letters, 518, 131, Cold DUst around NEarby Stars (DUNES). First results. A resolved exo-Kuiper belt around the solar-like star ζ2 Ret 2010

11. Tibbs C. T., et al. (including del Burgo C.) MNRAS, 402, 1969, Very Small Array observations of the anomalous microwave emission in the Perseus region

12. Del Burgo C., Allende Prieto C., Peacocke T. 2010, JInst, 5, 1006, PHASES: a concept for a satellite-borne ultra-precise spectrophotometer 2010

13. Zapatero Osorio M. R., Martín E. L., del Burgo C., Deshpande R., Rodler F., Montgomery M. M., 2009, A&A, 505, 5, Infrared radial velocities of vB 10. DOI: 10.1051/0004-6361/200912869

14. del Burgo C., Martín E. L., Zapatero-Osorio M. R., Hauschildt P., 2009, A&A, 501, 1059, Physical parameters of T dwarfs derived from high-resolution near-infrared spectra. DOI: 10.1051/0004-6361/200810752

15. Aguerri J. A. L., et al. (including del Burgo C.) 2010, A&A, accepted, Fossil Groups Origins: I. RX J105453.3+552102 a very massive and relaxed system at z~0.5

16. Peng E., et al. (including del Burgo C.), 2010, ApJ, accepted, The HST/ACS Coma Cluster Survey IV. Intergalactic Globular Clusters and the Massive Globular Cluster System at the Core of the Coma Galaxy Cluster

17. Ana S. Fernandes, Jose M. Fonseca, Ian H. Jarman, Terence A. Etchells, Paulo J.G. Lisboa, Elia Biganzoli, Chris Bajdik EVALUATION OF MISSING DATA IMPUTATION IN LONGITUDINAL COHORT STUDIES IN BREAST CANCER SURVIVAL Int. Journal on Knowledge Engineering and Soft Data Paradigms, Vol. 1, No. 3, 2009, pp. 257-276

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Total 2007 and following: 60

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2. I. Dorotovic, J. Fernandes, José Fonseca, André Mora, Rita A. Ribeiro. (2007). COSIS: Coimbra Observatory Solar Information System Coimbra. In Proceedings of the Solar Physics Meeting on: The Physics of Chromospheric Plasmas, Coimbra Solar Physics Meeting: The Physics of Chromospheric Plasmas, 9-13 Oct 2006, Coimbra, Portugal. ISBN: 978-1-583812-36-5. Indexed at Web of Science.

3. Michael Figueiredo, Gonçalo Martins, Manuel Barata, Pedro Sousa, Rita A. Ribeiro. (2007). Real time embedded system for control and monitoring a drill process. In Proceedings of the 2nd International Conference on Electrical Engineering, 2nd International Conference on Electrical Engineering (CEE'07), November, Coimbra, Portugal. , pp.557-565.

4. J. Jassbi, S. H. Alavi, P. J. Serra, Rita A. Ribeiro. (2007). Transformation of a Mamdani FIS to first order Sugeno FIS. In Proceedings of the IEEE international conference on Fuzzy systems, 2007, IEEE international conference on Fuzzy systems (FUZZIEEE07), 23-26 Jul 2007, London, Reino Unido. , pp.113-117ISBN: 978-1-4244-1209-9. Indexed at Web of Science. Indexed at IEEE.

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biostatistics", sessão especial: "Intelligent systems for medical decisions support (ISMDS)"; Génova (Italia); 15-17 Outubro 2009

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33. A. Quirrenbach, et al. (including del Burgo C.) CARMENES: Calar Alto high-Resolution for M dwarfs with Exo-earths with a Near-infrared Echelle Spectrograph. Proceedings of "Pathways towards habitable planets" (Barcelona, Spain), published in 2009 in arXiv:0912.0561 See http://arxiv.org/abs/0912.0561 (2009)

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41. Hesam T. Dashti, Adel Ardalan, Alireza F. Siahpirani, Jernej Tonejc, Ioan V. Uilecan, Tiago Simas, Bruno Miranda, Rita Ribeiro, Liya Wang, and Amir H. Assadi. Pattern Recognition in Collective Cognitive Systems: Hybrid Human-Machine Learning (HHML) By Heterogeneous Ensembles WORLDCOMP'10 - The 2010 World Congress in Computer Science, Computer Engineering, and Applied Computing, Las vegas, USA, July (2010)

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45. Ana Sofia Fernandes, Jose Manuel Fonseca, Paulo Lisboa and Elia Biganzoli. Assessment of benefit vs. risk of drug therapy: the potential for outcome analysis with flexible models. 2010 IEEE World Congress on Computational Intelligence, July 18-23, Barcelona, Spain

46. Graça Almeida, Hugo Biscaia, F. Melício, Carlos Chastre, J. Fonseca. Displacement Estimation of a RC Beam Test Based on TSS Algorithm. CISTI'2010, 5ª Conferência Ibérica de Sistemas e Tecnologias de Informação, 16-19 June 2010, Santiago de Compostela, Spain

47. Raúl Cordeiro, José Manuel Fonseca. Euronet lab, a cloud v-lab environment. CISTI'2010, 5ª Conferência Ibérica de Sistemas e Tecnologias de Informação, 16-19 June 2010, Santiago de Compostela, Spain

48. Andre Mora, Pedro Vieira e José Fonseca. Advances in Image Processing Techniques for Drusens Detection and Quantification in Fundus Images. 1st IFIP Doctoral Conference on Computing, Electrical and Industrial Systems, Lisboa (Portugal), 22-24 February 2010 published on IFIP Advances in Information and Communication Technology, 2010, Volume 314/2010, 299-307, DOI: 10.1007/978-3-642-11628-5_32

49. Ana S. Fernandes, Pedro Alves, Ian H. Jarman, Terence A. Etchells, José M. Fonseca and Paulo J. G. Lisboa. A clinical decision support system for breast cancer patients. 1st IFIP Doctoral Conference on Computing, Electrical and Industrial Systems, Lisboa (Portugal), 22-24 February 2010 published on IFIP Advances in Information and Communication Technology, 2010, Volume 314/2010, 299-307, DOI: 10.1007/978-3-642-11628-5_32

50. I. Dorotovic, J. Rybak, A. Garcia, P. Journoud. North-south asymmetry of Ca II K regions determined from OAUC spectroheliograms: 1996 ñ 2006, Proceedings of the 20th Slovak National Solar Physics Meeting, June, ed. I. Dorotovic, Hurbanovo, published on DVD, Pages 58-63, ISBN: 978-80-85221-68-8, 2010.

51. M. Rybansk´´, I. Dorotovic, T. Pinter, K. Kudela. Peculiarities of the level of cosmis radiation after sudden decreases, Proceedings of the 20th Slovak National Solar Physics Meeting, June, ed. I. Dorotovic, Hurbanovo, published on DVD, Pages 169-174, ISBN: 978-80-85221-68-8, 2010.

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53. P. Surovy, I. Dorotovic, V. Karlovsky, J. L. Lousada, J. C. Rodrigues, M. Rybansky, P. Fleischer. Impact of solar activity on the growth of pine trees (Pinus cembra: 1610 ñ 1970; Pinus pinaster: 1910 ñ 1989). Proceedings of the 20th Slovak National Solar Physics Meeting, June, ed. I. Dorotovic, Hurbanovo, published on DVD, Pages 184-188, ISBN: 978-80-85221-68-8, 2010.

54. Rodler F., del Burgo C., Martín E. L., Álvarez C. 2010, ASPC, 430, 526: "Detecting Planets around Very Cool Stars at Near Infrared Wavelengths with the Radial Velocity Technique"

55. Quirrenbach A. et al. (including del Burgo C.) 2010, ASPC, 430, 521: "CARMENES: Calar Alto High-Resolution Search for M Dwarfs with Exo-earths with a Near-infrared Echelle Spectrograph"

56. Martín E. L., Guenther E., del Burgo C., et al. 2010, ASPC, 430, 526: "NAHUAL: A Next-Generation Near Infrared Spectrograph for the GTC"

57. Quirrenbach et al. (including del Burgo C.) SPIE, 7735, 37: "CARMENES: Calar Alto high-resolution search for M dwarfs with exo-earths with a near-infrared Echelle spectrograph"

58. Deshpande R., Martín E. L., Montgomery M. M., Lyubnik Y., Zapatero Osorio M. R., Rodler F., del Burgo C., Pavlenko Y., American Astronomical Society, AAS Meeting 215th, 606.04: "Line Identification And Equivalent Width Measurements Of Atomic Lines In Spectra Of 40 Late M Dwarfs".

59. Danchi W. C., Eiroa C. et al. (incuding del Burgo C.), American Astronomical Society, AAS Meeting 215th, 440.14; Bulletin of the American Astronomical Society, Vol. 42, p.399: "Dust Around Nearby Stars: The Herschel DUNES Open Time Key Programme".

60. del Burgo C., *S4: From Macro to Micro-stellar transits*, JENAM 2010, Joint European and National Astronomy Meeting held 6-10 September, 2010 in Lisbon Portugal., p.50, "Time Series Observations". No Proceedings.

61. De Colle F., del Burgo C., Raga A., Protostellar Jets in Context, Astrophysics and Space Science Proceedings, Volume . ISBN 978-3-642-00575-6. Springer-Verlag Berlin Heidelberg, 2009, p. 311, "Application of Tomographic Techniques to Stellar Jets".

62. Quirrenbach a. and the CARMENES Consortium (including del Burgo C.) 2010, Proceedings of Astronomy of Exoplanets with Precise Radial Velocities (16 - 19 August, 2010, Penn State Dept. of A&A, The Pennsylvania State University, USA): "CARMENES: Calar Alto high-Resolution search for M dwarfs with Exo-earths with a Near-infrared Echelle Spectrograph"

63. Caballero J. A., Quirrenbach A., Amado P. J., Mandel H., Ribas I., Reiners A., Mundt R., and the CARMENES Consortium ((including del Burgo C.) 2010, Proceedings of Astronomy of Exoplanets with Precise Radial Velocities (16 - 19 August, 2010, Penn State Dept. of A&A, The Pennsylvania State University, USA): "CARMENES: Technical Details"

Conference Papers (Portuguese)
Total 2007 and following: 4

1. Patrícia G. Gonçalves and Isabel L. Nunes, Avaliação de Riscos nas Linhas de Produção de uma Indústria de Transformação de Papel. in International Symposium on Occupational Safety and Hygiene (SHO09), Arezes, P., Baptista, J. S., Barroso, M. P., Carneiro, P., Cordeiro, P., Costa, N., Melo, R., Miguel, A. S. and Perestrelo, G. P. (eds), pp 227-231, Fev 5-6, Publisher SPOSHO, ISBN 9789729950452, Guimarães-Portugal (2009) – Publicação ISI
2. Isabel L. Nunes, Ana Filipa Costa, Ana Fortes Baptista, M. Fátima Valério. (2008). TPM e a Saúde e a Segurança no Trabalho. In Riscos Públicos Industriais, II Encontro Nacional de Riscos, Segurança e Fiabilidade: Riscos Públicos e Industriais, 13-15 Nov 2008, Lisboa, Portugal. ISBN: 978-9-7268-9231-1.
3. Denis A. Coelho, João C. O. Matias, Isilda G. Barata, André Silva, Andreia Campos, Dinis Nunes, Isabel Nunes. (2008). Disseminação e apropriação de conhecimento sobre Saúde e Segurança no Trabalho nas PMEs através de aplicação multimédia inovadora incorporando recomendações ergonómicas. In , Colóquio Internacional sobre Segurança e Higiene Ocupacionais SHO 2008, 7-8 Fev 2008, Guimarães, Portugal. ISBN: 978-972-8826-19-2.
4. Denis A. Coelho, João C. O. Matias, Isilda G. Barata, Isabel Nunes. (2008). Aplicação multimédia inovadora incorporando recomendações ergonómicas visando a disseminação e apropriação de conhecimento sobre Saúde e Segurança no Trabalho nas PMEs. In , CLME'2008 - 5º Congresso Luso-Moçambicano de Engenharia- IICEM - 2º Congresso de Engenharia de Moçambique, 2-4 Set 2008, Maputo, Moçambique.

Doctoral and Post-doc Advising

Doctoral candidates, completed

- Andre Damas Mora (PhD) – Topic "Advanced Image Processing Techniques For Detection And Quantification Of Drusen", Completed December, 2010
- Ana Sofia Fachada Fernandes (PhD) – Topic "Prognostic Modelling of Breast Cancer Patients – A Benchmark with predictive models with External Validation", Completed November, 2010

Post-doc advising

- Rita Ribeiro. Responsible for post-docs Ivan Dorotevic and Carlos del Burgo

Doctoral candidates, current (FCT/UNL)

- Ehsan Shahamatnia (started 2010) – Topic "Fuzzy optimization and Memetic Algorithms". Advisor Rita Ribeiro
- José Xavier Ferreira Da Silva (started 2009) – Topic "Learning algorithm for identification of climate variability with Solar influence". Advisor Rita Ribeiro Co-advisor Yudel Gomez (Cuba).
- Dinesh Vather (started 2009) – Topic "The design of the opto-mechanical support structures for the PHASES instrument for use in low earth orbit". Advisor Niall Murphy (DIT, Ireland). Co-advisors: Carlos del Burgo and Tully Peacocke (NUI Maynooth, Ireland).
- Raúl Cordeiro (started 2009) – "Euronet Lab : a Cloud V-Lab Environment ". Advisor José Manuel Fonseca. Co-advisor Andrew Donnellan (ITT Dublin).
- Graça Almeida (started 2009) – "Displacement Estimation of RC Beams Test based on Image Processing Techniques". Advisor José Manuel Fonseca. Co-advisor Fernando Melicio.
- Carla Gomes (started 2009) – Topic "B-learning effectiveness evaluation using Artificial Intelligence". Advisor José Manuel Fonseca. Co-advisor Ruy Costa.
- Hugo Cordeiro (started 2010) – Topic to be defined. Advisor José Manuel Fonseca. Co-advisor Carlos Meneses.
- Abel Pinto (started 2008) – Topic: "Fuzzy Risk Analysis in Construction". Advisor Isabel Nunes. Co-advisor Rita Ribeiro.
- Natacha Correia (on-going) – Topic: Lean Management and Ergonomics. Advisor Isabel L. Nunes, co-advisor V. Cruz Machado
- Sara Salgueiro Figueira (on-going) – Topic: Fuzzy sets and Lean Management. Advisor Isabel L. Nunes, co-advisor V. Cruz Machado

Masters advising

Here we only mention finished Ms Thesis (on-going Msc students are about 10)

Masters, completed (pre-Bologna)

- Margarida Gomes - (Concluded March 2009) – Topic: "Optimization of the Number of Membership Functions in Linguistic Variables from Sensor Data".

Advisor Paula Amaral. Co-advisor Rita Ribeiro

- Natacha Correia - (Concluded 2009) – Topic: Lean Management e Ergonomia, Mestrado em Engenharia Industrial, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa. Advisor Isabel L. Nunes, co-advisor V. Cruz Machado

- David Miguel Vera Cruz Beja (Concluded September 2008) – Topic: "Avaliação Automática de Deformação de Micro-Estruturas em Cristais Líquidos por Processamento de Imagens". Advisor: José Fonseca

- Carlos Manuel Coutinho Moreira (Concluded July 2008) – Topic: "Sistema Automático de Identificação e Caracterização de Zonas de Actividade em Imagens Solares". Advisor: José Fonseca

- Ana Celeste Alegre Marques (Concluded May 2007) – Topic: "Uma Arquitectura Multi-Agente para a Partilha de Informação Médica Distribuída". Advisor: José Fonseca

Masters, completed (Bologna)

- Bruno Miguel Marques Rodrigues – (Concluded December 2010) – Topic "Análise e simulação de técnicas de análise de Stocks – O mercado de retalho como caso de estudo". Advisor: José Fonseca

- Jorge Rodrigo Marreiros Duarte Elias - (Concluded December 2010) – Topic "Sistema de apoio à navegação baseado em AIS". Advisor: José Fonseca

- Pedro Nuno Extreia Ribeiro Semeano - (Concluded April 2010) - "Programa de controlo de acessos com configuração de regras em XML". Advisor: José Fonseca

- Tiago Trigueiro Santos - (Concluded December 2009) - "Projecto e Desenvolvimento de uma aplicação de suporte à gestão de manipulação e consultas farmacêuticas". Advisor: José Fonseca

- Abílio Manuel Figueira de Abreu – (Concluded December 2009) - "Detecção de incêndios nocturnos através de processamento digital de imagens". Advisor: José Fonseca. Co-advisor: Pedro Vieira, Physics Department, FCT/UNL

- Ricardo João Pimenta de França Coutinho Ramos – (Concluded December 2009) - "Estudo de novas técnicas de caracterização da resposta eléctrica em Biosensores para detecção de componentes agrícolas". Advisor: José Fonseca. Co-advisors: Maria Fátima Raposo and Paulo Ribeiro, Physics Department, FCT/UNL

- Pedro Miguel Vieira Guiomar da Rocha - (Concluded December 2009) - "Sistema de visão para apoio à avaliação da obstrução da orofaringe em crianças". Advisor: José Fonseca

- João Reis Costa Mendes - (Concluded December 2009) - "Real Time Mobile System for Support in Firefighting Environments". Advisor: José Fonseca. Co-advisor: Pedro Vieira, Physics Department, FCT/UNL

- Bernardo Manuel da Silva Coelho Garcia Barbosa - (Concluded May 2009) - "Projecto e implementação de um sistema de apoio ao seguimento

Farmacoterapeutico". Advisor: José Fonseca

- Hélio Alexandre Malão Martins - (Concluded April 2009) - "Image Retrieval efficiency based on selected MPEG-7 descriptors". Advisor: José Fonseca

- David dos Santos Alves - (Concluded March 2009) - "Drum transcription from multi-channel recording with non-negaytive matrix factorization". Advisor: José Fonseca. Co-advisor: Professor Anssi Jalapmoi, Tampere University of Technology

- Fernando Miguel Bernardo Moitinho - (Concluded February 2009) - "Detecção automática de Drusas em imagens de retinografia". Advisor: José Fonseca

- Ricardo José Fernandes Pereira - (Concluded January 2009) - "Programa de monitorização para apoio a doentes domiciliados". Advisor: José Fonseca

- Teresa Isabel de Oliveira Maia Rebelo - (Concluded May 2009) - "Detecção e quantificação automática da actividade solar". Advisor: José Fonseca

- Ricardo Jorge Pires Correia Farinha - (Concluded July 2008) - "Segmentation of Striatal Brain Structures From High Resolution Pet Images". Advisor: José Fonseca. Co-advisor: Professor Ulla Ruotsalainen, Tampere University of Technology

- Nelson Filipe Bôto Ribeiro - (Concluded May 2008) - "Sistema sem fios para monitoração de vida em tempo real de pacientes domiciliados". Advisor: José Fonseca

- Sara Valério Granjo - (Concluded March 2008) - "Estudo e implementação de algoritmos de classificação automática para disponibilização em portais on-line". Advisor: José Fonseca

- Henrique Braz Falcão Ferreira - (Concluded March 2008) - "Expert Decision Support System". Advisor: José Fonseca

- Joana Crisna Gonzaga Caseiro Carreira Panaca - (Concluded July 2007) - "Sistema de interligação hospitalar para envio/recepção de imagens médicas". Advisor: José Fonseca

- Afonso Pimentel – (Concluded April 2009) – Topic "Multi-criteria Analysis for Architectural Choices in Software Product Lines". Advisor João Araújo, co-advisor Rita Ribeiro

- Ana Filipa P. Costa - (Concluded 2009) – Topic: Contributo para o Estudo da relação entre o Índice de Capacidade para o Trabalho, o Envelhecimento e a Ergonomia, Mestrado em Engenharia e Gestão Industrial, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa,. Advisor Isabel L. Nunes