

INSTITUTO DE TELECOMUNICAÇÕES

Relatório de Actividades

1998

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1. Introdução

O Instituto de Telecomunicações (IT) é uma instituição privada sem fins lucrativos, de utilidade pública, resultante da associação de quatro instituições com experiência e tradições de investigação e desenvolvimento na área das Telecomunicações:

- Instituto Superior Técnico (IST),
- Universidade de Aveiro (UA),
- Faculdade de Ciências e Tecnologia da Universidade de Coimbra (FCTUC),
- Portugal Telecom, através do seu Centro de Estudos de Telecomunicações (CET).

O IT está organizado em três Pólos: um em Aveiro, no Campus Universitário da Universidade de Aveiro (UA), outro em Coimbra, no Pólo II da Universidade de Coimbra (UC) e o terceiro em Lisboa, no IST.

A constituição do IT beneficiou do apoio do programa CIENCIA, num montante total de 1,5 milhões de contos, através de três contratos celebrados em 1991, com as instituições associadas. Este financiamento permitiu a construção de infraestruturas nos três Pólos e a aquisição de equipamentos para os respectivos laboratórios.

A instalação do Pólo de Aveiro ficou concluída em 1993 e a dos pólos de Lisboa e de Coimbra em 1994. Nesse sentido pode-se considerar que, desde 1995, o IT desenvolve uma actividade em regime normal. Resumem-se, em seguida, algumas das actividades mais marcantes realizadas em 1998 deixando para os relatórios das linhas de investigação o seu desenvolvimento.

2. Organização interna

No ano de 1998 realizaram-se:

- duas Assembleias Gerais, uma em Março, em Aveiro, e outra em Dezembro, em Coimbra, destinadas respectivamente a aprovar o “Relatório de Actividades e Contas de 1997” e o “Plano de Actividades e Orçamento para 1999”;
- reuniões mensais da Comissão Executiva;
- a constituição da Comissão de Aconselhamento, formada pelo Dr. Roland Hüber, Prof. John O’Reilly e Prof. Martin Tomlinson, que visitou detalhadamente os Pólos de Aveiro, Coimbra e Lisboa, em Julho, e produziu uma relatório com a análise da situação e desempenho do IT e com recomendações para actividades futuras;
- uma reunião do Conselho Científico, em Novembro, em Lisboa, para preparação da proposta de “Plano de Actividades para 1999” a submeter à Assembleia Geral em Dezembro de 1998 e para uma apresentação e recolha de sugestões sobre um documento de Planeamento Estratégico do IT a aprovar em 1999.

3. Actividades em projectos de âmbito nacional

No âmbito do programa lançado pela JNICT para financiamento de projectos liderados por “Jovens Doutorados”, decorreram 10 projectos, que deverão ser concluídos no primeiro trimestre de 1999:

- 7 no Pólo de Lisboa,
- 1 no Pólo de Coimbra,
- 2 no Pólo de Aveiro;

No âmbito do Programa PRAXIS XXI, medida 2, continuaram as actividades em 12 projectos envolvendo o Instituto de Telecomunicações:

- 8 envolvendo apenas um Polo do IT (2 do Pólo de Aveiro, 1 do Pólo de Coimbra e 5 do Pólo de Lisboa),
- 1 projecto liderado pelo Pólo de Aveiro, em colaboração com a Universidade do Algarve,

- 1 projecto liderado pelo INESC, envolvendo o Pólo de Coimbra,
- 1 projecto liderado pelo IST, envolvendo o Polo de Aveiro,
- 1 projecto envolvendo os Pólos de Lisboa e de Aveiro do IT.

Prosseguiram os estudos e foi iniciada a construção de protótipos no âmbito do projecto ITCOM (Integração de Tecnologias em Comunicações Móveis), envolvendo equipas dos 3 Pólos do IT.

Foi iniciado um novo projecto PRAXIS XXI, medida 2, envolvendo os Pólos de Lisboa e de Aveiro.

Foi desenvolvido, no Pólo de Lisboa, a “Análise Técnica de Processos de Aquisição do Instituto das Comunicações de Portugal” por encomenda da Price Waterhouse.

Foi continuada a colaboração do Pólo de Aveiro com a TEKA, com vista à implementação de um sistema de distribuição de serviços de televisão (projecto DISERT).

Grupos dos Pólos de Lisboa e de Coimbra mantiveram actividade no projecto PRODIGIOS (Processamento Digital de Sinais de Audio e Vídeo) liderado pelo INESC; este projecto foi concluído em finais de 1998.

Por encomenda da Portugal Telecom, através do Centro de Estudos de Telecomunicações, o Pólo de Aveiro desenvolveu 14 projectos de I&D cobrindo as áreas de Redes (7) Rádio Microondas e Ondas Milimétricas (4) Sistemas e Circuitos Integrados (2) e Simulação e Caracterização de Componentes Electrónicos e Optoelectrónicos (1).

4. Actividades em projectos comunitários

As actividades no âmbito de projectos comunitários, em particular no programa ACTS (4º Programa Quadro da União Europeia), traduziram-se na participação num número significativo de projectos, dos quais se destacam:

- FRAMES (comunicações móveis),
- MOMUSYS (codificação de imagem),
- UPGRADE (comunicações ópticas),
- VITAL (serviços avançados de telecomunicações),
- TALISMAN (protecção dos direitos de cópia de sinais audio e video),
- SPEED (transmissão óptica com elevados débitos binários),
- BLISS (componentes ópticos activos),

- SAMBA (comunicações móveis de banda larga em ondas milimétricas),
- CABSINET (distribuição celular de televisão).

Alguns dos projectos a que se faz referência neste relatório foram desenvolvidos em colaboração com as instituições associadas.

5. Produção Científica

O número de trabalhos publicados em revistas científicas e livros, o número de comunicações apresentadas em conferências e o número de teses concluídas, são indicadores precisos da actividade realizada no IT. No quadro seguinte apresentam-se os dados referentes a estes indicadores ao longo dos últimos 5 anos:

Produção Científica	1994	1995	1996	1997	1998
Teses de doutoramento	7	7	10	5	6
Teses de mestrado	3	13	30	21	27
Artigos em revistas e livros	23	32	69	81	104
Artigos em conferências	71	91	197	237	301

No que respeita a formação graduada e pós-graduada é de salientar o elevado número de projectos finais de licenciatura realizados no IT bem como de teses de mestrado e de doutoramento em curso. Os números relativos aos últimos 5 anos são indicados no quadro seguinte:

Formação	1994	1995	1996	1997	1998
Doutoramentos em curso	56	61	56	65	74
Mestrados em curso	58	77	94	91	86
Alunos Finalistas	n.d.	n.d.	85	126	140

6. Conferências e Seminários

O Pólo de Lisboa do IT preparou a II Conferência de Telecomunicações, Conftele'99, a realizar em Sesimbra, nos dias 15 e 16 de Abril de 1999. Até á data foram aceites e recebidas 145 comunicações, o que demonstra bem a vitalidade da I&D no sector.

O Pólo de Coimbra promoveu, em Coimbra, em 28 e 29 de Setembro de 1998 um encontro designado 'Matemática em Telecomunicações - Que Problemas?' aberto a toda a comunidade científica e precedido de um concurso, realizado via Internet, destinado a recolher problemas das telecomunicações, com especiais dificuldades matemáticas. Neste encontro, que contou com mais de 70 participantes, para além de comunicações convidadas, foram apresentados os problemas, seleccionados por um júri de matemáticos, e as respectivas soluções.

Organizado pelo Pólo de Aveiro, em 4 de Dezembro de 1998, um seminário, aberto a toda a comunidade científica, sob o tema "Ondulas — teoria e aplicações", que foi frequentado por mais de 60 participantes e cujo conteúdo foi disponibilizado na página da Internet do IT. Espera-se que este seja o primeiro de uma série de seminários destinados a divulgar técnicas avançadas na área das telecomunicações.

Foram organizadas diversas reuniões no âmbito dos projectos comunitários e das Acções de Cooperação COST em que as equipas do IT estão envolvidas.

7. Prémios

Regista-se, com muito agrado, que colaboradores do Instituto de Telecomunicações tenham sido novamente distinguidos com os prémios Jovem Engenheiro - 1º, 2º e 3º lugares, pela Ordem dos Engenheiros - Região Sul.

8. Recursos humanos

Os recursos humanos do IT referidos a Dezembro de 1998 são os seguintes:

Pólo de Aveiro:

- 21 investigadores, docentes da UA, dos quais 15 doutorados
- 15 investigadores do Centro de Estudos de Telecomunicações da Portugal Telecom,
- 50 outros colaboradores, dos quais 15 estudantes de doutoramento da UA, 21 estudantes de mestrado, e 14 bolsiros (bolsas BIC, bolsas do IT e bolsas PraxisXXI).
- 28 alunos finalistas de licenciatura da UA, em Projectos de Fim de Curso,
- 6 funcionários a tempo inteiro,
- 1 funcionários a tempo parcial.

Pólo de Coimbra:

- 20 investigadores, docentes da FCTUC, dos quais 10 doutorados, 7 estudantes de doutoramento e 3 estudantes de mestrado,
- 20 investigadores, docentes de outras instituições de ensino superior, dos quais 2 doutorados, 5 estudantes de doutoramento e 11 estudantes de mestrado,
- 4 outros colaboradores dos quais 2 alunos de mestrado da FCTUC,
- 22 alunos finalistas de licenciatura da FCTUC, em trabalhos finais de curso
- 1 funcionários administrativo a tempo inteiro,
- 1 funcionário administrativo a tempo parcial.

Pólo de Lisboa:

- 51 investigadores, docentes do IST dos quais 43 são doutorados e 8 são estudantes de doutoramento,
- 19 investigadores, docentes de outras instituições de ensino superior ou laboratórios oficiais, dos quais 1 doutorado, 8 estudantes de doutoramento e 10 estudantes de mestrado,
- 32 outros estudantes de mestrado e 27 outros estudantes de doutoramento do IST ,
- 90 alunos finalistas de licenciatura, do IST, em Projectos Finais de Curso,

- 1 funcionário administrativo a tempo inteiro,
- 1 funcionário administrativo a tempo parcial,
- 1 técnico de laboratório a tempo parcial.

INSTITUTO DE TELECOMUNICAÇÕES

Annual Report

1998

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1. Introduction

“Instituto de Telecomunicações” (IT) is a private, not-for-profit organisation, association of four institutions with experience and traditions in research and development in the field of Telecommunications:

- “Instituto Superior Técnico” (IST);
- “Universidade de Aveiro” (UA);
- “Faculdade de Ciências e Tecnologia da Universidade de Coimbra” (FCTUC);
- “Portugal Telecom” (PT), through its research centre “Centro de Estudos de Telecomunicações” (CET).

IT is organised around three poles: one in Aveiro, in the University Campus, another in Coimbra, in Pole II of the University of Coimbra and the third one in Lisbon, in IST.

Setting up of IT was the result of a 1.5 billion escudos grant from Programme CIENCIA, through three contracts signed in 1991. This investment enabled new infrastructures to be built and research laboratories to be equipped in every pole

Installation was concluded in Aveiro in 1993 and in Lisbon and Coimbra in 1994. Therefore, since 1995 IT activities proceed regularly. Key developments in 1998 are sketched below leaving the details for the report of each individual research line.

2. Management

The following management meetings were held:

- two meetings of the General Assembly one in March, in Aveiro, to approve the “1997 Annual Report” and another in December, in Coimbra, to approve the “Plan and Budget for 1999”;
- monthly meetings of the Executive Board;
- one meeting with the Advisory Committee, formed by three independent experts in the field of Telecommunications (Dr. Roland Hüber, Prof. John O’Reilly and Prof. Martin Tomlinson) acting in a personal capacity who, in July, carried out a detailed survey of IT activities, including visits to the laboratories in all centres and issued recommendations for future activities;

- the Scientific Board met in November, to prepare a proposal for the “Plan and Budget for 1999”, to be submitted to the General Assembly in December 1998 and to present and receive suggestions for a document on IT Strategic Review to approve during 1999.

3. National Projects

In the scope of JNICT programme to finance “Proposals Lead by Young Doctors” 10 projects continued and should reach their end during the first trimester of 1999:

- 7 in Lisbon
- 1 in Coimbra
- 2 in Aveiro

In the scope of Program PRAXIS XXI, Measure 2, 12 research projects were continued:

- 8 involving one IT-Pole alone (5 in Lisbon, 2 in Aveiro, 1 in Coimbra),
- 1 led by IT-Aveiro in co-operation with the University of Algarve,
- 1 led by INESC in co-operation with IT-Coimbra,
- 1 led by IST in co-operation with IT-Aveiro
- 1 involving the IT-Aveiro and IT-Lisbon.

Project ITCOM (Integration of Technologies in Mobile Communications), involving teams for all three poles continued and prototypes started to be built. The project lifetime was extended for another year until October 1999;

A new PRAXIS XXI project, involving both the IT-Lisbon and the IT- Aveiro, was started;

IT-Lisbon carried out and completed a “Technical Analysis to the Acquisitions of the Instituto das Comunicações de Portugal”, by request of Price Waterhouse;

IT-Aveiro continued its co-operation with TEKA in order to implement a system to distribute television services (Project DISERT);

Teams from IT-Lisboa and IT-Coimbra were active in project PRODIGIOS (Audio and Video Signal Processing) led by INESC. This project was concluded in the end of 1998;

IT-Aveiro on contract with Portugal Telecom (CET), was involved in 14 projects in the areas of networks (7), radio microwave and millimetre waves (4), integrated circuits and systems (2) and electronic and optoelectronic components (1).

4. European Community Projects

IT participation in European Community research and developments projects, namely in Programme ACTS (European Union 4th Framework Programme) included:

- FRAMES, in mobile and personal communications;
- MOMUSYS, in image coding;
- UPGRADE, in optical communications;
- VITAL, in advanced telecommunication services;
- TALISMAN, in copyright protection for audio and video signals;
- SPEED, in optical transmission with high bit rates.
- BLISS, in active optical components;
- SAMBA, in wide band mobile communications in the millimetre band;
- CABSINET, in cellular radio distribution of television signals;

Remark: Some of the projects mentioned in this report were carried out in collaboration with the associates.

5. Scientific Output

The number of papers in scientific journals and books, the number of papers published in conference proceedings and the number of concluded theses, are valuable indicators of the activity carried out at IT.

The following table shows the evolution of the scientific output of IT in the last five years:

Scientific output	1994	1995	1996	1997	1998
Ph.D. Theses	7	7	10	5	6
M.Sc. Theses	3	13	30	21	27
Papers in Journals and Books	23	32	69	81	104
Papers in Conferences	71	91	197	237	301

Concerning graduate and post-graduate training, it is important to refer the number of final year project students and the number of MSc and PhD students working in IT laboratories. In the last 5 years the following number of students were envolved in IT activities:

Training	1994	1995	1996	1997	1998
PhD students	56	61	56	65	74
MSc students	58	77	94	91	86
Final year students	n.a.	n.a.	85	126	140

6. Conferences and Seminars

IT-Lisbon prepared The Second Conference on Telecommunications, Conftel'99, to be held in Sesimbra, in April 15 and 16, 1999. Up to now 145 papers were accepted and received, a good sign of the sector vitality.

IT-Coimbra organised, in Coimbra, in 28 and 29 September 1998 a workshop on the topic of 'Mathematical Problems in Telecommunications'. This workshop, opened to the whole scientific community, was preceeded by a request, via Internet, aiming at gathering telecommunications problems, with particular mathematical difficulties. The problems selected by a committee lead by mathematicians, and the solutions, were presented together with a few invited papers, in the workshop attended by more than 70 participants.

In 4 December, IT-Aveiro organised a seminar, open to the whole scientific community, under the theme "Wavelets — Theory and Applications", with gathered more than 60 participants. The presentations were made available on the IT WEB site. We hope that this is the first of a series of seminars aimed at the diffusion of advanced telecommunications techniques

A number of COST and Community Project meetings in which IT research teams participated were organised and held.

7. Prizes

Researchers of IT-Lisboa were distinguished with the following awards: 'Jovem Engenheiro' - 1st, 2nd and 3rd prizes from Ordem de Engenheiros - Região Sul.

8. Human resources

IT human resources referred to December 1998 are as follows:

IT-Aveiro:

- 21 researchers, of which 15 hold a doctor degree, staff members from UA,
- 15 researchers staff members from PT,
- 50 researchers: 15 PhD students and 21 M.Sc. students at UA, and 14 students with grants (BIC, IT and PraxisXXI grants).
- 28 UA students doing their final year project,
- 6 full-time administrative staff,
- 1 part-time administrative staff,

IT-Coimbra:

- 20 researchers, of which 10 hold a doctor degree, 7 are PhD students and 3 MSc students, staff members from FCTUC,
- 20 researchers, of which 2 hold a doctor degree, 5 are PhD students and 11 MSc students, staff members from other universities and polytechnic schools,
- 4 other collaborators of which 2 are MSc students from FCTUC,
- 22 FCTUC students doing their final year project,
- 1 fulltime administrative staff,
- 1 part-time administrative staff,

IT-Lisbon:

- 51 researchers, staff members from IST, of which 43 hold a doctor degree and 8 are Ph.D. students,
- 19 researchers, staff members from other universities and polytechnic schools, of which 1 holds a doctor degree, 8 are Ph.D. students and 10 are M.Sc. students at IST,
- 32 other M.Sc. students and 27 other Ph.D. students at IST,
- 90 IST students doing their final year project,
- 1 full-time administrative staff,
- 1 part-time administrative staff,
- 1 part-time technician.

A detailed description of the activities performed by the research lines in the three poles is presented in the annex.

9. ANNEX

9.1 Lisbon Pole

9.1.1 Radio, Microwaves and Millimeter Waves Research Line

Human Resources

Collaborators

- Afonso M. Barbosa Ph. D. Full Professor, IST
- João Costa Freire Ph.D. Associate Professor, IST
- Carlos C. Fernandes Ph. D. Associate Professor, IST
- Carlos R. Paiva Ph. D. Associate Professor, IST
- Maria João Rosário Ph.D. Assistant Professor, IST
- Luís M. Correia Ph. D. Assistant Professor, IST
- Custódio O. Peixeiro Ph.D. Assistant Professor, IST
- António L. Topa Ph. D. Assistant Professor, IST
- João Caldinhas Vaz Ph. D. Assistant Professor, IST

Other Collaborators

- Jorge R. Costa Ph. D. Student Grant, PRAXIS XXI
- Fernando M. Janeiro Ph. D. Student Grant, PRAXIS XXI
- Fernando J. Velez Ph. D. Student Assistant, Univ. Beira Interior
- Pedro M. Ramos Ph. D. Student Grant, PRAXIS XXI
- Jorge Alves Torres Ph. D. Student Professor, ISEL
- Fernando Fortes Ph. D. Student Assistant, ISEL
- Kam Weng Tam Ph. D. Student Assistant, Macau University
- Luís M. Manica M. Sc. Student Grant, PRAXIS XXI
- Miguel L. Filipe M. Sc. Student Grant, PRAXIS XXI
- Luís M. Anunciada M. Sc. Student Grant, PRAXIS XXI
- Gabriela Marques M. Sc. Student Grant, DEEC/IST
- José L. Pereira M. Sc. Student Engineer, ANA
- Pedro Vasconcelos M. Sc. Student Engineer, TMN

- Nuno C. Gonçalves M. Sc. Student Engineer, ICP
- Ana Domingues M. Sc. Student Engineer, Optimus
- Dragana Kristic M. Sc. Student Engineer, Optimus
- Henrique J. Silva M. Sc. Student Assistant, ISEL
- Fernando Azevedo M. Sc. Student Assistant, ISEL
- Joaquim José Oliveira M. Sc. Student Assistant EST-IPCB
- Guilherme Mascarenhas M. Sc. Student Assistant ISECMAR
- Cristina Mota Lic. Student IST, Final Year Project
- Vitor Silva Lic. Student IST, Final Year Project
- Miguel Pinto Lic. Student IST, Final Year Project
- João Eira Lic. Student IST, Final Year Project
- Pedro António Lic. Student IST, Final Year Project
- João Palma Lic. Student IST, Final Year Project
- João Luis Lic. Student IST, Final Year Project
- Ana Claro Lic. student IST, Final Year Project
- José Ferreira Lic. student IST, Final Year Project
- Sandra Almeida Lic. student IST, Final Year Project
- José Queijo Lic. student IST, Final Year Project
- Francisco Gil Lic. student IST, Final Year Project
- Carlos Pardelinha Lic. student IST, Final Year Project
- João Chaves Lic. student IST, Final Year Project
- Pedro Oliveira Lic. student IST, Final Year Project
- Hugo Silvestre Lic. student IST, Final Year Project
- Micael Parente Lic. student IST, Final Year Project
- Pedro Ferreira Lic. student IST, Final Year Project
- Bruno Gomes Lic. student IST, Final Year Project
- João Vinagre Lic. student IST, Final Year Project
- Paulo Soares Lic. student IST, Final Year Project
- Horácio Santos Lic. student IST, Final Year Project
- Nuno Carvalho Lic. student IST, Final Year Project
- Bruno Cabaço Lic. student IST, Final Year Project
- Alcides Dias Lic. student IST, Final Year Project
- Mayte Rodrigo B.Sc. Student SOCRATES, U.P. Valencia
- Nuria Higuera Ruiz B.Sc. Student SOCRATES, U.P. Valencia

- Enrico Specos B.Sc. Student SOCRATES, U. Pisa
- Giulio Salvatori B.Sc. Student SOCRATES, U. Pisa
- Beniamino Barilese B.Sc. Student ERASMUS, U. Pisa
- Jorge S. Silva Technician Lab. Technician, IST
- Carlos Brito Technician Lab. Technician, IST

Projects

- FCT – PBICT/TIT/2531/95 – Propagation in Photonics: Complex Media in Integrated Optics; Solitons in Optical Fibers

Solitonlike pulse switching in multiple-core nonlinear fiber arrays. Wavelength-division-multiplexing soliton communication systems: dispersion management. Soliton transmission control. Spectral representation of the electromagnetic field of planar multilayered waveguides containing omega media. Leaky modes in chiral rib waveguides (C.R. Paiva, A.L. Topa).
- FCT PBIC/C/TIT/2501/95 - Shaped beam antennas - impact on the millimetrewave mobile communications propagation channel

Improvement of the design of shaped beam lens antennas for use in indoor mobile or portable applications at 60 GHz: modeling of lens internal reflections; study of the influence of lens size on its performance; design, construction and test of switchable beam lens antenna, with shaping in the elevation plane; integration of shaped lenses with planar printed feeding circuits; preliminary study of shaped lenses with beam steering capability. Measurement campaign in indoor scenarios for evaluation of the performance of constant flux lens antennas with respect to coverage. Implementation of a wide-band channel sounder using the frequency sweeping technique. Tests in laboratory scenarios, using shaped beam lens antennas. Modeling of obstacles in indoor environments, and validation with measurements (Carlos Fernandes).
- FCT – PBIC/C/TIT/2517/95 - MODPROP: Propagation Models for Urban Micro-cells in Mobile Communication Systems

Development of propagation models both for indoor and outdoor environments for mobile communication systems working at the UHF and millimetre wavebands. Special attention is being given to the average power decay, fading and wideband characterization of the propagation channel at the millimetre waveband. Also the particular case of street crossings and obstruction by urban structures, as well as penetration into buildings and other structures, is being considered for mobile systems at UHF, mainly GSM (Luís Correia).
- FCT – PBIC/C/TIT/2507/95 - Active Printed Antennas

Characterization of wire bonding in a broad frequency range, up to 50 GHz. Integration and test of a LNA MMIC with a patch antenna with chip on board technology on soft substrate (Custodio Peixeiro, M. J. Rosário).

- PRAXIS XXI – 3/3.1/TIT/35/94 – ITCOM - Integration of Technologies for Mobile Communications
Helical type of antennas for the base station. Design, of base station antennas for shaped coverage of sectored cells. Start antenna parameter optimization using Genetic Algorithms. Development of propagation models for mobile communications in outdoors environments at the 1.8 GHz band. The models are intended for the estimation of propagation loss, considering the specific characteristics of the scenario where the mobile exists. Design, fabrication and test of a microstrip diplexer. Design and test of a GaAs MMIC with a FETs switch for the mobile terminal. Mounting of the switch, up and down converters MMICs on a soft substrate for integration and test (Carlos Fernandes, Custódio Peixeiro, Luís Correia, J.Costa Freire).
- PRAXIS XXI – 2/2.1/TIT/1663/95 – Microwave and Optical Devices for Transmission and Switching
Using Linear and Nonlinear Media Soliton switching in nonlinear fiber couplers: effect of intermodal dispersion; influence of intermodal dispersion on the switching of solitons at different wavelengths in twin-core fiber couplers. Multichannel soliton amplification in erbium-doped fiber amplifiers. Full-wave analysis of microwave waveguides (rectangular waveguide and nonradiative dielectric waveguide) inhomogeneously filled with omega media (A.M. Barbosa, C.R. Paiva, A.L. Topa).
- PRAXIS XXI – 2/2.1/TIT/1641/95 – Compact Range Antenna Measurement System at Millimeterwaves Using Dielectric Lenses
Preliminary studies for the design of a collimating dielectric lens antenna (Carlos Fernandes).
- PRAXIS XXI - 2/2.1/TIT/1562/95 - ISAC - Implementation Aspects of a Mobile Telecommunication Satellite Payload with Dynamic Channel Allocation
Study of voltage controlled reactive elements to be used on monolithic active phase shifters with GaAs and Si technologies. One MMIC with MESFET GaAs technology was fabricated and tested and a model for small gate width MESFETs was derived. (J. Costa Freire, Custódio Peixeiro).
- COST 245 – Active and Phased Array Antennas
Participation in the Management Committee Meeting that took place in Trondheim, Norway, 3-5 June (A.M. Barbosa).
- COST 259: Wireless Flexible Personalized Communications
Development of propagation models for outdoor environments in the UHF and millimetre wavebands: at the UHF band, models have been developed for urban scenarios and tested in the city of Lisbon for GSM with the collaboration of TELECEL. The work in the millimetre waveband has been done within the characterization of the propagation channel, for both the average decay of power and signal fading. Also some work on traffic aspects and optimization of cellular planning has been done (Luís Correia).
- ACTS AC204 – SAMBA: System for Advanced Mobile Broadband Applications
Design, construction and test of dielectric lens antennas for the base station of MBS systems, intended to provide uniform coverage of wide sectored cells at 40 GHz band. Re-design, fabrication and test of elongated cell lens antennas. Propagation measurements campaign in indoor scenarios, to assess the

antenna performance. Comparison of cellular deployment characteristics between the 40 and 60 GHz bands for Mobile Broadband Systems. Study of traffic aspects, considering users mobility in linear cell structures, and the influence of cell size and mobile speed on handover performance.. Design of a wide band microstrip/WG transition. (Carlos Fernandes, J. Costa Freire, Custódio Peixeiro and Luís Correia).

- ACTS - CABSINET: Cellular Access to Broadband Services and Interactive Television

Survey of the literature on propagation channel characteristics at the 6 GHz band. Measurement of penetration losses for various building materials inside the IST campus, and of power decay with distance for several scenarios inside the IST campus as well; from these measurements general characteristics of wall losses and signal propagation have been inferred (Luís Correia).

- SMRF - Modular RF System

Design and test of hemispherical coverage quadrifilar helical antennas for a LEO portable ground station terminal. Optimization of the configuration for hemispherical coverage and impedance. Design and test of the VHF upconverter (with special emphasis on the design of an active image rejection filter) and the transceiver frequency synthesizer that includes a HF temperature compensated crystal oscillator TCXO and two PLLs (Carlos Fernandes, J. Costa Freire).

- Solid dielectric horn antennas (internal project)

Theoretical study of the similarities between circular and rectangular dielectric rods - joint work with Prof. Carlos Salema (Carlos Fernandes).

- Modeling of wall penetration loss at 5 GHz (internal project)

Development of a new model to describe building penetration loss at 5 GHz and enable interpretation of measured results. Simulation and measurement campaigns. Final Year project of B.Sc. student (Nuria Ruiz), in the frame of Socrates program (Carlos Fernandes).

- Health safety analysis for mobile communication systems (internal project)

Some attention is being devoted to this area, by evaluating the maximum transmitted power that is possible at the mobile phone for mobile communications systems, due to limitation imposed by safety considerations. Also the case of buildings with GSM base stations on top or in the vicinity has been analyzed (Luís Correia).

- Cellular planning for nonuniform traffic distributions (internal project)

Optimization of cellular planning parameters, like the ratio of division into micro- and macro-cells and cell radius for both cell types, in the real case of nonuniform distributions of traffic in city environments. Deployment cost is being considered as well. Data from a real system is being used, given by a GSM operator, TELECEL (Luís Correia).

- Telecel - Signal level requirements for 2 W mobile phones (internal project)

With the purpose of setting standard values for additional attenuation coming from penetration to indoor scenarios, a measurement campaign was performed for various buildings in the cities of Lisbon and

Oporto. After processing the data from a statistical point of view, buildings were classified, and several statistical parameters (mean, median, standard variation, and so on) were evaluated for each class (Luís Correia).

- MMICs on BiCMOS technology (internal project)

Design and test of microwave power amplifiers and antenna switch using conventional BiCMOS technology. Test of the amplifiers using chip on board technology (M. João Rosário).

- High linearity optical amplifier (internal project)

Study of linear amplifiers for amplitude modulated cable TV distribution. Design, fabrication and test of an optical receiver for use in all-optical cable television distribution network. The key component is a highly linear hybrid amplifier (M. João Rosário).

- CMOS low noise down converter (internal project)

Design of a low noise down converter for GSM (900MHz) specifications using conventional CMOS technology (M. João Rosário).

Ph. D. Theses

- Pedro M. Ramos (supervisor: C. R. Paiva), Instituto Superior Técnico, to be concluded in 2000 (subject: Soliton switching in nonlinear fiber couplers).
- António L. Topa (supervisor: A. M. Barbosa; co-supervisor: C. R. Paiva), Instituto Superior Técnico, concluded in 1998 (subject: Propagation and radiation in planar bianisotropic structures).
- Jorge R. Costa (supervisor: C. R. Paiva; co-supervisor: A. M. Barbosa), Instituto Superior Técnico, to be concluded in 2000 (subject: Soliton amplification in erbium-doped fiber amplifiers).
- Fernando M. Janeiro (supervisor: C. R. Paiva; co-supervisor: A. L. Topa), Instituto Superior Técnico, to be concluded in 2000 (subject: Soliton transmission control).
- Fernando J. Velez (supervisor: Luis M. Correia), Instituto Superior Técnico, in preparation (subject: Cellular planning for mobile broadband systems in urban environments).
- João Caldinhas Vaz (supervisor: J. Costa Freire), Instituto Superior Técnico, concluded April 1998 (subject: Monolithic millimetrewaves Class A Power Amplifier)
- Jorge Torres (supervisor: J. Costa Freire), Instituto Superior Técnico, in preparation (subject: Multifunction Monolithic Microwave Integrated Circuits)
- Fernando Fortes (supervisor: M. João Rosário), Instituto Superior Técnico, in preparation (subject: Monolithic Microwave Power Amplifiers)

M.Sc. Theses

- Luís M. Manica (supervisor: C. R. Paiva), Instituto Superior Técnico, concluded in 1998 (subject: Wavelength-division-multiplexing soliton communication systems).
- Pedro Vasconcelos (supervisor: Luis M. Correia), Instituto Superior Técnico, concluded in 1998 (subject: Characterization of the propagation channel in mobile broadband systems at the millimeter waveband).
- Nuno C. Gonçalves (supervisor: Luis M. Correia), Instituto Superior Técnico, concluded in 1998 (subject: Propagation models for mobile communication systems in micro-cell structures at the UHF band).
- José L. Pereira (supervisor: C. R. Paiva), Instituto Superior Técnico, to be concluded in 1999 (subject: Dispersion management in soliton communication systems).
- Miguel André Filipe (supervisor: Carlos Fernandes), Instituto Superior Técnico, in preparation (subject: Development of shaped beam antennas for millimetrewaves mobile communications).
- Luís Manuel Anunciada (supervisor: Carlos Fernandes), Instituto Superior Técnico, in preparation (Subject: Impact of shaped beam antennas on the millimetrowave mobile communications propagation channel).
- Ana Domingues (supervisor: Luis M. Correia), Instituto Superior Técnico, to be concluded in 1999 (subject: Models for penetration and indoor propagation in mobile communication systems at the UHF band).
- Dragana Kestic (supervisor: Luis M. Correia), Instituto Superior Técnico, to be concluded in 1999 (subject: Optimization of cellular planning for nonuniform traffic distributions in mobile communication systems at the UHF band).
- Gabriela Marques (supervisor: Luis M. Correia), Instituto Superior Técnico, in preparation (subject: Wideband channel modelling for wireless broadband communications at the millimetre waveband).
- Henrique José da Silva (supervisors: Maria João Rosário and Custódio Peixeiro), Instituto Superior Técnico, to be concluded in 1999 (subject: Active Printed Antennas).
- Fernando Azevedo (supervisor: Maria João Rosário), Instituto Superior Técnico, to be concluded in 1999 (subject: CMOS Monolithic DECT RF receiver front end).
- Guilherme Mascarenhas (supervisor: João Costa Freire), Instituto Superior Técnico, to concluded in 1999 (subject: monolithic active phase shifters).

Publications

Books and Book Chapters

A.L. Topa, C. R. Paiva, and A. M. Barbosa, "Complete Spectral Representation for the Electromagnetic Field of Planar Multi-Layered Waveguides Containing Pseudochiral Ω -Media," in *Progress in Electromagnetics Research 18*, EMW Publishing, Cambridge, Massachusetts, USA, Chapter 5: pp. 85-104, 1998.

Eraldo Damosso and Luis M. Correia (eds.), "*Digital Mobile Radio: Evolution Towards Future Generation Systems. COST 231 Final Report*", COST Secretariat, CEC, Brussels, Belgium, 1998.

Papers in Journals

L. M. Manica and C. R. Paiva, "Combined Effect of Group Velocity and Group-Velocity Dispersion Mismatches on Wavelength-Division Multiplexing with Fiber Solitons", *Microwave and Optical Technology Letters*, Vol. 18, no. 2, pp. 154-159, June 1998.

L. Topa, C. R. Paiva, and A. M. Barbosa, "Full-Wave Analysis of a Nonradiative Dielectric Waveguide with a Pseudochiral Slab", *IEEE Transactions on Microwave Theory and Techniques*, Vol. 46, no. 9, pp. 1263-1269, September 1998.

J. R. Costa and C. R. Paiva, "Multichannel Soliton Amplification in Erbium-Doped Fiber Amplifiers," *Microwave and Optical Technology Letters*, Vol. 19, no. 4, pp. 309-313, November 1998.

Fernando J. Velez and Luis M. Correia, "Traffic from Mobility in Mobile Broadband Systems", *Telekonikk*, Vol. 94, No. 3/4, 1998, pp. 95-101.

Fernandes; J. G. Fernandes; "Performance of Lens Antennas in Wireless Indoor Millimeter Wave Applications", Accepted for publication in a special issue, *IEEE Trans. of Microwave Theory and Techniques*.

Kam Weng Tam, Pedro Vitor and Rui Martins, "MMIC active filter with tuned transversal element", *IEEE Trans. on circuits and systems II: Analog and Digital Signal Processing*, vol. 45, pp.632-634, May 1998.

Papers in Conference Proceedings

A. L. Topa, C. R. Paiva, and A. M. Barbosa, "Hybrid Mode Propagation in Pseudochiral Uniaxial Waveguides with Rectangular Cross-Section", *Bianisotropics'98*, pp. 151-154, Braunschweig, Germany, June 3-6, 1998.

A. L. Topa, L. N. Vicente, C. R. Paiva and A. M. Barbosa, "Application of the Least Squares Method to the Analysis of Planar Waveguides for Integrated Optics" (Abstract), *Optimization 98*, Coimbra, Portugal, July 1998.

P. M. Ramos, J. R. Costa, and C. R. Paiva, "Erbium-Doped Nonlinear Fiber Coupler: Influence of Wavelength Mismatch on Soliton Switching", *PIERS'98 - Progress in Electromagnetics Research Symposium*, p.210, Nantes, France, July 1998.

J. R. Costa and C. R. Paiva, "Wavelength-Division Multiplexing with Solitons in Erbium-Doped Fiber Amplifiers", *Progress in Electromagnetics Research Symposium (PIERS'98)*, p. 211, Nantes, France, July 1998.

A. L. Topa, C. R. Paiva, and A. M. Barbosa, "Leaky Modes in Chiral Rib Waveguides", *Progress in Electromagnetics Research Symposium (PIERS'98)*, p. 517, Nantes, France, July 1998.

A. L. Topa, C. R. Paiva, and A. M. Barbosa, "Rigorous Analysis of the Rectangular Waveguide Loaded with a Pseudochiral Slab", *APMC'98 - Asia-Pacific Microwave Conference*, Vol. 1, pp. 277-280, Yokohama, Japan, December 1998.

Plattner, B. Byzery, C. Fernandes, T. Karttaavi, "A Compact, Portable 40 GHz Transceiver for the Mobile Broadband System", *Procs. ACTS Mobile Communication Summit 1998*, Rhodes, Greece, p. 843, June 1998.

C. A. Fernandes; J. G. Fernandes; "Performance of Lens Antennas in Wireless Indoor Millimeter Wave Applications", *RAWCON'98*, Colorado, pp. 225-228, August 1998.

C. A. Fernandes; "Synthesis of Lens Antennas Using Geometrical Optics", *MTQP Workshop – Mathematical Problems in Telecommunications*, Coimbra, September 1998.

J. G. Fernandes, C. A. Fernandes; "Impact of Shaped Lenses on MBS Systems", *PIMRC' 98*, Boston, USA, p. 744, September 1998.

Luis M. Correia, "Traffic Modelling and Its Influence in Planning Optimization in Dense Urban Networks", *Communications for the Millennium - COST 252/259 Joint Workshop*, Bradford, UK, April 1998.

Peter Karlsson and Luis M. Correia, "Propagation Characteristics for Broadband Radio Access at mm-Waves", *Communications for the Millennium - COST 252/259 Joint Workshop*, Bradford, UK, April 1998.

Pedro Vasconcelos and Luis M. Correia, "Fading Dependence on Scenario and Antenna Characteristics at the 60 GHz Band", *IEEE 48th Vehicular Technology Conference*, Ottawa, Canada, May 1998.

Filippo Gaggioli and Luis M. Correia, "Assessment of Diversity Performance from Measured Data at the Millimetre Waveband", *IEEE 48th Vehicular Technology Conference*, Ottawa, Canada, May 1998.

Gerardo C. Angelo, Isabel Neto and Luis M. Correia, "Health and Penetration Issues in Buildings with GSM Base Station on Top", *IEEE 48th Vehicular Technology Conference*, Ottawa, Canada, May 1998.

Krzysztof Kurek and Luis M. Correia, "Wideband Analysis of the Propagation Channel for Urban Streets at 60 GHz", *MIKON'98 - International Conference on Microwave & Radar*, Krakow, Poland, May 1998.

Fernando J. Velez and L. M. Correia, "Influence of Traffic from Mobility on the Microcellular Coverage Distance in Mobile Broadband Systems", *ACTS Mobile Summit*, Rhodes, Greece, June 1998.

Lívio Santos, Lúcio S. Ferreira, Valentina Garcia and Luis M. Correia, "Cellular Planning Optimisation for Non-Uniform Traffic Distributions", *IEEE 9th International Symposium on Personal, Indoor and Mobile Radio Communications*, Boston, USA, September 1998.

Fernando J. Velez and , L. M. Correia, "Capacity Trade-offs in Mobile Broadband Systems Using Guard Channels for High Mobility Handover", *IEEE 9th International Symposium on Personal, Indoor and Mobile Radio Communications*, Boston, USA, September 1998.

Dragana Kristic and Luis M. Correia, "Optimisation of Micro-Cellular Areas by Minimising the Number of Base Stations", *IEEE 9th International Symposium on Personal, Indoor and Mobile Radio Communications*, Boston, USA, September 1998.

Nuno C. Gonçalves and Luis M. Correia, "Propagation Model for Urban Micro-Cellular Systems at the UHF Band", *IEEE 9th International Symposium on Personal, Indoor and Mobile Radio Communications*, Boston, USA, September 1998.

Fernando J. Velez, L. M. Correia, "Models for Traffic from Mobility in Micro-cellular Mobile Communication Systems" (in Portuguese), *MTQP Workshop - Mathematical Problems in Telecommunications*, Coimbra, Portugal, September 1998.

Luis M. Correia, "Mobile Broadband Systems - Early Concepts and Future Perspectives", *Workshop on Enabling Technologies for Future Wireless Communications at the 28th European Microwave Conference*, Amsterdam, The Netherlands, October 1998.

Sadowski, W. and C. Peixeiro, "Microstrip Patch Antenna for a GSM 1800 Base Station", *MIKON'98 - International Conference on Microwaves & Radar*, pp. 409-413, Crakow, Poland, May 1998.

Barilese, B. and C. Peixeiro, "Wide-Band Microstrip Patch Antenna Element", *1998 AP-S International Symposium*, pp. 1104-1107, Atlanta, USA, June 1998.

Peixeiro, C., "Teaching Microstrip Patch Antennas to Undergraduate Students", *1998 AP-S International Symposium*, pp. 2284-2287, Atlanta, USA, June 1998.

Jorge P. Torres, J. Costa Freire, "MMIC Chips on Board for Wireless Communications", *4th International Conference on Millimeter and Submillimeter Waves Applications*, SPIE vol.3465, pp. 112-116, San Diego, USA, July 1998.

J. P. Cordeiro, C. Peixeiro and J. Costa Freire, "Millimetrewave Microstrip to Waveguide Transition", *M+RF Microwave and Communication Technologies Conference*, pp. 300-303, London, UK, September 1998.

Henrique J. Silva, Maria João Rosário, "Monolithic Feedback LNA for Active Antenna Simultaneously Input Port Signal and Noise Matched", *5th International Conference on Electronics, Circuits and Systems*, vol.3, pp. 33-36, Lisboa, Portugal, September 1998.

Fernando Fortes, Maria João Rosário, "Design of Low Voltage BiCMOS Power Amplifiers for Wireless Communications", *5th International Conference on Electronics, Circuits and Systems*, vol.3, pp. 41-44, Lisboa, Portugal, September 1998.

Fernando Fortes, J. Costa Freire, Maria João Rosário, "A BiCMOS Low Voltage Power Amplifier for Wireless Communications", *28th European Microwave Conference*, pp. 150-155, Amsterdam, Netherlands, October 1998.

Jean-Philippe Cordeiro, J. Costa Freire, "Scaling Non Linear Models for Low g_m Mesfets", *GAAS'98 - Gallium Arsenide Applications Symposium*, pp. 361-365, Amsterdam, Netherlands, October 1998.

H. J. Silva, M. J. Rosário and C. Peixeiro, "X Band Active Microstrip Antenna", *APMC'98 - Asia-Pacific Microwave Conference*, pp. 483-487, Yokohama, Japan, December 1998.

Deliverables

A. Fernandes; "Description and Test Report on Antennas", Deliverable of ACTS-AC204 SAMBA Project, 0204/IST/DEC/DS/R/010/b1.

Jorge Torres, J. Costa Freire, "Monolithic Low Noise Down Converter and LSB Rejection Up Converter for the Mobile Handset Terminal", Deliverable R2200.1 of PRAXIS XXI – 3/3.1/TIT/35/94 – ITCOM Project.

Miscellaneous

- C. R. Paiva, C. Fernandes, L. Correia, C. Peixeiro reviewers for *CONFETELE'99 - II Conference on Telecommunications* to be held in Sesimbra, Portugal, April 1999.
- A.M. Barbosa reviewer for *28th European Microwave Conference*, Amsterdam, Holland.
- A.M. Barbosa National Delegate to Action *COST 260*.
- A.M. Barbosa member of the Executive Board of *Instituto de Telecomunicações*.
- A.M. Barbosa, L. Correia, C. Fernandes, C. Peixeiro, A. Topa members of the Organizing Committee of *CONFETELE'99 – II Conference on Telecommunications*.
- J. Costa Freire is a Member of the Management Committee of the *European Microwave Conference*.
- J. Costa Freire was reviewer of papers presented to the *28th European Microwave Conference and GAAS'98 - Gallium Arsenide Application Symposium*.
- Carlos Fernandes; "Switchable shaped beam lens antenna for millimetrewave mobile applications", Presented in the *22nd QMW Antenna Symposium*, London, April 1998.
- Luis M. Correia is reviewer for *Wireless Personal Communications*, *IEEE Transactions on Vehicular Technology*, *28th European Microwave Conference* and *Globecom'98*.
- Luis M. Correia co-editor, with Prof. Masao Nakagawa (Keio University, Japan), of a special issue of *Wireless Personal Communications on Wireless Broadband Systems*.
- Luis M. Correia member of the Technical Committee of *International Conference on Telecommunications*, Thessaloniki, Greece, June 1998.
- Luis M. Correia elected Chairman of *COST 259* in April 1998.
- Luis M. Correia, "Propagation Models and Cellular Planning", *Training Course on Mobility Applications and Services*, King's College, London, UK, April 1998.
- Luis M. Correia, "Health and Antennas Issues of Mobile Communications Applied to GSM", *Training Course on GSM*, Universidad Politécnica de Valencia, Valencia, Spain, November 1998.

9.1.2 Integrated Circuits and Systems Research Line

Human Resources

Collaborators

- José E. Franca Ph.D Associate Professor, IST
- Carlos A. Leme Ph.D Assistant Professor, IST
- João C. Vital Ph.D Assistant Professor, IST
- Nuno Horta Ph.D Assistant Professor, IST

Other Collaborators

- Dra. Yan Yan Qiu Ph.D Grant, IST
- Rui P. Martins Ph.D Director FCT/Univ. Macau
- Nuno Franca Ph.D Student Research Assistant INETI
- Alexandre Almeida Ph.D Student
- João Goes Ph.D Student
- João P. Carreira Ph.D Student Engineer ATMEL-ES2
- Jorge Guilherme Ph.D Student Assistant, IPT
- Nuno Garrido Ph.D Student Grant, IST
- Paulo J. Santos Ph.D Student Grant, IST
- Rui Neves Ph.D Student Grant, IST
- Marco Pereira M.Sc. Student
- Ricardo Reis Ph.D Student
- Pun Pang Ph.D Student Grant, IST
- Eduardo Viegas Ph.D Student
- Tiago Marques Researcher Grant, IST
- Paulo Pereira Researcher student Grant, IST
- Vitor Mendes Research Student Grant, IST
- Paulo Jesus Research Student Grant, IST
- Pedro Azevedo Research Student Grant, IST
- Marco Oliveira Research Student Grant, IST
- Vitor Silva Research Student Grant, IST
- Paulo Assis Research Student Grant, IST
- Gonçalo Minderico Research Student Grant, IST
- António Leal Research Student Grant, IST
- Ana Marcelino Secretary Staff member IST

- Paula Silva Secretary Staff member IST

Projects

The main focus and strategic scientific objectives of Group are in the field of analogue-digital integrated circuits, including analogue and digital signal processing techniques, design of components, circuits and systems in silicon technologies, as well as design-oriented testing and computer-aided design, which are vital for the development of state-of-the-art microsystems. International competitiveness is of paramount concern to the group activities.

Stimulation of final year students of electrical engineering to undertake advanced research projects, preferably leading to the completion of post-graduation programs.

Creation of modern computational and instrumentation facilities as well as easy access to advance processing technologies for integrated circuit manufacturing.

Stimulation of closer links to the national industry, both through the undertaking of joint cooperative research projects as well as through the development of continuing education and training courses of professionals.

Development of an European-wide, diversified funding-base for the continuous development of state-of-the-art research development projects.

During 1998, research activities were carried-out in the following cooperative projects:

- ECOCLIMAT

Objectives: Research and development of sensorial microsystems and power line carrier modems for home system applications, notably for automatic management of energy. Participants: The IST Centre for Microsystems is part of a national consortium led by ATECMIC. Sponsor: Ministry of Industry through the PEDIP program.

- CATALYST: HIGH-LEVEL SYNTHESIS AND MODELING OF MULTI-STEP ADCs

Objectives: Research and development of computer-aided methodologies and techniques for high-level synthesis and modeling of high-frequency multi-step analog-to-digital converters. Sponsor: The Portuguese Agency for Scientific and Technology Research (JNICT).

- MINIAN: MINIMUM ANALOG CONTENT SIGMA-DELTA MODULATORS

Objectives: Research, development and experimental demonstration of new sigma-delta modulators with minimum analog content for oversampling analog-to-digital converters. Sponsor: The Portuguese Agency for Scientific and Technology Research (JNICT).

- PAPRICA: POWER AND PART COUNT REDUCTION INNOVATIVE COMMUNICATION ARCHITECTURE
Objectives: Specify design, build and validate the DECT and DCS application Demonstration Board.
Participants: ATMEL/ES2 (France), IST (Portugal), Matra Communications (France).
- ASIC4PMR: ARCHITECTURE FOR SINGLE CHIP FOR PRIVATE MOBILE RADIO COMMUNICATION
Objectives: The project will provide telecommunication equipment manufacturers the capability to integrate on a single chip a baseband and control circuitry of a digital radio terminal. Participants: ATMEL ES2 (France), ARM (United Kingdom), THERA (Italy), IST (Portugal), Matra Communication (France), OTE (Italy).
- POLICOM : POWER LINE COMMUNICATION ASIC
Objectives: The objective of this project is the design of a low-cost, easy-installation, robust system to allow communication between different equipment using the low-voltage power line. It will cover a whole range of applications from remote power reading to home-automation and remote control for industrial applications. Participants: SAINCO (Spain), ATMEL ES2 (France), Instituto Superior Técnico (Portugal), SANTEL (Sweden).
- RAPID: Retargetability for Reusability of Application-Driven Quadrature D/A Interface Block Design
Objectives: The objective of this project is to develop an advanced methodology to support the design of Quadrature D/A Interface blocks aiming at their reusability by an automatic retargetting procedure with minimal changes on their structural sub-blocks. Participants: CM-IST Coordinator (Portugal), IMSE-CNM (Spain), Chipidea (Portugal).
- MIXMODEST: Mixed Mode in Deep Submicron Technology
Objectives: The most important objective of the project is to obtain a design methodology including basic structures and circuits that will enable future state of the art analogue functions, such as front-ends, to be implemented in a basic mainstream digital 0.35 μ m and 0.25 μ m CMOS technology. Participants: ALCATEL Microelectronics Coordinator, IMSE, IST, UNIPAV, KULeuven

Ph.D. Theses

- N. Franca, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: automatic synthesis of circuit components for mixed-signal VLSI integration).
- A. Gano, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: design and applications of sensorial microsystems combining monolithic and thick film hybrid integrated technologies).
- A. Almeida, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: analog circuit techniques for neural networks and applications).

- P. Jorge Santos, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: decimation and interpolation switched-capacitor circuits for high-frequency application in radiocommunications).
- J. P. Carreira, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: current-mode data converters in sub-micron technologies).
- N. Garrido, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: design of adaptive analog filters for magnetic front-end read channels).
- R. Neves, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: signal processing and conversion techniques for narrow bandwidth applications).
- J. P. Oliveira, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: video frequency A/D converters using current processing techniques).
- J. Goes, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: high-resolution and high-speed analog-digital converters using linearization techniques).
- J. C. Guilherme, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: design techniques for logarithmic analog-digital conversion in CMOS technology).
- R. Reis, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: nanopower delta-sigma modulators).
- P. Pang, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: CMOS analog techniques for quadrature modulators in RF front-ends).
- E. Viegas, (supervisor: Carlos Azeredo Leme), Instituto Superior Técnico, in preparation (subject: Integrated Circuits for Mobile Communications).

Msc. Theses

- M. Pereira, (supervisor: José E. Franca), Instituto Superior Técnico, in preparation (subject: automatic layout generation methodologies of analogue modules for CMOS integrated circuits).

Publications

Books and book chapters

José E. Franca, Carlos Azeredo Leme, João C. Vital, "Analog-digital Conversion", Encyclopedia of Electrical Engineering, Wiley to be published.

Papers in Journals

Y. Y. Qiu, A. Almeida, R. Vilar, "Structure Characterisation of a Laser Surface Processed Al-Mo Alloy", *Journal of Materials Science*, Vol. 33, pp. 2639-2651, 1998.

C. Azeredo Leme, J. Silva, P. Rodrigo, J. Franca, "A Low-Power CMOS 9-Channel 40 Mhz Binary Detection System with Self-Calibrated 500 μ V Offset", *IEEE Journal of Solid-State Circuits*, Vol. 33, No. 4, pp. 565-572, April 1998.

Seng-Pan U, R. P. Martins, J. E. Franca, "Impulse Sampled FIR Interpolation with SC Active-delayed Block Polyphase Structures", in *Electronic Letters*, Vol. 34, No. 5, pp. 443-444, 5th March 1998.

Y. Y. Qiu, "The Splitting Behavior of Y' Particles in Ni-based Alloys", *Journal of Alloys and Compounds*, 270, 1998, pp. 145-153.

João Goes, João C. Vital, José E. Franca, "Systematic Design for Optimization of High-Speed Self-Calibrated Pipelined A/D Converters", *IEEE Transactions on Circuits and Systems*, Part II, December 1998.

Papers in Conference Proceedings

Nuno de F. Garrido, José E. Franca, "A Continuous-Time Area Detector Servo Demodulator for Hard Disk Drives", *Proc. IEEE ICECS'98*, Vol. 2, pp. 127-130, Spt. 1998.

Nuno de F. Garrido, José E. Franca, "An Auto-Biased 0.5 μ m CMOS Transconductor for Very High Frequency Applications", *Proc. IEEE ISCAS*, May 1998.

N. Horta, J. E. Franca, "Exploring Data Conversion Architectures by Symbolic Computation", *Proc. IEEE International Symposium on Circuits and Systems*, 1998.

J. Guilherme, N. Horta, J. E. Franca, "Symbolic Synthesis of Non-Linear Data Converters", *Proc. IEEE International Conference on Electronics Circuits and Systems*, Vol. 3, pp. 219-222, 1998.

N. Horta, J. E. Franca, "Analog and Mixed-Signal Systems Topologies Exploration Using Symbolic Methods", *5th International Workshop on Symbolic Methods and Applications to Circuit Design*, pp. 150-153, 1998.

R. F. Neves, J. E. Franca, "A Switched-Capacitor N-path Decimating Filter", *Proc. IEEE Trans. ISCAS'98*, Vol-I, pp. 472-475, June 1998.

R. F. Neves, J. E. Franca, "Dynamic Element Matching for Time Interleaved Filters", *UCSB Workshop on Signal and Image Processing*, December 1998.

K. P. Pun, J. E. Franca and C. A. Leme, "Basic Principles and New Solutions for Analog Sampled-Data Image Rejection Mixers", *5th International Conference on Electronics, Circuits and Systems*, Vol. 3, pp. 165-168, September 1998.

Markus Helfenstein, José E. Franca, George Moschytz, "Exact Design of Multirate Switched-Current Filters with Improved Phase Linearity", *Proc. 5th International Conference on Electronics, Circuits and Systems*, Vol. 3, pp. 351-354, September 1998.

Seng-Pan U, R. P. Martins, J. E. Franca, "A Novel Half-Band SC Architecture for Efficient Analog Impulse Sampled Interpolation", *5th International Conference on Electronics, Circuits and Systems*, vol. 1, pp. 389-393, September 1998.

F. Chavez, A. Olmos, C. Azeredo Leme, E. Charry, " A Temperature Compensation Subsystem for an IMEMS CMOS Pressure Sensor", presented at *11th Annual 1998 IEEE International ASIC Conference*.

C. Azeredo Leme, " Wideband Sub-Sampling A/D Conversion with Image Rejection", presented at *1st IEEE CAS Workshop on Wireless-Communication Circuits and Systems*, Lucerne, Switzerland, June 22-24, 1998.

C. Azeredo Leme, " Highly Integrated RF Front-Ends for Telecommunications", presented as a tutorial at *ICECS'98*, Lisbon, Portugal, September 7-10, 1998.

P. J. Santos, J. E. Franca, " Switched-Capacitor Interpolator for Direct Digital Frequency Synthesizers ", *Proc. of International Symposium on Circuits and Systems*, Monterey, June 1998.

F. A. Barúqui, A. Petraglia, S. K. Mitra, J. E. Franca, "Switched-Capacitor Filter for 0.8 μm CMOS", in *Proc. IEEE Int. Symp. Circuits and Systems ISCAS*, Monterey (CA) June 1998.

Chung-Yuk Or, José E. Franca, "Layout Driven Macromodel of an Operational Amplifier", in *Proc. of International Symposium on Circuits and Systems ISCAS*, Monterey (CA), June 1998.

9.1.3 Signal and Image Processing Research Line

9.1.3.1 Communication Theory and Pattern Recognition Group

Human Resources

Collaborators

- José Manuel Nunes Leitão Ph. D. Full Professor, I.S.T.
- Mário Alexandre Teles de Figueiredo Ph. D. Assistant Professor, I.S.T.
- Ana Luisa Nobre Fred Ph. D. Assistant Professor, I.S.T.
- Fernando Duarte Nunes Ph. D. Assistant Professor, I.S.T.
- José Manuel Bioucas Dias Ph. D. Assistant Professor, I.S.T.
- José E. Charters Ribeiro C. Sanguino M. Sc Assistant, I.S.T.
- Francisco Alberto Sena da Silva M. Sc. Assistant, I.S.T.

Other Collaborators

- Fernando Gomes de Sousa Ph. D. student Adjoint Professor, I.S.E.L.
- Paulo Alexandre Carapinha Marques Ph. D. student Adjoint Professor, I.S.E.L.
- José António de Oliveira Costa Ph. D. student Grant, PRAXIS XXI
- Rui Manuel Pires da Silva Castro Ph. D. student Grant, PRAXIS XXI
- Luis António TavaresRocha Pontes M. Sc. Student Grant, PRAXIS XXI
- Tiago Araújo Marques da Silva M. Sc. Student Grant, PRAXIS XXI

Projects

- SICNAP - Integrated System for Harbour Control and Navigation.

This is a multidisciplinary and multi-institutional project, coordinated by LNEC (*National Laboratory of Civil Engineering*) and financially supported by NATO through the *Science for Stability* program (PO-NAVIGATION project). Its goals are to develop and implement a harbor traffic control system, to be installed in Sines. It involves navigation and positioning systems (GPS - *global positioning system*), radar, and telecommunications aspects. (José M. N. Leitão, José E. C. R. C. Sanguino, and Luis R. Pontes).

- SARA – Sistema Aéreo de Reconhecimento Automático (Automatized Systems for Air Surveillance) (PRAXIS XXI).

It is a multi-disciplinary and multi-institutional project coordinated by the Department of Mechanical Engineering of IST. We are dealing with the communications (data-links) and navigation (differential GPS – Global Positioning System) aspects. (José M. N. Leitão, José E. C. R. C. Sanguino, and F. D. Nunes).

- μEEG - Microstructural Characterization of Sleep EEG.

This project is supported by JNICT (FCT) under grant PECS/C/SAU/212/95. It deals with the hierarchical analysis of the microstructure of sleep electroencephalographic data using stochastic models, in a lower level, and syntactic models (stochastic grammars) at a higher level. (Ana L. N. Fred - project co-ordinator).

- ENN - European Neurological Network.

Supported by the Telematics Applications Program of the European Union. It is headed by ISTEEL (*Institute of Sleep and Telemedicine*, of Portugal) and involves teams from 9 European countries. Goals are the creation of a multimedia telematic network in the areas of sleep and epilepsy. Our domains of participation include signal processing and artificial intelligence aspects. (Ana L. N. Fred).

- SIN - Integrated Systems for Communication and Navigation (PRAXIS XXI 2/2.1/TIT/1583/95).

This project deals with differential GPS navigation, in which the communication between the mobile platform and the base station plays an essential role. This project emerges from the group's participation in the above mentioned SICNAP and ARMOR projects. (José M. N. Leitão - project coordinator, Fernando D. Nunes, José E. C. R. C. Sanguino, Francisco A. S. Silva, Fernando M. G. Sousa, and Luis R. Pontes).

- IMAPA - Integration of Stochastic and Structural Models in Image and Pattern Analysis (PRAXIS XXI – 2/2.1/TIT/1580/95).

Its goals are the development of image/pattern analysis techniques combining stochastic and structural models and methods. Application areas include: medical imaging, remote sensing images, and financial document images. (José M. N. Leitão - project coordinator, Mário A. T. Figueiredo, Ana L. N. Fred, and José M. B. Dias).

- HIPNOS - Automatic Sleep Classification (PRAXIS XXI).

This is a collaboration project involving the Electroencephalography Laboratory of *Centro de Estudos Egas Moniz* (Egas Moniz Study Center) of *Santa Maria* hospital, the Center for Sleep Medicine of the University of Parma, and the Medical Physics Institute of the University of Warsaw. (Ana L. N. Fred)

- SAMI - Segmentation and Analysis of Medical Images: A Content-Based Retrieval Approach.

This project is supported by NATO Collaborative Research grant #CRG 960010; it involves collaboration with the Pattern Recognition and Image Processing Laboratory (Department of Computer Science) of the Michigan State University (Prof. Anil K. Jain). The goal of the project is to develop integrated

segmentation/analysis techniques for medical images, by approaching the problem from a content-based image retrieval perspective. (José M. N. Leitão, Mário A. T. Figueiredo).

PhD. Theses

- José Eduardo Charters Ribeiro Cunha Sanguino (supervisor: José M. N. Leitão), Instituto Superior Técnico. In preparation. (Subject: Positioning and navigation based on differential GPS).
- Francisco Alberto Sena da Silva (supervisor: José M. N. Leitão). Instituto Superior Técnico. In preparation. (Subject: Importance sampling for communication systems simulation).
- Fernando Manuel Gomes de Sousa (supervisor: José M. N. Leitão), Instituto Superior Técnico. In preparation. (Subject: Open loop structures for digital communications; DSP based implementations).
- Paulo Alexandre Carapinha Marques (supervisor: José M. B. Dias), Instituto Superior Técnico. In preparation. (Subject: Mobile Targets Detection and Tracking in Synthetic Aperture Radar).
- José António de Oliveira Costa (supervisor: José M. N. Leitão), Instituto Superior Técnico. In preparation. (Subject: Ambiguity Resolution as a Nonlinear Recursive Estimation and Sequential Detection Problem).
- Rui Manuel Pires da Silva Castro (supervisor: José M. N. Leitão), Instituto Superior Técnico. In preparation. (Subject: Systematic Criteria for the Synthesis of Nonlinear Filters).

MSc. Theses

- Luis António Tavares Rocha Pontes (supervisor: José M. N. Leitão), Instituto Superior Técnico. Concluded in 1998. (Subject: Satellite Positioning and Navigation as a Nonlinear estimation Problem: Application to GPS).
- Tiago Araújo Marques da Silva (supervisor: José M. B. Dias), Instituto Superior Técnico. To be concluded in 1999. (Subject: Absolute Phase Estimation in Interferometry).
- Elsa Susana dos Reis da Fonseca (co-supervisor: José M. B. Dias), Instituto Superior Técnico, Concluded in 1998. (Subject: Monitoring of smoke emissions by a LIDAR system).

Publications

Books and Book Chapters

M. Figueiredo, J Leitão and A. K. Jain, *Elements of Bayesian Theory and Markov Random Fields for Image Analysis*. To be published by Springer Verlag (New York).

Papers in Journals

J. Dias and J. Leitão, "Nonparametric estimation of mean Doppler and spectral width", *IEEE Transactions on Geoscience and Remote Sensing*. Submitted.

M. Figueiredo, J. Leitão and A. Jain, "Unsupervised contour representation and estimation using B-splines and a minimum description length criterion". *IEEE Transactions on Image Processing*. Submitted.

M. Figueiredo and R. Nowak, "A Bayesian Non-Informative Approach to Wavelet-Based Signal Denoising", *IEEE Transactions on Signal Processing*. Submitted.

J. Leitão and M. Figueiredo, "Absolute phase image reconstruction: A stochastic nonlinear filtering approach" in *IEEE Transactions on Image Processing*, Vol. 7, No. 6, pp. 868-882, June 1998.

F. Nunes, J. Santos and M. E. Manso, "Recursive algorithm for fast evaluation of the Abel inversion integral in broadband reflectometry", *Review of Scientific Instruments*. Accepted for publication.

F. Nunes, M. Manso, I. Nunes, A. Silva, and P. Varela, "On the application of the Wigner-Ville distribution to broadband reflectometry", *Fusion Engineering and Design*. Accepted for publication.

F. Nunes and J. Leitão, "A nonlinear filtering approach to estimation and detection in mobile communications", *IEEE Journal on Selected Areas in Communications – JSAC*, Vol. 16, No. 9, pp. 1649-1659, December 1998.

F. Nunes and J. Leitão, "Signal processing aspects of fusion plasma broadband reflectometry", *IEEE Transactions on Signal Processing*. Accepted for publication.

Papers in Conference Proceedings

A. Fred and J. Leitão, "Minimal sample size for grammatical inference: A bootstrap approach", in *Advances in Pattern Recognition*, pp. 920-928, Springer Verlag, 1998.

R. Castro and J. Leitão, "Phase estimation in mobile communications and navigation", in *Second Conference on Telecommunications - ConfTele'99*, Sesimbra (Portugal), 1999. Accepted for publication.

J. Cordeiro and J. Dias, "Contour estimation on piecewise homogeneous random fields", in *First International Conference on Enterprise Information Systems*, Setúbal (Portugal), 1999. Accepted for publication.

J. Costa and J. Leitão, "Satellite attitude estimation using GPS carrier phase", in *Second Conference on Telecommunications - ConfTele'99*, Sesimbra (Portugal), 1999. Accepted for publication.

J. Dias, A. Fernandes and P. Tavares, "Bayesian contour estimation: a subspace representation approach", in *Portuguese Conference on Pattern Recognition – RECPAD'98*, pp. 35-42, Lisboa, 1998.

J. Dias and J. Leitão, "Group lapped iterative techniques for fast resolution of large linear systems", in *Proceedings of IEEE International Conference on Electronics, Circuits, and Systems – ICECS'98*, Lisbon (Portugal), 1998.

- J. Dias and J. Leitão, "Simultaneous phase unwrapping and speckle smoothing in SAR images: a stochastic nonlinear filtering approach", in *Proceedings of the European Conference on Synthetic Aperture Radar – EUSAR'98*, pp. 373-377, Frieddrichshafen (Germany), 1998.
- J. Dias and T. Silva and J. Leitão, "Absolute phase estimation wit hdiscontinuities: a stochastic nonlinear filtering approach" in *Proceedings of the IEEE InternationalGeoscience and Remote Sensing Symposium – IGARSS' 98*, Seattle (USA), 1998.
- J. Dias and T. Silva and J. Leitão, "Adaptive restoration of speckled SAR images" in *Proceedings of the IEEE InternationalGeoscience and Remote Sensing Symposium – IGARSS' 98*, pp. 19-22, Seattle (USA), 1998.
- J. Dias and T. Silva and J. Leitão, "Adaptive restoration of speckled SAR images using a compound Markov random field" in *Proceedings of the IEEE InternationalConference on Image Processing – ICIP'98*, vol. II, pp. 79-82, Chicago (USA), 1998.
- M. Figueiredo and R. Nowak, "Bayesian wavelet-based signal estimation using non-informative priors", in *Proceedings of the 1998 IEEE Signal Processing Society Asilomar Conference on Signals, Systems, and Computers*. Accepted for Publication.
- M. Figueiredo and R. Nowak, "Empirical Bayes wavelet denoising using Jeffreys' prior", in *Second Conference on Telecommunications - ConfTele'99*, Sesimbra (Portugal). Accepted for publication.
- A. Fred and J. Leitão, "A comparative study of string dissimilarity measures in structural clustering" in *Proceedings of the International Conference on Advances in Pattern Recognition – ICAPR'98*, Springer Verlag, 1998.
- A. Fred and J. Leitão, "From EEG microstructure to sleep macrostructure: a unified approach", in *X Portuguese Conference on Pattern Recognition – RECPAD'98*, pp. 179-186, Lisboa, 1998.
- F. Nunes and J. Leitão, "Open loop receiver forMSK with Doppler frequency shift", in *IEEE GLOBECOM' 98*, Sidney (Australia), pp. 3626-3631, 1998.
- F. Nunes and J. Leitão, "Fast phase acquisition receiver for LEO communications in Rician channels", in *IEEE International Conference on Communications – ICC'99*, Vancouver (Canada). Accepted for publication.
- F. Nunes and J. Leitão, "A fast phase acquisition receiver for nongeostationary orbit satellites", in *Second Conference on Telecommunications - ConfTele'99*, Sesimbra (Portugal), 1998. Accepted for publication.
- F. Nunes, J. Santos, M. Manso, "Two layer perceptrons for fast plasma density evaluation in broadband reflectometry" in *Proceedings of IEEE International Conference on Electronics, Circuits, and Systems – ICECS'98*, pp. 2.253 – 2.256, Lisbon (Portugal), 1998.
- L. Pontes, A. Miranda, S. Marques, and J. Sanguino, "Integrated harbour navigationcontrolsystem", in *Proceedings of the Third CARIS Conference on Marine and Hydrographic Applications*, Rotterdam (The Netherlands), 1998.

F. Silva and J. Leitão, "Contour Processing for left ventricle function automatic classification", in *X Portuguese Conference on Pattern Recognition – RECPAD'98*, pp. 199-204, Lisboa, 1998.

T. Silva and J. Dias, "Restoration on coherent images using a compound Markov random field", in *in X Portuguese Conference on Pattern Recognition – RECPAD'98*, pp. 109-114, Lisboa, 1998

A. Vailaya, M. Figueiredo, A. K. Jain, and H. Jiang Zhang, "A Bayesian framework for classification of vacation images", in *Proceedings of the SPIE Conference on Electronic Imaging '99*, San Jose (USA), 1999. Accepted for Publication.

A. Vailaya, M. Figueiredo, A. K. Jain, and H. Jiang Zhang, "Content based hierarchical classification of vacation images", in *Proceedings of the IEEE International Conference on Multimedia Computing and Systems – ICMCS'99*, Florence (Italy), 1999. Accepted for publication.

Miscellaneous

Tutorials and other talks:

- M. Figueiredo, "Introduction to Bayesian methods and Markov random fields". Tutorial presented in the *IEEE International Conference on Computer Vision and Pattern Recognition – CVPR'98*, Santa Barbara (USA), June 1998.
- M. Figueiredo, "Bayesian signal estimation based on wavelets" (in Portuguese), Presented in the *IT Seminar on Theory and Applications of Wavelets*, December 1998.
- M. Figueiredo, "Bayesian analysis for biomedical imaging", Presented at the *Workshop on Biomedical Computing*, Pittsburgh Supercomputing Center, Pittsburgh (USA), June 1998.
- M. Figueiredo, "Introduction to Rissanen's minimum description length principle", Presented in the Department of Computer Science and Engineering, Michigan State University, East Lansing (USA), May 1998.
- J. Leitão, "Optimization Problems in Communication and Navigation", Presented in *the IT Seminar on Mathematics in Telecommunications*, September 1998.
- J. Leitão, "Surface Reconstruction in Interferometric Imaging", Presented in the Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh (USA), May 1998.

Editorial activity:

- José M. B. Dias: Associate Editor for IEEE Transactions on Circuits and Systems.

Refereeing activity:

- José M. N. Leitão: reviewer for IEEE Transactions on Signal Processing, IEEE Transactions on Circuits and Systems.

- Mário A. T. Figueiredo: reviewer for IEEE Transactions on Image Processing, IEE Electronics Letters, IEEE Transactions on Circuits and Systems.
- Ana L. N. Fred: reviewer for International Journal of Pattern Recognition and Artificial Intelligence
- José M. B. Dias: reviewer for IEEE Transactions on Signal Processing.
- Fernando D. Nunes, reviewer for IEEE Transactions on Signal Processing and Review of Scientific Instruments

Participation in International Organizations:

- José M. B. Dias: Delegate of Action COST 75 (Meteorological Radar).

9.1.3.2 Image Group

Human Resources

Collaborators

- Carlos Eduardo da Costa Salema Ph.D. Full Professor, IST
- Fernando Manuel Bernardo Pereira Ph.D. Assistant Professor, IST
- Maria Paula dos Santos Queluz Ph.D. Assistant Professor, IST
- Paulo Luis Serras Lobato Correia M.Sc. Assistant, IST

Other Collaborators

- Manuel Menezes de Sequeira Ph.D. Student Assistant, ISCTE
- Paulo Jorge Lourenço Nunes Ph.D. Student Grant, PRAXIS XXI
- Luís Ducla Soares Ph.D. Student Grant, PRAXIS XXI
- Gabriel Antunes Abrantes M.Sc. Student Grant, PRAXIS XXI
- Ricardo Rosa Engineer Grant, IST
- Carla Raquel Zibreira Lic. Student IST, Final Year Project
- Eva Lúcia Serafim Lic. Student IST, Final Year Project
- Mónica Alexandra Santos Lic. Student IST, Final Year Project
- João Manuel Valentim Lic. Student IST, Final Year Project
- João Miguel Ascenso Lic. Student IST, Final Year Projects
- Pedro Bandeira Lic. Student IST, Final Year Project
- José Martinho Lic. Student IST, Final Year Project
- Tiago Ribeiro Lic. Student IST, Final Year Project
- Miguel Soares Lic. Student IST, Final Year Project
- Nuno Correia Lic. Student IST, Final Year Project
- Luis Chaves Lic. Student IST, Final Year Project
- Luis Estevam Lic. Student IST, Final Year Project
- Pedro Henriques Lic. Student IST, Final Year Project
- Vasco Santos Lic. Student IST, Final Year Project
- Tiago Silva Lic. Student IST, Final Year Project
- Alexandre Carinhas Lic. Student IST, Final Year Project

Projects

- PRODÍGIOS - Processamento Digital de Audio e Vídeo (sponsored by JNICT - Programa Base):

Objective: Research on audio-visual processing, coding and digital transmission, notably for low bitrates.

Partners: IT (Lisboa & Coimbra), INESC (Porto & Aveiro) and Grundig.

Duration: 3 years starting in March 1995 (finished in March 1998).

IST participation: The IST activity in 1998 has been mainly concentrated on the development of processing and segmentation methodologies to fill the general video analysis framework previously developed and called **Integrated Segmentation and feature extraction Tools - IST**. The framework includes a set of modules that can be combined following specific application needs. It includes both automatic (more objective) and user interaction (more semantic) analysis modules. During 1998, a specific segmentation solution for one of the most relevant application scenarios - off-line applications requiring precise segmentation – has been developed.

This project allowed to establish closer links between the various audiovisual processing and coding teams in Portugal.

- Normalização de Métodos Avançados de Representação de Vídeo (sponsored by JNICT):

Objective: Participation in the audio-visual representation standardisation activities of ISO/MPEG, notably MPEG-4.

Duration: 3 years starting in December 1995 (finished in December 1998).

IST participation: The IST activity in 1998 has been divided between the finalisation of the MPEG-4 standard and the starting of the MPEG-7 standard. For MPEG-4, the most relevant activities have been the definition of profiles and levels and the development of technology for the non-normative MPEG-4 blocks, such as error concealment, and rate control. For MPEG-7, the most relevant activities have been the identification of applications and the corresponding abstraction of requirements and functionalities in order that MPEG-7 may provide a general description framework, supporting as many as possible applications.

- MOMUSYS (ACTS 098) - Mobile Multimedia System (sponsored by the European Commission DG XIII):

Objective: European platform for the development of the MPEG4 standard including the implementation of an MPEG4 mobile audio-visual prototype providing content-based functionalities.

Partners: about 20 companies, telecoms and universities notably Bosch, Siemens and Philips. Aims at European consensus.

Duration: 4 years starting in November 1995.

Note: participation through IST.

IST participation: During 1998, the IST activity was mainly concentrated on the implementation of an MPEG-4 compliant facial animation system, allowing animation and configuration of 3D facial models, and on the development of object-based video coding rate control strategies allowing to take the most

benefit from the MPEG-4 video coding tools for the simple and main visual profiles. Moreover IST developed the Graphical User Interface for a user assisted video segmentation tool, integrating automatic tools and user assistance, allowing to create natural video objects to be coded with the MPEG-4 tools.

- TALISMAN (ACTS) - Tracing Authors' Rights by Labelling Image Services and Monitoring Access Network (sponsored by the European Commission DG XIII):

Objective: Protection of copyrights for digital audio-visual signals; labelling and watermarking.

Partners: Thomson-CSF, UCL, RTBF, HISPASAT, CSELT, EPFL, FRAUNHOFER-IGD among others.

Duration: 3 years starting in October 1995.

Note: participation through IST.

IST participation: The main work carried out during 1998 was concerned with labelling development, particularly with features extraction from a video that survive to MPEG-2 compression in order to detect whether changes occurred or not.

- DICEMAN (ACTS 308) - Distributed Internet Content Exchange with MPEG-7 and Agent Negotiations (sponsored by the European Commission DG XIII):

Objective: DICEMAN intends to provide a solution to what is probably the single biggest problem facing the archive content industry and its consumers today. Content holders have vast quantities of material, which they would like to sell. Content consumers have a growing need to access and purchase this content. However, today's business model is primarily based on paper, videotapes and CDs, and the postal system, making it slow, expensive and cumbersome. In this era of digital content and global digital networks, it is time a digital solution to this problem revolutionized the industry. DICEMAN aims to do this by: Opening up valuable databases of multimedia content by making them easier to search, using advanced forms of descriptions and indexing, and advanced forms of user interfaces; Enabling the location of the best content for the purpose, both locally and globally, over electronic networks, using agent-based assistants to users and provider; Enabling the exchange and trading of multimedia content over electronic networks using standardized interfaces to electronic databases.

Partners: 8 companies, namely IBM (D), INA (F), CSELT (I) and KPN (NL)

Duration: 2 years, starting in May 1998.

Note: participation through IST.

IST participation: The activity at IST in 1998 was mainly concentrated on the identification of requirements for the audiovisual description technology to be used, on the definition of an MPEG-7 proposal for the description of visual content, including descriptors and description schemes, and on the development of the video analysis technology to extract the information to instantiate the selected descriptors.

- ISO/MPEG-4 and 7 (no sponsor):

Objective: Research and standardisation of object-based audiovisual representation and indexing methodologies.

Partners: Hundreds of universities and companies from all over the world.

IST participation: In 1998, IST contributed both for the finalisation of MPEG-4 Version 1 and for the launching of the MPEG-7 process. While for MPEG-4 the most relevant activities have been the definition of the MPEG-4 profiling strategy and the specification of object types, profiles and levels, for MPEG-7 the most relevant activities have been the identification of applications, requirements and functionalities and the design of evaluation methodologies for the MPEG-7 proposals received following the Call for Proposals. Moreover several processing and coding techniques developed in the context of the other projects have been brought to MPEG whenever adequate.

- ITCOM (3/3.1/TIT/35/94) - Integration of Technologies for Mobile Communications (sponsored by PRAXIS XXI):

Objective: To build a prototype of a UMTS terminal and base station.

Partners: IT poles

Duration: 4 years, starting in October 1995.

Image Group participation: Project management.

PhD Theses

- Manuel Menezes Sequeira (supervisor: Prof. Carlos Salema), Instituto Superior Técnico, concluded in 1998 (subject: Image segmentation based on texture and motion)
- Paulo Luis Serras Lobato Correia (supervisor: Prof. Fernando Pereira), Instituto Superior Técnico, to be concluded in 1999 (subject: Video analysis for object-based representation environments)
- Luis Ducla-Soares (supervisor: Prof. Fernando Pereira), Instituto Superior Técnico, in preparation (subject: Object-based error resilient video representation techniques)
- Paulo Jorge Lourenço Nunes (supervisor: Prof. Fernando Pereira), Instituto Superior Técnico, in preparation (subject: Join rate control for object-based video representation schemes)

M.Sc. Theses

- Gabriel Antunes Abrantes (supervisor: Prof. Fernando Pereira), Instituto Superior Técnico, concluded in 1998 (subject: MPEG-4 compliant 3D facial animation systems)
- Jorge Rocha (supervisor: Maria Paula Queluz), Instituto Superior Técnico, in preparation (subject: Automatic classification of urban areas using satellite images and non-spectral information).

Publications

Books and Book Chapters

C. Salema, C. Fernandes and R. Jha, “*Solid Dielectric Horn Antennas*”, Artech House, Boston, 1998 (244 pp)

C. Salema, “*Feixes Hertzianos*”, IST Press, Lisboa, 1998 (448 pp.)

F.Pereira, R.Koenen, "MPEG-7: Status and directions", chapter in the book ‘Advances in Multimedia: Systems, Standards and Networks’ edited by Atul Puri and Tsuhan Chen, Marcel Dekker, Inc., to appear in 1999

Papers in Journals

F.Pereira, “Televisão digital: a revolução já começou !”, in “O mercado das telecomunicações em Portugal” published by Maxitel, to appear in 1999

P.Correia, F.Pereira, “The role of analysis in content-based video coding and indexing”, Signal Processing Journal, Special Issue on Video Sequence Segmentation for Content-Based Processing and Manipulation, vol. 66, n°2, 1998

G.Abrantes, F.Pereira, “MPEG-4 facial animation technology: survey, implementation and results”, IEEE Transactions on Circuits and Systems for Video Technology, Special Issue on SNHC, Spring 1999

L.Ducla Soares, F.Pereira, “Error resilience and concealment performance for MPEG-4 frame-based video coding”, Signal Processing Journal: Image Communication, Special Issue on Error Resilience, to appear in 1999

P.Nunes, F.Marques, F.Pereira, A.Gasull, “A contour-based approach to binary shape coding using a multiple grid chain code”, Signal Processing Journal: Image Communication, Special Issue on Shape Coding, to appear in 1999

F. Pereira, R. Koenen, “MPEG-4: opening new frontiers to broadcasting”, invited paper for the EBU Technical Review, Spring 1999

Papers in Conference Proceedings

P.Correia, F.Pereira, “The IST Video Analysis Framework”, 10th Portuguese Conference on Pattern Recognition, Lisboa - Portugal, March 1998

G.Abrantes, F.Pereira, “The IST MPEG-4 facial animation system”, II Conferência Nacional de Telecomunicações, Sesimbra - Portugal, April 1999

F.Pereira, “New trends on image and video coding”, invited speech at 10th Portuguese Conference on Pattern Recognition (RECPAD’98), Lisboa - Portugal, March 1998

L. Ducla Soares, F.Pereira, "MPEG-4: a flexible coding standard for the emerging mobile multimedia applications", IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, Boston - USA, September 1998

P.Correia, F.Pereira, "User interaction in content-based video coding and indexing", European Conference on Signal Processing (EUSIPCO) 98, Rhodes - Greece, September 1998

G. Abrantes, F.Pereira, "Interactive analysis for MPEG-4 facial models configuration", EUROGRAPHICS'98, Lisboa - Portugal, September 1998

P.Correia, F.Pereira, "Proposal for an integrated video analysis framework", 1998 Int. Conf. on Image Processing, Chicago - USA, October 1998

L. Ducla Soares, F.Pereira, "An alternative to the MPEG-4 object-based error resilient video syntax", 1998 Int. Conf. on Image Processing, Chicago - USA, October 1998

F.Pereira, "MPEG-4: a new approach to audiovisual coding", invited speech at MUST'98, Paris-France, May 1998

M. P. Queluz, "Authentication of Multimedia Contents " (in Portuguese), Proceedings of Congresso 98 from Ordem dos Engenheiros, Lisboa - Portugal, June 1998

F.Pereira, "MPEG-4: the key for a new generation of multimedia applications", invited tutorial at 5th International Workshop on Interactive Distributed Multimedia Systems and Telecommunication Services, Oslo - Norway, September 1998

F.Pereira, "MPEG-4 and MPEG-7: coding and describing multimedia objects", invited speech at Information Society Technologies Conference, Vienna – Austria, December 1998

M. P. Queluz, "Towards Robust, Content-Based Techniques for Image Authentication", 1998 IEEE Second Workshop on Multimedia Signal Processing, pp. 297-302, Los Angeles - USA, December 1998

M. P. Queluz, "Content-Based Integrity Protection of Digital Images", accepted for presentation at "IS&T/SPIE - Electronic Imaging'99 - Security and Watermarking of Multimedia Contents", San Jose - USA, January 1999

F.Pereira, "MPEG-7: a standard for describing audiovisual information", keynote speech at Workshop on Multimedia Databases and MPEG-7, London – UK, January 1999

F.Pereira, "MPEG-4: technologies and functionalities", plenary speech at VIII Simposium Nacional de Reconocimiento de Formas y Analisis de Imagenes, Bilbao - Spain, May 1999

C. Salema, C. Fernandes, "Similarities Between Circular and Square Dielectric Waveguides", accepted for the *II Conference on Telecommunications*, Sesimbra - Portugal, April 1999

C. Salema, C. Fernandes "Co-Siting Criteria for Wind Turbine Generators and Transmitter Antennas", accepted for the *II Conference on Telecommunications*, Sesimbra - Portugal, April 1999

C. Salema, "A Numerically Efficient Algorithm to Compute the Radiation Pattern of Large Aperture Antennas", presented at a seminar on *MTQP: Mathematical Problems in Telecommunications* (proceedings due shortly), Coimbra – Portugal, 1998

Project Deliverables and Reports

F.Pereira, "Push and pull models in MPEG-7", Document MPEG98/2990, San Jose (CA) – USA, February 1998

G.Abrantes, F.Pereira, "Implementation and evaluation of MPEG-4 facial animation tools", Document MPEG98/3312, Tokyo - Japan, March 1998

P.Nunes, F.Pereira, "Rate control in object-based video coding frameworks", Document MPEG98/3593, Dublin - Ireland, July 1998

F.Pereira, "MPEG-7 content donated by Portuguese broadcasters (RTP & SIC)", Document MPEG98/3738, Dublin - Ireland, July 1998

F.Pereira, "Revised MPEG-4 Applications", Document MPEG98/3867, Atlantic City - USA, October 1998

F.Pereira, "Some useful data about Portuguese MPEG-7 content", Document MPEG98/3892, Atlantic City - USA, October 1998

P. Correia, et al., "Description of the graphical user interface for the Video Object Generation Tool and specification of interfaces to the segmentation algorithms", ACTS MoMuSys Deliverable AC098\TUH\WP5.2\DS\I\043\B1, December 1998

P. Nunes, et al., " Revision of Integrated Solution for User Trials ", ACTS MoMuSys Deliverable AC098\IST\WP2.1\S\I\R\017\B1, December 1998

F.Pereira et al, "Final Report on Standardisation Activities", Project ACTS MoMuSys, Doc. AC098\IST\WP1.2\DS\P\029\B, January 1999

C. Salema, A. Barbosa, C. Fernandes "Análise Técnica de Processos de Aquisição do Instituto das Comunicações de Portugal" (in Portuguese), report presented to Instituto das Comunicações de Portugal

L. Chaves, L. Estevam, "FEIXER: Programa de projecto de ligações por feixes hertzianos", (in Portuguese), Degree Project, IST, January 1999

Miscellaneous

F.Pereira:

- Co-Chairman of the MPEG Ad Hoc on Testing and Evaluation for the MPEG-7 Standard, between March and July 1998

- Team leader (coding schemes) for the evaluation of the technology submitted as answer to the MPEG-7 Call for Proposals, to be held in Lancaster – UK, in February 1999
- “ISO Award for Outstanding Technical Contribution” for his contribution for the MPEG-4 Visual standard , in October 1998
- Invited talk: “Normalização de codificação de vídeo”, TV-Cabo Portugal, February 1998
- Invited talk: “O desafio da comunicação de imagem no limiar do século XXI”, Companhia Portuguesa Radio Marconi, March 1998
- Invited talk: “Image compression algorithms”, Workshop on Particle Image Velocimetry, Lisboa - Portugal, July 1998
- Member of the Scientific Committee of the 10th Portuguese Conference on Pattern Recognition (RECPAD’98), Lisboa - Portugal, March 1998
- Member of the Programme Committee of the European Conference on Multimedia Applications, Services and Techniques (ECMAST’98), Berlin - Germany, May 1998
- Member of the Scientific Committee of the International European Signal Processing Conference (EUSIPCO’ 98), Rhodes - Greece, September 1998
- Member of the Scientific Committee of the International Workshop on Very Low Bitrate Video Coding - VLBV98, Urbana, IL - USA, October 1998
- Member of the Programme Committee of Visual Communications and Image Processing’99, San Jose (CA) - USA, January 1999
- Member of the Organising Committee of Conferência de Telecomunicações 1999 (CONFTELE’99), Sesimbra - Portugal, April 1999
- Member of the Programme Committee of the Third International Conference on Visual Information Systems’99, Amsterdam – The Netherlands, June 1999
- Member of the Programme Committee of the IEEE International Conference on Multimedia Computing and Systems (ICMCS’99), Florence - Italy, June 1999
- Member of the Programme Committee of the 2^o Workshop on Image Analysis for Multimedia Interactive Services, Berlin - Germany, May 1999
- Member of the Programme Committee of the Workshop on Content-Based Multimedia Indexing, Toulouse – France, October 1999
- Member of the Programme Committee of the Visual Communications and Image Processing’2000, em Perth - Australia, 2000.
- Chairman of the do Seminar on MPEG-4, San Jose - USA, February 1998
- Chairman of the Session on "Image coding", at RECPAD’98, Lisboa – Portugal, March 1998
- Chairman of the Special Session on “Multimedia Standards and Graphics” at EUROGRAPHICS’98, Lisboa – Portugal, September 1998

- Chairman of the Special Session on “Multimedia Standards” at IEEE International Conference on Multimedia Computing and Systems (ICMCS’99), Florence – Italy, June 1999
- Member of the panel on “Video representation, coding and indexing” at the International Workshop on Very Low Bitrate Video Coding - VLBV98, Urbana, IL - USA, October 1998
- Member of the Editorial Board of the Signal Processing: Image Communication Journal, published by EURASIP
- Associate Editor of IEEE Transactions of Circuits and Systems for Video Technology
- Guest editor of the Special Issue on Object-based Video Coding and Description of IEEE Transactions on Circuits and Systems for Video Technology, to appear in 1999
- Guest editor of Tutorial Issue on MPEG-4 of Signal Processing: Image Communication Journal, to appear in 1999
- Reviewer for Signal Processing (EURASIP), Image Communication Journal (EURASIP), IEEE Transactions on Circuits and Systems for Video Technology, Proceedings of IEEE, Journal of Real-Time Imaging, IEEE Journal on Selected Areas in Communications, IEEE Transactions on Pattern Analysis & Machine Intelligence, ETRI Journal, IEEE Transactions on Multimedia and several international conferences.

C. Salema:

- Member of the organising committee of the MTQP seminar, Coimbra – Portugal, September 1998
- Chairman of the organising committee of the II Conference on Telecommunications, to be held in Sesimbra - Portugal, April 1999
- Elected chairman of the “Colégio de Engenharia Electrotécnica”, Ordem dos Engenheiros, in April 1998
- Portuguese delegate to the ACTS Programme
- Member of the External Evaluation Committee for the degrees in Informatics lectured at Portuguese Public Universities
- Member of the evaluation committee for granting a national licence for terrestrial audio broadcasting
- Chairman of Executive Committee of Instituto de Telecomunicações
- Chairman of the Board of Representatives of Instituto Superior Técnico

P. Queluz:

- reviewer for IEEE Transactions on CSVT
- reviewer of papers submitted to the *II Conferência Nacional de Telecomunicações*, Sesimbra - Portugal, April 1999

9.1.3.3 Radio Communication Systems Group

Human Resources

Collaborators

- Prof. Américo Manuel Carapeto Correia Ph.D. Assistant Professor, IST
- Prof. Francisco António Bucho Cercas Ph.D. Assistant Professor, IST
- Prof. Jorge Manuel Nunes Pereira Ph.D. Assistant Professor, IST
- Prof. Antonio José Castelo Branco Rodrigues Ph.D. Assistant Professor, IST
- Prof. Carlos Manuel Gutierrez Sá da Costa Ph.D. Assistant Professor, IST

Other collaborators

- Augusto Afonso de Albuquerque Ph.D. Full Professor, ISCTE
- Luis Filipe Carvalho Antunes MSc. Student
- Alberto Amaral Lopes MSc. Student
- Pedro Joaquim Amaro Sebastião MSc. Student
- Henrique Martins dos Santos Cunha MSc. Student
- Rui Filipe Efigénio Gomes MSc. Student
- José Manuel Pires Braz de Oliveira Antunes MSc. Student
- Mário Pedro Guerreiro Marques da Silva MSc. Student
- José António Pereira Velez MSc. Student
- Carlos Miguel Vasques Lopes MSc. Student
- Rosa Maria da Fonseca Monteiro MSc. Student
- Francisco António T. B. Nunes Monteiro MSc. Student
- Francisco José Barros Freitas MSc. Student
- Vitor Manuel Ferreira Fonseca MSc. Student
- Luis Miguel Ribeiro Coimbra Lic. Student Final Year Project
- Sérgio Alexandre Castelo Catalão Lic. Student Final Year Project
- Jorge Marques Santana Lic Student Final Year Project
- João Filipe Santos Belchior Lic. Student Final Year Project
- Sérgio Miguel Santos Vaz Lic. Student Final Year Project
- José Manuel Pinto Pinela Lic. Student Final Year Project

• Bruno Ruben Nóbrega Sales Gomes	Lic. Student	Final Year Project
• Carlos Manuel Gonçalves Cotrim	Lic. Student	Final Year Project
• João Tiago de Oliveira Marques Fonseca	Lic. Student	Final Year Project
• Tomás Gomes da Silva Serpa Brandão	Lic. Student	Final Year Project
• Pedro Luís Ruivo Dias	Lic. Student	Final Year Project
• Nuno Ricardo da Silva G. Nunes Sarmento	Lic. Student	Final Year Project
• Nuno Alexandre Barbosa Vigário	Lic. Student	Final Year Project
• Hugo Miguel da Cruz Louro	Lic. Student	Final Year Project
• João Miguel Gaspar da Silva	Lic. Student	Final Year Project
• Hugo Ricardo Santos Bento Pinto	Lic. Student	Final Year Project
• Jorge Filipe Ribeiro Fernandes	Lic. Student	Final Year Project
• Paula Alexandra Matos dos Santos Cunha	Lic. Student	Final Year Project
• Patrícia Alexandra Augusto Varandas Freixial	Lic. Student	Final Year Project
• Bruno Ricardo G. Fazenda	Lic. Student	Final Year Project
• David Oliveira Duarte Lopes	Lic. Student	Final Year Project

Projects

- ACTS 090 - FRAMES “Future Radio Wideband Multiple Access System”

The trade-off analysis between coding versus multiple-user detector for Wideband CDMA was done. The specification of Commutation Signaling for the Downlink of WCDMA was presented.

- COST 252 “Evolution of Satellite Personal Communications from 2nd to Future Generation Systems”

This COST project has continued with its main objectives, i.e., with the mid-term activity focused on the adaptability of the GSM standard (second generation mobile terrestrial systems) to Mobile Satellite Systems (MSS) considering the future requirements of an integrated third generation system (UMTS). All these activities point towards a long-term activity dealing with the exploitation of the satellite component for the MBS able to provide services at higher rates (> 2Mb/s) than presently assumed in the UMTS. The results already obtained were presented in a joint workshop with COST 255 (1st International Workshop on Radiowave Propagation Modelling for SatCom Services at Ku-band and Above, Noordwijk, The Netherlands, 28-29 October 1998): Due to the success of this workshop, in which there was a panel with specialist from Europe and USA, a new one is being planned with COST actions 253 and 255 in Toulouse, May 1999.

- COST 255 “Radiowave Propagation Modeling for New SatCom Services at Ku-Band and Above”

According to the main objective of improving the design and planning of present and future telecom systems and services through the development of tools for the evaluation of their performance, this year’s activity progressed in further working on the test cases previously defined. The models developed in this

action can be used for scientists in other projects, namely COST 252, which has a good co-operation with and, as mentioned, organised a joint workshop for a more in depth analysis of the problems to be solved.

- COST 259 “Wireless Flexible Personalised Communications”

During this year contributions were presented to working group 1 dealing with systems aspects such as the choice of optimum spreading sequences for spread spectrum CDMA mobile systems and the development of flexible solutions for new services to be supported in future mobile and personal communications systems.

- COST 262 “Spread Spectrum Systems and Techniques in Wireless and Wired Communications”

During this year there was only the First Management Committee Meeting. The main objective of this action is to increase the knowledge of spread-spectrum techniques and applications for any wireless and wired system.

MSc. Theses

- José Pedro Cabral Diogo Pinto (supervisor: Prof. Carlos Eduardo do Rego Costa Salema and Prof. António José Castelo Branco Rodrigues), Instituto Superior Técnico, Maio 1998 (subject: Multi-*h* CPM Modulations with Direct Sequence Spread Spectrum for Wideband Satellite Mobile Communications)
- Alberto Amaral Lopes (supervisor: Prof. Américo Manuel Carapeto Correia), Instituto Superior Técnico, 1998 (subject: Coding of Mobile Communication Systems with Variable Rate)
- Pedro Joaquim Amaro Sebastião (supervisor: Prof. Francisco António Bucho Cercas), Instituto Superior Técnico, concluded in 1998/ started 1996 (subject: Efficient Performance Evaluation of TCH Codes using Stochastic Models)
- Luís Filipe Carvalho Antunes (supervisor: Prof. Francisco António Bucho Cercas), Instituto Superior Técnico, to be concluded in 1999/ started 1996 (subject: Performance Evaluation of TCH Sequences in CDMA Systems)
- Mário Pedro Guerreiro Marques da Silva (supervisor: Prof. Américo Manuel Carapeto Correia), Instituto Superior Técnico, to be concluded in 1999/ started 1997 (subject: CDMA with Multiple Codes and Bit Rates)
- José António Pereira Velez (supervisor: Prof. Francisco António Bucho Cercas), Instituto Superior Técnico, to be concluded in 1999/ started 1996 (subject: Study and Implementation of a TCH Receiver using a DSP)
- Carlos Miguel Vasques Lopes (supervisor: Prof. Francisco António Bucho Cercas), Instituto Superior Técnico, to be concluded in 1999/ started 1997 (subject: Control Optimization Techniques of the Doppler Effect for LEO Satellite Communications)
- Henrique Martins dos Santos Cunha (supervisor: Prof. António José Castelo Branco Rodrigues), Instituto Superior Técnico, to be concluded in 1999/ started 1997 (subject: Interference Between Fixed and Terrestrial Mobile Services)

- Rui Filipe Efigénio Gomes (supervisor: Prof. António José Castelo Branco Rodrigues), Instituto Superior Técnico, to be concluded in 1999/ started 1997 (subject: Wideband CDMA Systems for Personal Communications)
- José Manuel Pires Braz de Oliveira Antunes (supervisor: Prof. António José Castelo Branco Rodrigues), Instituto Superior Técnico, to be concluded in 1999/ started 1997 (subject: Overlay/Underlay Techniques in Personal Communications Systems)
- Francisco António T. B. Nunes Monteiro (supervisor: Prof. António José Castelo Branco Rodrigues), Instituto Superior Técnico, to be concluded in 2000/ started 1998 (subject: Multi-h Coded Modulation in Multipath Fading Channel)
- Francisco José Barros Freitas (supervisor: Prof. António José Castelo Branco Rodrigues), Instituto Superior Técnico, to be concluded in 2000/ started 1998 (subject: Frequency Planning in GSM 900/1800 Dual Networks)
- Vitor Manuel Ferreira Fonseca (supervisor: Prof. António José Castelo Branco Rodrigues), Instituto Superior Técnico, to be concluded in 1999/ started 1997 (subject: Fixed and Dynamic Channel Allocation in Mobile Radio)
- Rosa Maria da Fonseca Monteiro (supervisor: Prof. Francisco António Bucho Cercas), Instituto Superior Técnico, to be concluded in 2000/ started 1998 (subject: Efficient control of CDMA Systems for Satellite Communications).

Publications

Book Chapters

A. Rodrigues, contribution to chapter “Advanced Radio Interface Techniques and Performance” in *Digital Mobile Radio Towards Future Generation Systems*, Edited by E. Damosso, European Commission, (accepted for publication).

Papers in Journals

A. Correia, A. Rodrigues, F. Cercas “Frequency Hopping Versus Interference Cancellation for TD-CDMA”, submitted to the Journal on Selected Areas on Communications (JSAC), Special Issue on Wireless Communications.

A. Correia, “Commutation Signaling to Combat ISI over Nakagami and Ricean Fading”, *Wireless Personal Communications*, Special Issue on CDMA for Universal Personal Communications Systems, Vol. 7, no 2-3, August 1998, pp. 213-231

Papers in Conference Proceedings

A. Correia, A. Rodrigues, "Adaptive Frequency-Hopping for TDMA/CDMA", 1st FRAMES Long Term Research Workshop, Gotenburg, Sweden, 12-13 January 1998, pp. 19-28

A. Rodrigues, "Near-Far Resistant Techniques in CDMA", 1st COST 252/259 Joint Workshop, Bradford, United Kingdom, 21-22 April 1998, pp. 182-187

A. Correia, A. Rodrigues, "Adaptive Frequency-Hopping for TDMA/CDMA with Joint Detection", 48th IEEE Vehicular Technology Conference (VTC'98), Ottawa, Canada, 18-21 May 1998, pp. 2212-2216

J. Pinto, A. Rodrigues, "Direct-Sequence Spread Spectrum Multi-h CPM in Integrated Mobile Satellite Communications", IEEE International Symposium on Wireless Communications (ISWC'98), Montréal, Canada, 22-23 May 1998, pp. 40

A. Correia, F. Cercas, A. Rodrigues, C. Salema, "IST Participation in the FRAMES Project", Congress'98, Ordem dos Engenheiros, Lisboa, Portugal, 18-21 June 1998

A. Correia, "Design of Reed-Solomon Frequency-Time Hopping Sequences", 5th IEEE International Symposium on Spread-Spectrum Techniques and Applications, (ISSSTA'98), Sun City, South Africa, 2-4 September 1998, pp. 982-986

A. Correia, F. Cercas, A. Rodrigues, "CDMA with Multiuser Detection versus Coding", 9th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC'98), Boston, USA, 8-11 September 1998, pp. 410-414

M. Nunes, J. Santos, A. Rodrigues, J. Punt, H. Nikokaar, R. Prasad "Effects of Downlink Intercell Interference on MC-CDMA System Performance", 9th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC'98), Boston, USA, 8-11 September 1998, pp. 1050-1054

J. Pinto, A. Rodrigues, F. Cercas, "Multi-h CPM Spread Spectrum in Satellite Mobile Communications", 1st International Workshop on Radiowave Propagation Modelling for SatCom Services at Ku-band and Above, Noordwijk, The Netherlands, 28-29 October 1998

F. Cercas and L. C. Antunes, "Spreading and coding using the same TCH codes", IEEE International Conference on Telecommunications (ICT'98), Porto Carras, Greece, 21-25 June 1998, Vol. III, pp. 50-53

A. Miranda, S. Marques and F. Cercas, "On the Performance of TCH Sequences in DS-CDMA Systems", 5th IEEE International Symposium on Spread-Spectrum Techniques and Applications (ISSSTA'98), Sun City, South Africa, 2-4 September 1998, pp. 818-822

F. Cercas and L. Antunes, "Efficient receiver for CDMA using TCH codes", 1st International Workshop on Radiowave Propagation Modelling for SatCom Services at Ku-band and Above, Noordwijk, The Netherlands, 28-29 October 1998

Elisabete Vidal, Miguel Bentes and Francisco Cercas, "Image transfer optimisation articulating commercial network satellites", XIII Symposium Nacional de la Union Científica Internacional de Radio, September 16-18, 1998, Pamplona, Spain, pp. I 419-420

José Brito, Artur Vargas and Francisco Cercas, "Detection and compensation of the Doppler frequency shift in communications with non-geostationary satellites", XIII Symposium Nacional de la Union Científica Internacional de Radio, September 16-18, 1998, Pamplona, Spain, pp. I 423-424.

C. Pires, A. de Albuquerque, "Access Networks for Broadband Digital Multimedia Services", Cable Tech 98 Convention, Paris, Sept. 98.

A de Albuquerque, C. Pires, "Network Architectures for Fiber Hybrid Coax", Maximizing Access Technologies in the Local Loop Conference, Singapura, 25-27 February, 1998.

A. de Albuquerque, C. Pires, "The Success of Video To The Home: the AMUSE example", Maximizing Access Technologies in the Local Loop Conference, Singapura, 25-27 February, 1998.

Project Deliverables

A. Correia, A. Rodrigues and F. Cercas, "CDMA with Multiuser Detection versus Coding ", FRAMES internal report AC090/IST/PT5/DN/I/001/a1, September 1998

A. Correia, A. Rodrigues and F. Cercas, "Commutation Signaling for the Downlink of WCDMA", FRAMES internal report AC090/IST/PT5/DN/I/002/a1, May 1998.

A. Correia "Final Deliverable of the Physical Transport Work-Package of FRAMES Project", FRAMES final report December 1998.

F. Cercas and L. C. Antunes, "Spreading and coding using the same TCH codes", TD98(07) for the 5th Management Committee Meeting of COST 252, Florence, Italy, 12-13 February 1998.

F. Cercas and L. C. Antunes, "Efficient receiver for CDMS using TCH codes", TD98(31) COST 252 report, 1998.

F. Cercas and P. Sebastião, "New performance results for TCH codes using interval simulation technique", TD98(29) COST 252 report, 1998.

F. Cercas , E. Del RE, R. Fantacci and L. S. Ronga, "Simplified receiver structure with new sequences for CDMA using FFT implementation", TD98(15) COST 252 report, 1998

F. Cercas and L. C. Antunes, "Spreading and coding using the same TCH codes", TD98(07) for the 5th Management Committee Meeting of COST 252, Florence, Italy, 12-13 February 1998.

Miscellaneous

- F. Cercas, National Portuguese Delegate and Working Group 3 (WG3) leader to the COST 252 project “*Evolution of Satellite Personal Communications from 2nd to Future Generation Systems*”
- F. Cercas, National Portuguese Delegate to the COST 255 project “*Radiowave Propagation Modeling for New SatCom Services at Ku-Band and Above*”
- F. Cercas, National Portuguese Delegate to the COST 262 project “*Spread Spectrum Systems and Techniques in Wireless and Wired Communication*”
- A. Rodrigues, National Portuguese Delegate to the COST 259 project “*Wireless Flexible Personalised Communications*”
- A. Rodrigues auditor of ACTS program – Multimedia Line – by invitation of the Commission of European Communities
- A. Correia, National Portuguese Delegate to the COST 262 project “*Spread Spectrum Systems and Techniques for Wireless and Wired Communications*”
- A. Correia, member of the International Advisory Committee of the Vehicular Technology Conference 99, VTC-99 Fall.
- F. Cercas, member of the International Advisory Committee of the Vehicular Technology Conference 99, VTC-99 Fall.
- A. Correia, reviewer of the following journals: IEEE Journal of Selected Areas on Communications, Special Issue on Spread Spectrum for Global Communications, IEEE Transactions on Signal processing, IEEE Transactions on Vehicular Technology, Special Issue on Universal Mobile Telecommunication System, and IEE Proceedings-Communications.
- F. Cercas, A. Rodrigues, reviewers for ConfTele'99 to be held in Sesimbra, Portugal in April 1999
- Pedro Joaquim Amaro Sebastião, “Prémio Inovação Jovem Engenheiro1998” – First Prize.

9.1.4 Optical Communications Research Line

Human Resources

Collaborators

- António A. Moreira PhD Associate Professor, IST
- Adolfo V.T. Cartaxo PhD Assistant Professor, IST
- João J. O. Pires PhD Assistant Professor, IST

Other Collaborators

- José A. P. Morgado PhD Student Grant, AFA
- Luis G. C. Cancela PhD Student Assistant, Polit. Setubal
- José L. C. S. Nunes Lic. Student IST, Final Year Project
- António J. S. Narra Lic. Student IST, Final Year Project
- José P. F. Dias Lic. Student IST, Final Year Project
- Sandro M. C. Parrança Lic. Student IST, Final Year Project
- Luis M. C. Santo Lic. Student IST, Final Year Project
- Paulo H. B. Duarte Lic. Student IST, Final Year Project

Projects

- ACTS 049-SPEED: Superhighway by Photonically and Electronically Enhanced Digital Transmission.

The influence of fiber nonlinearity on the conversion of laser and optical amplifier phase noise to intensity noise by fiber transmission was investigated theoretically and experimentally. A novel measurement technique of nonlinear refractive index of optical fibre was presented. The nonlinearity coefficient is estimated by fitting of a new fibre transfer function which takes into account the fibre dispersion and nonlinearity. The improvement of 20 Gbit/s binary dispersion supported transmission performance achieved by further linear equalisation through transversal filters was investigated numerically. Two kinds of transversal filters were studied: no fractionally spaced equaliser, and fractionally spaced equaliser, with period spacing of half symbol period.

- JNICT-PBIC/C/TIT/2525/95-CORA: Optical switching in the Access network.

A demonstrator based on an 2x4 optical switch, used to route both STM1 and analogue signals, was developed. The demonstrator includes a PC interface and an interactive program that allows to obtain a graphical visualisation of the switch state and the signals being routed. A detailed analysis of the multisource crosstalk in optical space switches was also realised.

- IT-L02-Optical Protection.

A reconfigurable optical add-drop multiplexer was developed. It operates with two wavelengths (1310 and 1550 nm). This development includes a supervisory system used to detect failures and a control system appropriate to reconfigure the multiplexer. The supervisory system is based on pilot tones and can be applied for monitoring both SDH and analogue traffic. The size limitations of WDM rings using AWG to implement the add-drop functions was also analysed.

PhD Theses

- José A. P. Morgado (supervisor: Adolfo Cartaxo), Instituto Superior Técnico, in preparation (subject: Limitations imposed by active devices in optical fibre communication systems).
- Luis G. C. Cancela (supervisor: João Pires), Instituto Superior Técnico, in preparation (subject: Multichannel optical networks based on hierarchical ring topologies).

M.Sc. Theses

- José A. P. Morgado (supervisor: Adolfo Cartaxo), Instituto Superior Técnico, concluded in 1998 (subject: Simulation and analysis of the influence of intensity and phase noises in direct detection optical communication systems)

Publications

Papers in Journals

A. Cartaxo, B. Wedding, W. Idler, "Influence of fiber nonlinearity on the phase noise to intensity noise conversion in fiber transmission: theoretical and experimental analysis", *IEEE/OSA Journal of Lightwave Technology*, vol. 16, n°7, July 1998, pp. 1187-1194.

A. Cartaxo, J. Morgado, "Intensity and frequency noise transmission along single-mode fibre at zero-dispersion wavelength", *Proceedings IEE, Part J -- Optoelectronics*, vol. 145, n°4, August 1998, pp. 211-216.

A. Cartaxo, "Impact of modulation frequency on cross-phase modulation effect in intensity modulation - direct detection WDM systems", *IEEE Photonics Technology Letters*, vol. 10, n°9, September 1998, pp. 1268-1270.

A. Cartaxo, J. Morgado, "Rigorous assessment of small signal analysis for linear and dispersive optical communication systems operating near zero-dispersion wavelength", *IEEE/OSA Journal of Lightwave Technology*, vol. 17, n°1, January 1999, pp. 86-94.

A. Cartaxo, "Cross-phase modulation in intensity modulation - direct detection WDM systems with multiple optical amplifiers and dispersion compensators", to appear in *IEEE/OSA Journal of Lightwave Technology*, vol. 17, n°2, February 1999.

J. Pires, M. O'Mahony, N. Parnis and E. Jones, "Scaling limitations in full-mesh networks using arrayed-waveguide grating OADMs," *Electronic Letters*, vol. 35, n°1, January 1999, pp-73-75.

Papers in Conference Proceedings

J. Morgado, A. Cartaxo, "Impact of amplifier spacing on RIN enhancement of IM/DD transmission system", in *Networks and Optical Communications --- Long-Haul, ATM and Multi-Media Networks*, Edit. D. W. Faulkner and A. L. Harmer, IOS Press, 1998, pp. 220-227.

P. Goulart, A. Cartaxo, "Increasing the transmission distance of 40 Gbit/s 4-level DST system", in *Networks and Optical Communications --- Long-Haul, ATM and Multi-Media Networks*, Edit. D. W. Faulkner and A. L. Harmer, IOS Press, 1998, pp. 236-243.

A. Cartaxo, M. O'Mahony, "Impact of cross-phase modulation on WDM system performance taking the relative delay between channels into account", in *Networks and Optical Communications --- Long-Haul, ATM and Multi-Media Networks*, Edit. D. W. Faulkner e A. L. Harmer, IOS Press, 1998, pp. 259-266.

A. Cartaxo, J. Morgado, "Relative intensity noise induced by fiber dispersion near zero-dispersion wavelength in linear singlemode fibers", presented in *Applications of Photonic Technology 3*, Ottawa, Canada, 27-30 July 1998.

A. Cartaxo, J. Morgado, "Validation of small-signal analysis for nonlinear dispersive fiber systems with multiple in-line amplifiers using numerical simulation", presented in *Applications of Photonic Technology 3*, Ottawa, Canada, 27-30 July 1998.

J. Morgado, A. Cartaxo, "Assessment of laser intensity noise spectrum from rigorous numerical simulation of singlemode laser rate equations", presented in *Applications of Photonic Technology 3*, Ottawa, Canada, 27-30 July 1998.

J. Morgado, A. Cartaxo, "A new measurement technique of optical fiber nonlinearity using the first dip frequency of fiber transfer function", presented in *Applications of Photonic Technology 3*, Ottawa, Canada, 27-30 July 1998.

A. Cartaxo, J. Morgado, "Rigorous assessment of RIN induced by dispersion at zero-dispersion wavelength in singlemode fibers", *European Conf.on Lasers and Electro-Optics / European Quantum Electronics Conference*}, Glasgow, Scotland, paper CThH99, 14-18 September 1998, pp. 319.

A. Cartaxo, B. Wedding, W. Idler, "New measurement technique of nonlinearity coefficient of optical fibre using fibre transfer function", *1998 European Conference on Optical Communications (ECOC'98)*, Madrid, Spain, 20-24 September 1998, pp. 169-170.

J. Morgado, A. Cartaxo, "Frequency noise transmission over nonlinear dispersive singlemode fibres at zero-dispersion wavelength", to be presented in *II Conferência Nacional de Telecomunicações*, Sesimbra, April 1999.

J. Morgado, A. Cartaxo, "Relative intensity noise induced by fiber dispersion at zero-dispersion wavelength in nonlinear dispersive singlemode fibres", to be presented in *II Conferência Nacional de Telecomunicações*, Sesimbra, April 1999.

J. Morgado, A. Cartaxo, "Influence of fibre nonlinearity on noise transmission in IM/DD repeaterless system with optical post- and pre-amplifiers", to be presented in *II Conferência Nacional de Telecomunicações*, Sesimbra, April 1999.

A. Cartaxo, "Cross-phase modulation in intensity modulation - direct detection WDM systems with multiple fibre spans" to be presented in *II Conferência Nacional de Telecomunicações*, Sesimbra, April 1999.

A. Cartaxo, J. Nunes, "First results on dispersion supported transmission performance improvement achieved by using transversal filters", to be presented in *II Conferência Nacional de Telecomunicações*, Sesimbra, April 1999.

L. Cancela and J. Pires, "Coherent multipath crosstalk due to crossovers in an active splitter/active combiner optical switch," *Proc. 1998 IEEE Conference on Lasers and Electro-Optics-Europe*, Glasgow, September 1998, pp. 455.

L. Cancela and J. Pires, "Multisource crosstalk as a function of channel frequency spacing in an 8x8 Benes Optical Switch," *Proc. SPIE Conference on All-Optical Networking: Architecture, Control and Management Issues*, vol. 3531, pp. 328-336, Boston, November 1998.

J. Pires, N. Parnis, E. Jones and M. O'Mahony, "Crosstalk implications in full-mesh WDM ring networks using arrayed-waveguide grating OADMs," *Proc. 1998 European Conference on Optical Communications (ECOC'98)*, Madrid, September 1998, pp. 541-542.

J. Pires, M. O'Mahony, N. Parnis, and E. Jones, "Size limitations of a WDM ring network based on arrayed-waveguide grating OADMs," *Proc. 3rd Working Conference on Optical Network Design and Modeling*, pp.71-79, Paris, February 1999.

Project Deliverables and Reports

José L. S. Nunes, António J. S. Narra, "Optimização e simulação de um sistema de comunicação óptica TDM com igualação discreta", IST Final Year Project, July 1998.

José P. F. Dias, Sandro M. C. Parrança, "Simulação e modelação de um sistema de comunicação óptica TDM/WDM de muito alta velocidade", IST Final Year Project, October 1998.

Luís M. C. Santo, Paulo H. B. Duarte, "Simulação e optimização de um sistema de comunicação óptica multi-canal (WDM)", IST Final Year Project, October 1998.

Luis Cancela e João Pires, " Report on optical signal monitoring in SDH and Cable Television Networks," *Project L02 (Optical Protection)*, October 1998.

João Pires, "Final Report on the Network Sensitivity Studies," OPEN (AC066), University of Essex, April 1998.

Miscellaneous

- Adolfo Cartaxo has investigated the effect of cross-phase modulation in intensity modulation - direct detection WDM systems, and, together with José Morgado, the noise transmission in linear and nonlinear dispersive optical communication systems operating near zero-dispersion wavelength.
- Adolfo Cartaxo has been reviewer for IEEE/OSA Journal of Lightwave Technology and IEEE Photonics Technology Letters. He has been also reviewer for II Conferência Nacional de Telecomunicações.
- João Pires has been reviewer for IEEE Photonics Technology Letters and also for II Conferência Nacional de Telecomunicações.

9.1.5 Electronic and Opto-electronic Components Research Line

Human Resources

Collaborators

- Artur Lopes Ribeiro PhD Assistant Professor, IST
- Jorge Torres Pereira PhD Associate Professor, IST
- Carlos Ferreira Fernandes PhD Assistant Professor, IST

Other Collaborators

- Paulo Jorge dos Santos Almeida M.Sc. student Grant, PraxisXXI

Projects

- ACTS-BLISS - (AC065) - "Broadband Lightwave Sources and Systems"

This project was initiated in September 1995 and was concluded in September 1998. To our team was distributed the task of studying the electric crosstalk problem in optical transceivers. Different mathematical tools, analytical and numerical, were developed to study this effect. The finite element method in two dimensions and a conformal method were used to study the crosstalk due to conduction currents in the substrate of a transceiver grown on n+-InP material. The finite element method in three dimensions was used to determine the coupling capacitances between the emitter diode laser and the diode detector in an integrated transceiver constructed on InP:Fe semi-insulating material.

- SCCEO - PRAXISXXI (TIT/1591/95) - "Simulation and Characterisation of Electrical and Optoelectronic Components"

During this period we continued our previous work on the development of modelling tools needed for the study of the steady-state and transient response of optoelectronic devices namely Multiple Quantum Well (MQW) lasers of the Fabry-Perot and DFB type and passive components, such as the multi-mode interference (MMI) devices, used as splitters, combiners or duplexers. The effects of phase discontinuity and its position on the single phase-shifted DFB laser characteristics were investigated using the TMM (Transfer Matrix Method). In the near threshold regime comparative analysis of multi-phase shifted DFB lasers allowed the calculation of the optimum structure parameters necessary to ensure an emission with high mode selectivity, zero frequency detuning and an almost uniform field distribution. Temperature effects on the light-current characteristics and on the large signal transient response of MQW 1.3 μm InP/InGaAsP lasers of the Fabry-Perot type were also studied. The temperature effects are included in the Fermi factors, the energy band gap, the Auger recombination coefficients and the internal losses. The temperature is seen to affect the gain, the threshold current density and the photon and carrier. The finite

differences method was used to study the behaviour of a MMI duplexer, taking into account the reflections on the input and output discontinuities and considering the two possible polarisations for one of the two frequencies.

Publications

Journals

C. A. Ferreira Fernandes, "Single Phase-Shifted DFB Laser Diodes", *Microwave and Optical Technology Letters*, Vol. 17, no. 6, pp. 398-402, April 1998.

A. Lopes Ribeiro, "The COALA Program – Computer Analysis of Lasers", *Microelectronic Engineering*, Vol. 43-44, pp. 545-552, 1998.

Conference Proceedings

A. Lopes Ribeiro, "Electrical Crosstalk Modelling in Optoelectronic Integrated Transceivers", IEEE Melecon'98 – 9th Mediterranean Electrotechnical Conference, Tel-Aviv, Israel, Vol. 2, pp. 1427-1431, May 1998.

J. Torres Pereira, "Temperature Effects on the Large Signal Transient Response of Long - Wavelength MQW Lasers", IEEE Melecon'98 – 9th Mediterranean Electrotechnical Conference, Tel-Aviv, Israel, Vol. 2, pp. 1432-1435, May 1998.

C. A. Ferreira Fernandes, "Threshold Analysis of Phase-Shifted Distributed Feedback Lasers", IEEE Melecon'98 – 9th Mediterranean Electrotechnical Conference, Tel-Aviv, Israel, Vol. 2, pp. 1436-1439, May 1998.

9.1.6 Power Systems Research Line

Human Resources

Collaborators

- Mário J. A. Lança PhD Full Professor, IST
- M^a Inês C. Simas PhD Associate Professor, IST
- M^a Beatriz V. Borges PhD Assistant Professor, IST
- A. Victor A. Anunciada PhD Assistant Professor, IST

Other Collaborators

- Pedro Santos PhD. Student I Pupilos do Exército
- António Pedro Casimiro PhD. Student Grant PRAXISXXI
- Paulo Tavares Engineer Grant PRAXIS XXI
- Raul Monteiro M.Sc. Student Assistant, I P Tomar
- Floriberto Lima M.Sc. Student Grant PRAXIS XXI
- Luis Barata Lic. Student IST, Final Year Project
- António Miguel Lapa Lic. Student IST, Final Year Project
- Paulo Henriques Lic. Student IST, Final Year Project
- Pedro Cunha Pereira Lic. Student IST, Final Year Project
- Rui Santos Lic. Student IST, Final Year Project
- Frank Behrens Ph.D Assistant Prof. PUCC¹
- Saulo Finco M.Sc. Ph.D. Student, R. Assist. FCTI¹

Projects

- Project PRAXIS XXI/2/2.1/TIT/1655/95 - Integrated Circuits for High Efficiency Power Conversion, Using CMOS Technologies, Based on NMOS Devices.

High performance power conversion solutions were studied and new solutions were developed, namely: Optimization, development and fabrication of new power switching structures in a standard CMOS technology, paying attention to cells geometry and using 2-dimensional simulation (SPICES) and electrical simulation (PSPICE and SABER), regarding ON-resistance and breakdown voltages. Novel cell

¹ Collaborators under the Joint venture IT/FCTI(Brazil) granted by ICCTI/CNPq

architecture for basic power switching cells considering IPICs Electromagnetic Compatibility and fast smart power prototyping. Development of new power control functions based on a unique NMOS cell type, aimed at very low cost semicustom smart power design, by means of convenient top metal layers interconnections using a programmable NMOS structures based matrix. These results are extremely suitable to decrease low series production cost, to reduce turn-around production cycle and to enable the reuse of functional blocks. A related Patent is pending.

- SWITCH - Internal project - High Frequency DC-DC Power Converters

Development of new design rules for full bridge, phase modulated, soft switching DC-DC converters in order to increase the usefull range of duty ratio. Development of feasibility studies and economical evaluation of active power filters, with both active line and load impedances, based on a single hf switcher and two cycloconverters. Development of the concepts of a new switched input circuit for soft-switching in single and 3-phase bridge inverters, operating with positive or negative input power. Conclusion of the study of a new topology of sinusoidal input current pre-regulator, for low power switch mode power supplies, based on the use of a flyback circuit as a controller of a bridge of storage capacitors.

- CEM - Internal project - Continuing education for Electromagnetic Compatibility.

Efforts have been carried out to create the skills to solve CEM problems, which are arising in Industry, Services and Research Institutes. Two Tutorial Courses were lectured for professionals involved in the design and implementation of Telecommunication systems. The group lectured also two lessons on a Power Quality Seminar about the subjects of electronic equipment as harmonic distortion cause in the mains networks load and active power filters.

PhD Theses

- Saulo Finco (supervisor: M. I. Castro Simas), Universidade Estadual de Campinas; started in 1996, (subject: Cost Effective Smart Power ICs Using Standard CMOS Technologies and NMOS based blocks).
- António Pedro Padez Casimiro (supervisor: M. I. Castro Simas), Instituto Superior Técnico; started in 1997, (subject: Cost Effective Smart Power ICs Using Standard CMOS Technologies and Programmable Arrays).
- Pedro Nuno Mendonça dos Santos (supervisor: M. I. Castro Simas), Instituto Superior Técnico; started in 1998, (subject: Characterization and Optimization of Power Switching Cells Towards Smart Power ICs Using Standard CMOS Technologies).

M.Sc. Theses

- Raul Monteiro (supervisor: Victor Anunciada), Instituto Superior Técnico, to be concluded in 1999 (subject: Soft-switching Techniques for PWM bridge converters).
- Floriberto Lima (supervisor: Victor Anunciada), Instituto Superior Técnico, to be concluded in 1999 (subject: Active Power Filters).

- João Beirante (supervisor: M^a Beatriz Borges), Instituto Superior Técnico, to be concluded in 1999 (subject: Phase Modulation Soft Switching Converters).

Publications

Papers in Conference Proceedings

P. Santos, J. Dias, S. Finco, M. I. Castro Simas and F. Behrens, *Optimização de uma Estrutura LDD-NMOS, Proceedings of the IV Workshop IBERCHIP, IBERCHIP '98*, pp. 381-387, La Plata, Argentina, March 1998

F. Behrens, S. Finco, and M. I. Castro Simas, *Power Devices in Standard CMOS Technologies, XIII SBMicro '98, International Conference on Microelectronics and Packaging, ICMP '98*, Invited Tutorial, pp. 447-459, Brazil, August 1998.

A. P. Casimiro, S. Finco, M. I. Castro Simas and F. Behrens, *Semicustom Smart Power Design: A Novel Transistor Cell Architecture, XIII SBMicro '98, International Conference on Microelectronics and Packaging, ICMP '98*, pp. 395-402, Brazil, August 1998.

S. Finco, P. Tavares, P. Santos, A. P. Casimiro, M. Lança, M. I. Castro Simas and F. Behrens, *A Cost-Effective Smart Power Approach with NMOS Based Blocks in Standard CMOS Technology, Proceedings of the IEEE, 5th International Conference on Electronics, Circuits and Systems, ICECS '98*, vol. 2, pp. 2.135-2.138, Lisbon, Portugal, September 1998.

P. Santos, A. P. Casimiro, M. I. Castro Simas and M. Lança, *Fully CMOS Compatible Gate-Shifted LDD NMOS, Proceedings of the IEEE, XXXIII Industry Applications Society Annual Meeting, IAS '98*, pp. 1119-1123, St. Louis, Missouri, USA, October 1998.

S. Finco, A. P. Casimiro, P. Santos, P. Tavares, F. Behrens and M. I. Castro Simas, *A New Concept for Cost-Effective Smart Power ICs Based on a Unique Cell Type, Proceedings of the IEEE, XXXIII Industry Applications Society Annual Meeting, IAS '98*, pp. 1111-1118, St. Louis, Missouri, USA, October 1998.

F. A. Lima, A. V. Anunciada, *Novel Active Power Filter*, accepted for presentation at *II Conferência de Telecomunicações*

J. Dias, L. Barata, B. V. Borges, A. V. Anunciada, *Single-Phase Power Factor Correction Converters*, accepted for presentation at *II Conferência de Telecomunicações*

Project Deliverables and Reports

Paulo Tavares, *Métodos de Electromedicina*, Internal Report

Paulo Tavares, Saulo Finco, *DC Characteristic of the Level Shifter*, Internal Report

Paulo Tavares, *Analysis of a Clipper Circuit. DC Transfer Characteristic Analysis*, Internal Report

Paulo Tavares, *Detecção de Pontos de Baixa Impedância Cutânea*, Internal Report

A. P. Casimiro, *Descrição e Caracterização das Matrizes NMOSHH, NMOSHD*, Internal Report

Paulo Tavares, *Caracterização de um MOSFET*, Internal Report

P. Casimiro, Pedro Santos, *Circuito Integrado PIC_1_98 – ES2 0,7#245*, Internal Report

Pedro Santos, *Tópicos para a Caracterização do Perfil Bidimensional de Tecnologias CMOS*, Internal Report

Paulo Tavares, *Efeitos das Ligações do Substrato em Bombas de Carga*, Internal Report

Paulo Tavares, *Aquisição de Dados. Módulo de Condicionamento de Sinal*, Internal Report

Miscellaneous

- Beatriz Borges reviewer of papers submitted to the IEEE Power Electronics Specialists Conference, PESC98
- Victor Anunciada reviewer of papers submitted to the IEEE Transactions on Industrial Electronics

M.Sc. Theses

- Manuel Afonso Mourão Barbosa (supervisor: José M. Brázio), Instituto Superior Técnico, in preparation (subject: Provision of Quality of Service under IPv6).
- Nuno Miguel V. Ribeiro (supervisor: José M. Brázio), Instituto Superior Técnico, in preparation (subject: A Platform for Universal Access to Applications in a University Campus Environment).

Publications

Papers in Conference Proceedings

F. Velez, J. Brázio, "Microcellular Design and System Capacity Determination for Outdoors Urban Mobile Broadband Communication Systems in the Millimeterwave Bands", *Proc. International Conference on Telecommunications ICT'98*, Porto Carras, Greece, June 22–25, 1998.

R. Carvalho, J. Brázio, "Multiservice Traffic Model for the Sharing of a Resource by a Homogeneous Population of Users with Stochastically Heterogeneous Demands," (in Portuguese), *Proc. of the 6th. Conference of the Portuguese Statistical Society*, Coimbra, Portugal, June 1998.

R. Carvalho, J. Brázio, "Modelling and Performance of a Communications System under Differentiated Classes of Multi-component Calls," (in Portuguese), *Proc. of the 6th. Conference of the Portuguese Statistical Society*, Coimbra, Portugal, June 1998.

J. L. Sobrinho, A. S. Krishnakumar, "EQuB-Ethernet Quality of Service using Black Bursts," *Proc. 23rd Conference on Local Computer Networks*, pp.286-296, Boston, Massachusetts, October 11-14, 1998

Miscellaneous

- João L. Sobrinho reviewer for *Electronics Letters*
- José M. Brázio reviewer for *Electronics Letters*
- This research line and the Integrated Communications and Multimedia Research Line were the local organisers for the COST 257 Mid-Term Seminar, held in January of 1999 in Vilamoura, Portugal.

9.1.8 Integrated Communications and Multimedia Research Line

Human Resources

Collaborators

- Carlos Alberto Carvalho Belo Ph. D. Associate Professor, IST
- António Carlos Matias Almeida M. Sc. Assistant, IST
- João Luís C. C. G. Sobrinho Ph. D. Assistant Professor, IST³

Other Collaborators

- Kindoki Kimanima M. Sc. Student Grant, (Bartolomeu Dias)
- Valter Bouça M. Sc. Student
- Alberto L. Correia Lic. Student Final Year Project
- Carlos P. Nascimento Lic. Student Final Year Project
- João M. F. Correia Lic. Student Final Year Project
- Ricardo Rodrigues Lic. Student Grant, (ENN project)

Projects

- TELEMATICS, HC1014 - ENN ("European Neurological Network").

This project involves neurological laboratories spread over Europe from Finland to Portugal. Within the project this group dealt with the communications infrastructure. After the study of several technologies a network based on ISDN has been agreed upon and has been built and tested. In particular, inverse multiplexing techniques were used to support applications with bandwidth requirements above the 64kbps. Also, firewall mechanisms have been implemented to guarantee security in the communications among Health Care Centres. To reduce the need for long distance calls a proxy/cache server was implemented to provide for data in local environments. During the last semester of 1998 the system has been used on a regular basis between Health Care Centres and a specialised neurological laboratory.

- COST 237, "Multimedia Telecommunication Services".

This project ended in August 1998 and addressed topics including multimedia communication environments, multimedia applications and group communication. The participation of this group was centred on the study of quality of service and congestion control in multimedia communications.

³ He is also a collaborator of the Networks Research Line.

- COST 264, “Enabling Networked Multimedia Group Communication”.

This project is the follow-up of COST237 and was started in November 1998. Our main interests include those pursued in the previous project with the additional consideration of networks supporting multicasting communication

- COST 257, “Impact of new Services on the Architecture and Performance of Broadband Networks”.

The project is concerned with the modelling and analysis of broadband traffic. Within this project we studied the performance of an ATM queuing systems fed by Markov Modulated Poisson Processes (MMPP) describing a superposition of audio and video sources.

- “Transport of Real-Time Traffic in Data Networks”

Within the activities of this project research has been done into multiple access mechanisms for guaranteeing bounded access delays and ordered delivery for real-time traffic in local area networks. Overlay access methods have been devised for established local area networks which provide good delay and ordering properties for real-time traffic and do not require the access methods of pre-existing data stations to be changed. Their properties and performance have been assessed. Studies for both wired (IEEE 802.3) and wireless (IEEE 802.11) systems have been performed.

Ph. D. Theses

- António Carlos Matias Almeida (supervisor: Carlos A. Carvalho Belo), Instituto Superior Técnico, in preparation (subject: congestion control in packet-switching networks).

M.Sc. Theses

- Kindoki Kimanima (supervisor: Carlos A. Carvalho Belo), Instituto Superior Técnico, in preparation (subject: performance analysis of heterogeneous multilink connections).
- Valter Bouça (supervisor: Carlos A. Carvalho Belo), Instituto Superior Técnico, in preparation (subject: quality of service in multimedia networks).

Publications

Papers in Conference Proceedings

J. L. Sobrinho and A. S. Krishnakumar, “EQuB-Ethernet Quality of Service using Black Bursts”, Proc. 23rd Conference on Local Computer Networks, pp.286-296, Boston, Massachusetts, October 11-14, 1998.

António C. Almeida and Carlos A. Belo, “Congestion Control: Evaluation of Binary Schemes”, accepted for presentation in ConfTele99, Sesimbra, April 1999.

Miscellaneous

- Error probabilities for nonlinear filters – Development and analysis of a technique to design estimation filters in nonlinear problems based on a pre-specified error probability density function (Work done during the sabbatical holiday, April-September, by Carlos A. Belo in Carnegie Mellon University, Pittsburgh, U.S.A).
- Simulator for packet-switching networks – Development of a simulator for the evaluation of congestion control mechanisms in packet-switching networks (work done by António C. Almeida).
- Delay analysis in ATM queues for MMPP arrivals – Estimation of the parameters of Markov Modulated Poisson Processes to approximate the superposition of audio and video traffic in ATM networks. This study was applied to characterise the distribution of the cell delay in a network node queue (work done by Sandra C. Gonçalves).
- Seminar Organisation – This research line and the Networks Research Line were the local organisers for the COST 257 Mid-Term Seminar, held in January of 1999 in Vilamoura, Portugal.

9.1.9 Technology and Materials Research Line

Human Resources

Collaborators

- L. Alcácer Ph.D. Full Professor, IST
- R. T. Henriques Ph.D. Associate Professor IST
- J. M. F. Morgado Ph.D. Assistant Professor IST

Other Collaborators

- Nunzio Barbagallo Ph.D. Student Grant, UNIV. BOLOGNA
- A. C. Ribeiro Ph.D. Student Grant, PRAXIS XXI
- Ana Charas Ph.D. Student Grant, PRAXIS XXI

Projects

- JNICT PBIC/C/CTM/1913/95 — Electronic Devices based on conjugated polymers and oligomers
The activities of this project consisted on the construction of devices such as FETs and LEDs using conjugated polymers as active materials, namely poly(thienylvinylene), PTV, derivatives, and their characterisation by conventional methods.
- PRAXIS XXI N° 2/2.1/QUI/203/94 — Charge Transfer Solids. From Transition Metal Dichalcogenates to Synthetic Metals.
The work done under this project consisted on the detailed study of the electric and magnetic properties of charge transfer complexes containing transition metal bis-dithio(seleno)lenes.
- JNICT PBIC/C/CTM/1965/95 — Synthesis and characterisation of luminescent polymers
Polymer electrolytes containing luminescent centers, namely Eu^{3+} ions, were characterized by thermal and morphological studies (DSC, DTA, TGA, X-ray and SEM). The study of the luminescent properties was done.
- PRAXIS/3/3.1/MMA/1792/95— Polymer LED Active Matrix
Polymer LEDs of the ITO/PPV/M (M=Al) type were deposited on glass substrates and their characteristics were measured. An amorphous silicon thin film transistor array was fabricated to be used as the active element of a polymer LED active matrix.
- PRAXIS/3/3.1b. SENSION— Development of a reference microelectrode.

Polymer electrolytes based on polymethylmethacrilate gels with lithium perchlorate were developed for the reference system of pH sensors for medical applications.

- PRAXIS/PCEX/C/QUI/82/96, "Thin film p-n junctions based on electroactive polymers":

Thin film p-n junctions were prepared from blends of PPV (poly(p-phenylene-vinylene) and poly(ethylene-oxide) doped with lithium salts and their physical characteristics were studied.

- CONTRACT JOE3-CT97-0049(DG12-WSMN) Development on Low Temperature Fuell Cell with methanol as a fuell option

Our activities in this project, during 1998 consisted on the synthesis of new polymers for the proton exchange membranes of fuell cell prototypes.

Ph.D. Theses

- Antonieta Caneco Ribeiro (supervisor: L. Alcacer); Instituto Superior Tecnico. Started in 1998; (subject: Development of Reference Microelectrodes for Microsensors).
- Ana Maria Matos Charas (supervisor: L. Alcacer; co-supervisor: J. Morgado); Instituto Superior Tecnico. Started in 1998; (subject: Synthesis and Characterization of new Soluble Conjugated Polymers for LEDs).
- Nunzio Barbagallo (supervisor: L. Alcacer; co-supervisor: J. Morgado); Instituto Superior Tecnico. Started in 1998; (subject: Polymer LED active matrices).

M.Sc. Theses

- Antonieta Caneco Ribeiro (Supervisor: L. Alcacer); Instituto Superior Tecnico. Concluded in 1998. To be discussed in 1999 (subject: Ionic Conducting Polymers for Microsystems).
- Ana Maria Matos Charas (Supervisor: J. Morgado); Instituto Superior Tecnico. Concluded in 1998; discussed in January 1999, (subject: Synthesis and Characterization of Soluble Conjugated Polymers for Applications in Electronic Devices).

Publications

Papers in Journals

"Luminescence of Non-Hygroscopic Polymer Electrolytes Modified by Europium Picrate Complexes", L.D. Carlos, M. Assunção, P.M. Mourão e L. Alcácer, *Electrochim. Acta*, **43**, 1371 (1998).

"A Novel Class of Luminescent Polymers Obtained by the Sol-gel Approach", V. de. Zea Bermudez, L.D. Carlos, M.C. Duarte, M.M. Silva, C.J.R. Silva, M.J. Smith, M. Assunção e L. Alcácer, *J. Alloys & Comp.*, in press.

“Synthesis and characterization of novel urethane cross-linked ionic liquids for solid-state lithium batteries”; V. de Zea Bermudez, L. Alcácer, J.L. Acosta, E. Morales; accepted in *Solid State Ionics*.

“Sol-Gel Derived Urea Cross-Linked Organically Silicates. 1. Room Temperature Mid-infrared Spectra”, V. de Zea Bermudez, L.D. Carlos, e L. Alcácer, submitted to *Chem. Mater.*, 1998.,

“Luminescence Properties of Poly(*p*-phenylenevinylene): Role of the Conversion Temperature on the Photoluminescence and Electroluminescence Efficiencies.”, J. Morgado, F. Cacialli, J. Grüner, N. C. Greenham and R. H. Friend, Accepted for publication in *Journal of Applied Physics*.

“Ability of Substituted Perylenes to Form Organic Conductors”, L. F. Veiros and J. Morgado, Accepted for publication in *Mol. Cryst. and Liq. Cryst.*

“The (DT-TTF)₂M(mnt)₂ Family of Radical Ion Salts: From a Spin Ladder to Delocalised Conduction Electrons that Interact With Localised Magnetic Moments”, E. Ribera, C. Rovira, J. Veciana, J. Tarrés, E. Canadell, R. Rousseau, E. Molins, M. Mas, J.-P. Schoeffel, J.-P. Pouget, J. Morgado, R. T. Henriques and M. Almeida, Accepted for publication in *Chemistry - A European Journal*.

Papers in conference Proceedings

“TTF Derivatives as Versatile Building Blocks: From Metals to Spin-Ladders”, C. Rovira, J. Veciana, E. Ribera, J. Tarrés, E. Canadell, R. Rousseau, M. Mas, E. Molins, V. Laukhin, M. Almeida, R. T. Henriques, J. Morgado, J.-P. Schoeffel, J.-P. Pouget, J.-J. Novoa and M.-C. Rovira, *NATO Advanced Research Workshop - Supramolecular Engineering of Synthetic Metallic Materials: Conductors and Magnets*, Sitges (Barcelona), 10-14 Jan., 1998.

“Solid State Properties of the DT-TTF-M(mnt)₂ Family. (DT-TTF)₂Au(mnt)₂, The First Organic Spin Ladder”, E. Ribera, C. Rovira, J. Veciana, J. Tarrés, E. Canadell, R. Rousseau, E. Molins, M. Mas, M. Almeida, R. T. Henriques, J. Morgado, J.-P. Schoeffel and J.-P. Pouget, *NATO Advanced Research Workshop - Supramolecular Engineering of Synthetic Metallic Materials: Conductors and Magnets*, Sitges (Barcelona), 10-14 Jan. 1998.

“Synthesis and Characterisation of Soluble PTV Derivatives”, J. Morgado, A. Charas, A. Gomes, P. T. Gomes and L. Alcácer, *International Conference on Science and Technology of Synthetic Metals*, Montpellier, 12-18 July 1998.

“Novel Luminescent Polymers”, H. Rost, B. S. Chuah, D.-H. Hwang, S. C. Moratti, A. B. Holmes, J. Wilson, J. Morgado, J. J. M. Halls, J. C. De Mello and R. H. Friend, *International Conference on Science and Technology of Synthetic Metals*, Montpellier, 12-18 July 1998; to be published in *Synthetic Metals* .

“Synthesis of Porphyrin-PPV Copolymers for Applications in LEDs”, R. Iqbal, G. Yahioglu, L. Milgrom, S. C. Moratti, A. B. Holmes, F. Cacialli, J. Morgado and R. H. Friend, *International Conference on Science and Technology of Synthetic Metals*, Montpellier, 12-18 July 1998; to be published in *Synthetic Metals* .

“The DT-TTF M(mnt)₂ Family of Compounds”, E. Ribera, C. Rovira, J. Veciana, J. Tarrés, E. Cannadell, R. Rousseau, E. Molins, M. Mas, J. P. Schoeffel, J.-P. Pouget, J. Morgado, R. T. Henriques and M. Almeida, *International Conference on Science and Technology of Synthetic Metals*, Montpellier, 12-18 July 1998; to be published in *Synthetic Metals* .

“Synthesis and Characterisation of TTF-[Au(dcdmp)₂] Conductors”, D. Belo, J. Morgado, E. B. Lopes, I. C. Santos, V. Gama, R. T. Henriques and M. Almeida, *International Conference on Science and Technology of Synthetic Metals*, Montpellier, 12-18 July 1998; to be published in *Synthetic Metals* .

“Metals and Spin-Ladders from TTF’s”, C. Rovira, J. Veciana, E. Ribera, J. Tarrés, E. Canadell, R. Rousseau, M. Mas, E. Molins, V. Laukhin, M. Almeida, R. T. Henriques, J. Morgado, J.-P. Schoeffel, J.-P. Pouget, J.-J. Novoa and M. C. Rovira, *International Conference on Science and Technology of Synthetic Metals*, Montpellier, 12-18 July 1998; to be published in *Synthetic Metals* .

“New Organic and Polymeric Materials for Thin Film Luminescent Devices”, A. B. Holmes, B. S. Chuah, X.-C. Li, F. Cacialli, J. Morgado, H. Siringhaus, D. A. dos Santos, S. C. Moratti, J.-L. Brédas, R. H. Friend and F. Garnier, Submitted to *SPIE Meeting Proceedings Symposium 3476*, San Diego (USA) July 21-23, 1998.

“Structure and Properties of the New Compound Based on Tetrathiafulvalene: [tff]₃[Au(pds)₂]₃”, I. C. Santos, J. Morgado, R. T. Henriques, L. F. Veiros, M. T. Duarte, L. Alcácer and M. Almeida, (*Crystallography Meeting*, Prague, August, 1998)

“Light-emitting Devices Based on New PPV Derivatives with Crown-Ether Substituents”, J. Morgado, F. Cacialli, J. C. De Mello, R. H. Friend, B. S. Chuah, S. C. Moratti and A. B. Holmes, *Europhysics Conference on Macromolecular Physics - Electrooptical Properties of Polymers and Related Phenomena*, Villa Monastero, Varenna, Italy, 13-18 September, 1998.

“A New Class of Sol-Gel Luminescent Polymers Based on Eu(III)”, L.D. Carlos, V. de Zea Bermudez, M.M. Silva, M.C. Duarte, C.J.R. Silva, M.J. Smith, M. Assunção and L. Alcácer, *Physics and Chemistry of Luminescent Materials VI*, editor C. Ronda e T. Welker, (*The Electrochemical Society, Proceedings Series, San Francisco, 1998*), Vol. 97-29, p.352.

Miscellaneous

- Luis Alcacer was reviewer of papers submitted to *Chemistry of Materials*.
- Luis Alcacer was reviewer of papers submitted to the *International Conference on Science and Technology of Synthetic Metals*, Montpellier, 12-18 July 1998.
- Jorge Morgado held a post-doctoral position at the Optoelectronics Group (Prof. Richard Friend) of the University of Cambridge, from February 15 to August 15, 1998.

Participation in International Scientific Meetings

- International Conference on Science and Technology of Synthetic Metals, Montpellier, France, July 12-18, 1998.
- Europhysics Conference on Macromolecular Physics - Electrooptical Properties of Polymers and Related Phenomena, Villa Monastero, Varenna, Italy, 13-18 September, 1998.
- Adriatic Research Conference on Organic Semiconductors , 7-10 July 98, Trieste, Italy

9.1.10 Instrumentation and Measurement Research Line

Human Resources

Collaborators

- Pedro Manuel Brito da Silva Girão Ph.D. Associate Professor, IST
- António Manuel da Cruz Serra Ph.D. Assistant Professor, IST
- Helena Maria Geirinhas Ramos Ph.D. Assistant Professor, IST
- Francisco André Corrêa Alegria MSc. Assistant, IST
- Manuel José Freire Fonseca da Silva BSc. Assistant, IST
- Maria da Conceição F. C. Macedo BSc. Assistant, IST
- Raul Daniel Lavado Carneiro Martins BSc. Assistant, IST

Other Collaborators

- José Miguel Dias Costa Pereira MSc Adjoint Professor, IP Setubal
- Mouhaydine Tlemçani BSc. Assistant, U. Évora
- Paulo Jorge Maia dos Santos BSc. Assistant, U. Algarve
- José Fernando Morais Lopes Mariano BSc. Assistant, U. Algarve
- Pedro Miguel Pinelo Cruz Lic. Student IST, Final Year Project
- Daniela M. S. Campos Lic. Student IST, Final Year Project
- Telmo Edgar da Costa Cabrita Lic. Student IST, Final Year Project
- Pedro Miguel do Carmo Lic. Student IST, Final Year Project
- Vitor Hugo Cardoso Lic. Student IST, Final Year Project
- Nuno Filipe Fontes Morgadinho Lic. Student IST, Final Year Project
- Pedro Miguel A. Fernandes da Silva Lic. Student IST, Final Year Project

Projects

- PRAXIS XXI - 2/2.2/TIT/1591/95 – SCCEO: Simulation and Characterisation of Electronic and Optoelectronic Devices

New testing methods for the dynamic characterisation of Analog to Digital Converters (ADC) were studied. In particular an improvement of the traditional histogram method that uses gaussian noise as the stimulus signal was developed. It was proved that the transfer function of the ADC can be obtained with this new method and that it gives best results for broadband and high frequency characterisation than the

obtained with traditional procedures. Merit figures like SNR, THD, INL, DNL and the effective number of bits were derived. An automatic calibration system for measuring instruments was finished. The system can perform manual or automatic calibrations of measuring instruments equipped or not with a digital interface to the controlling computer. By using computer vision techniques, the system is able to obtain the readings of any analog or digital-measuring instrument. A database of calibrators and measurement instruments was associated to the application enabling a user-friendly interface with the system.

- Telematics Applications Programme HC 1020 – HECTOR: Health Emergency Management and Coordination through Telematic Operational Resources.

The implementation of a data acquisition and transmission system for the INEM (Portuguese National Institute for Medical Emergency) was completed.

- EUPAS (“European Project for ADC-based devices Standardization”)

European Network including 10 Universities and Research centres and 5 Industrial partners. During 1998, the work was focused in the improvement of the European rules concerning the test methods for analog-to-digital converters and sample-and-hold circuits, with emphasis on their dynamic behavior.

- “Calibration and Test” - Contract with the Lab. of Metrology CET-TELECOM Lisboa.

Automatic measurement and calibration systems based on PC and calibrators were implemented.

PhD Theses

- José Miguel Dias Costa Pereira (supervisors: Pedro M.B. S. Girão and António M. C. Serra), Instituto Superior Técnico, to be concluded in 1999 (subject: Automatic characterisation of high frequency devices).
- Manuel José Freire Fonseca da Silva (supervisor: António M. C. Serra), Instituto Superior Técnico, in preparation (subject: Impedance measurement system based in self-adjusted bridges).
- Francisco André Corrêa Alegria (supervisor: António M. C. Serra), Instituto Superior Técnico, in preparation (subject: High resolution measurements in non-stationary or very noisy signals).
- Mouhaydine Tlemçani (supervisor: António M. C. Serra), Instituto Superior Técnico, in preparation (subject: Simulation and characterisation of Analog to Digital Converters).

M.Sc. Theses

- Maria da Conceição Falcão Líbano Monteiro Costa Macedo (supervisor: António M. C. Serra), Instituto Superior Técnico, to be concluded in 1999 (subject: Real time transcription of sung melodies).
- Raul Daniel Lavado Carneiro Martins (supervisor: António M. C. Serra), Instituto Superior Técnico, to be concluded in 1999 (subject: Dynamic characterisation methods of Analog to Digital Converters).
- Paulo Jorge Maia dos Santos (supervisor: Pedro M.S. Girão), Instituto Superior Técnico, in preparation (subject: Monitorisation of water quality: measuring transducers, data acquisition and telemetry).

- José Fernando Morais Lopes Mariano (supervisor: Helena M. G. Ramos), Instituto Superior Técnico, in preparation (subject: Modelling of analog to digital converters).

Publications

Books and Book Chapters

P. M. Silva Girão, A. Cruz Serra and H. Geirinhas Ramos, "Electric Distortion Measurement", in "*Wiley Encyclopedia of Electrical and Electronics Engineering*", John Wiley and Sons, Inc. Nova York, USA (to appear in April 1999).

P. M. Silva Girão, A. Cruz Serra and H. Geirinhas Ramos, "Volt-Ampere meters", in "*Wiley Encyclopedia of Electrical and Electronics Engineering*", John Wiley and Sons, Inc. Nova York, USA (to appear in April 1999).

Papers in Journals

J. Dias Pereira, O. Postolache, P. M. Silva Girão, "A Temperature Compensated System for Magnetic Field Measurements Based on Artificial Neural Networks", *IEEE Transaction on Instrumentation and Measurement*, vol. 47, no.2, April 1998.

R. Martins, A. Cruz Serra, "Automated ADC characterization using the histogram test stimulated by Gaussian noise", accepted for publication, *IEEE Transaction on Instrumentation and Measurement*, 1999.

J. Dias Pereira, P. M. Silva Girão. "Instrumentação para Medidas Eléctricas: Dos Instrumentos Analógicos aos Instrumentos Virtuais," *Ingenium – 2ª Série*, No 28, pp. 69- 76, Aug 1998.

Papers in Conference Proceedings

J. Dias Pereira, O. Postolache, P. M. Silva Girão, M. Cretu, "Minimising Temperature Drift Errors of Conditioning Circuits using Artificial Neural Networks," *IMTC'98, IEEE Instrumentation and Measurement Technology Conference Proceedings*, vol. 1, pp. 257-260, St. Paul, USA, May 1998.

O. Postolache, J. Dias Pereira, M. Cretu, P. M. Silva Girão, "An ANN Fault Detection Procedure Applied in Virtual Measurement Systems Case," *IMTC'98, IEEE Instrumentation and Measurement Technology Conference Proceedings*, vol. I, pp. 257-260, St. Paul, USA, May 1998.

R. Martins, H. Geirinhas Ramos, P. Girão e A. Cruz Serra, "Taxonomic problems on ADC characterisation", *IEEE International Conference on Electronics, Circuits and Systems, ICECS'98 Proceedings*, vol. 3, pp. 445-448, Lisbon, Portugal, September 1998.

- R. Martins, A. Cruz Serra, "The use of a noise stimulus in ADC characterization", *IEEE International Conference on Electronics, Circuits and Systems, IEEE International Conference on Electronics, Circuits and Systems, ICECS'98 Proceedings*, vol. 3, pp. 457-460, Lisbon, Portugal, September 1998.
- R. Martins, A. Cruz Serra, "Automated ADC characterization using the histogram test stimulated by Gaussian noise", *Conference on Precise Electromagnetic Measurement, CPEM 98*, pp. 313-314, Washington, July 1998.
- P. M. Silva Girão, "Electromagnetic Compatibility: Aspects Involved in the Certification of Products," *IEEE Melecon'98 Proceedings*, vol. I, pp. 111-115, Tel-Aviv, Israel, May 1998.
- O. Postolache, J. Dias Pereira, P. Girão e A. Cruz Serra, "A new virtual instrument for temperature measurement based on a photodiode excited by a laser source," *IEEE Melecon'98 Proceedings*, vol. 2, pp. 1440-1443, Tel-Aviv, Israel, May 1998.
- H. Geirinhas Ramos, P. M. Silva Girão, "Software Environments for the Implementation of Virtual Instrumentation," *IEEE Melecon'98 Proceedings*, vol. I, pp. 534-538, Tel-Aviv, Israel, May 1998.
- O. Postolache, P. M. Silva Girão, H. Geirinhas Ramos, J. M. Dias Pereira, "A Temperature Sensor Fault Detector as an Artificial Neural Network Application," *IEEE Melecon'98 Proceedings*, vol. 2, pp. 678-682, Tel-Aviv, Israel, May 1998.
- R. Martins, A. Cruz Serra, "ADC interbit modulation: description, detection and quantification", *IMEKO TC-4, 10th International Symposium on Development in Digital Measuring Instrumentation Proceedings*, Vol. I, pp. 466-471, Naples, Italy, September 1998.
- O. Postolache, J. M. Dias Pereira, P. M. Silva Girão, M. Cretu, "A Virtual Magnetometer Based on Artificial Neural Networks," *IMEKO TC-4, 10th International Symposium on Development in Digital Measuring Instrumentation Proceedings*, vol. 2, pp. 580-584, Naples, Italy, Sept 1998.
- J. M. Dias Pereira, O. Postolache, P. M. Silva Girão, J. A. Brandão Faria, M. Cretu, "An Optical Temperature Transducer Based on a Bimetallic Sensor," *IMEKO TC-4, 10th International Symposium on Development in Digital Measuring Instrumentation Proceedings*, vol. 2, pp. 661-664, Naples, Italy, Sept 1998.
- J. Dias Pereira, A. Cruz Serra, P. Girão, "Dithered ADC systems in the presence of hysteresis errors", accepted for presentation at *IEEE Instrumentation and Measurement Technology Conference, IMTC/99*, Venice, Italy, May 1999.
- J. Dias Pereira, A. Cruz Serra, P. Girão, "Dithering in A/D converters: a compromise between resolution and bandwidth", accepted for presentation at *Contetele 99*, Sesimbra, Portugal, Abril, 1999.
- R. Martins, A. Cruz Serra, "Dynamic characterisation of analog to digital converters", accepted for presentation at *Contetele 99*, Sesimbra, Portugal, Abril, 1999.
- C. Monteiro, A. Cruz Serra, "Real time transcription of sung melodies", accepted for presentation at *Contetele 99*, Sesimbra, Portugal, Abril, 1999.

M. F. Silva, A. Cruz Serra, "Automatic capacitance measurement system", accepted for presentation at *Contetele 99*, Sesimbra, Portugal, Abril, 1999.

Project Deliverables and Reports

F. Corrêa Alegria and A. Cruz Serra, "GEMI – Automatic gathering of information about vacancies in intensive care units", HECTOR Project HC 1020.

Miscellaneous

- During 1998 plug&play boards for personal computers were designed and fabricated. IST Lic. Students developed these within the Final Year Project. The boards are used to implement automatic measurement systems (work done by A. Cruz Serra and R. Martins).
- A measurement and control system for the protection of a cable TV optical ring network was developed. This work is done in collaboration with the Optical Communications Research Line of the Instituto de Telecomunicações (work done by A. Cruz Serra and P. Cruz).
- Modelling and testing of interleaved ADCs systems was performed. The use of dither techniques to linearise ADCs transfer functions was studied (work done by J. M. Costa Pereira, P. M. Silva Girão and A. Cruz Serra).
- The development of an impedance measurement system based on self-adjusted measurement bridges continued (work done by A. Cruz Serra and M. F. Silva).
- Prof. Pedro M. B. Silva Girão, Prof. António M. Cruz Serra and Prof. Helena M. Geirinhas Ramos were reviewers of the Wiley Encyclopedia of Electrical and Electronics Engineering to be published in 1999.
- Prof. Pedro M. B. Silva Girão was reviewer for IEEE Transactions on Instrumentation and Measurement .
- Prof. Pedro M. B. Silva Girão is member of the Scientific Committee of "Caderno do CEFAT" from the Faculty of Engineering of Oporto University.
- Prof. Pedro M. B. Silva Girão was the Portuguese National Representative to European Programme SMT.
- Prof. Pedro M. B. Silva Girão is Consultant and Auditor of the Portuguese Institute for Quality (IPQ).
- Prof. António M. Cruz Serra is member of the editorial board of the International Journal of Computer Standards & Interfaces, Elsevier Science B. V..
- Prof. António M. Cruz Serra is member and Scientific Secretary of the Technical Committee on Measurement of Electrical Quantities (TC-4) of the Instrumentation and Measurement Confederation (IMEKO).
- Prof. António M. Cruz Serra was reviewer and member of the Technical Program Committee of the IEEE Instrumentation and Measurement Technology Conference (IMTC 99) to be held in Venice, Italy, May, 1999.
- Prof. António M. Cruz Serra was reviewer and Secretary of the International Program Committee of the IMEKO TC-4, "10th International Symposium on Development in Digital Measuring Instrumentation",

Naples, Italy September 1998. He was also chairman of the technical session 9T3 "Digital Instrumentation in Biomedical Measurement".

- Prof. António M. Cruz Serra is member of the Organising Committee of the 2nd Conference on Telecommunications, to be held in Sesimbra, Portugal, April 1999.
- Prof. António M. Cruz Serra is the person in charge of the collaboration within the European Programme SOCRATES Programme: Higher Education (ERASMUS) between the DEEC, Instituto Superior Técnico and the Dip. di dell'Informazione ed Ingegneria Elettrica, University of Salerno, Italy and the Dip. di Ingegneria dell'Informazione ed Ingegneria Elettrica, University of Salerno, Italy.
- Prof. Pedro M. B. Silva Girão and Prof. António M. Cruz Serra organised and were chairman of the Special Technical Session "ADC modelling and testing", included in IEEE Instrumentation Conference on Electronics, Circuits and Systems, ICECS'98 Lisbon, September, 1998.
- Prof. António M. Cruz Serra organised the seminar "On the use of the wavelet transform for the digital processing of transient measurement signals", by Professors Leopoldo Angrisani e Pasquale Daponte from the Dip. di Ingegneria dell'Informazione ed Ingegneria Elettrica, University of Salerno, Italy. The seminar was held at DEEC, Instituto Superior Técnico October 1998.

9.2 Coimbra Pole

9.2.1 Signal and Image Processing Research Line

Human Resources

Collaborators

- | | | |
|----------------------|-------|----------------------------|
| • Luís Vieira de Sá | PhD | Associate Professor, FCTUC |
| • Vitor Mendes Silva | PhD | Assistant Professor, FCTUC |
| • Fernando Perdigão | PhD | Assistant Professor, FCTUC |
| • Eduardo Sá Marta | M.Sc. | Assistant, FCTUC |
| • Luís Alberto Cruz | M.Sc. | Assistant, FCTUC |
| • Paulo Monteiro | M.Sc. | Assistant, FCTUC |
| • Emanuel Martins | M.Sc. | Assistant, FCTUC |

Other Collaborators

- | | | |
|-------------------------------|-------------|----------------------------|
| • Sérgio Maciel de Faria | PhD | Coordinator Professor, IPL |
| • Pedro Amado Assunção | PhD | Coordinator Professor, IPL |
| • João Carlos Silvestre | M.Sc. | Assistant, ISEC |
| • Fernando Lopes | M.Sc. | Assistant, ISEC |
| • Nuno Rodrigues | Lic | Assistant, IPL |
| • Carlos Manuel Ribeiro | Lic | Assistant, IPL |
| • Mário Gonçalo Silveirinha | Lic. | Grant, FCTUC |
| • Artur José de Sousa Gaspar | Lic Student | FCTUC, Final year project |
| • Elisabete daCunha Cordeiro | Lic Student | FCTUC, Final year project |
| • Gonçalo Henrique Pereira | Lic Student | FCTUC, Final year project |
| • João Paulo Viana Duque | Lic Student | FCTUC, Final year project |
| • Jorge Manuel Ferreira Rato | Lic Student | FCTUC, Final year project |
| • Paulo Melanda Silva Pereira | Lic Student | FCTUC, Final year project |
| • Pedro Miguel dos Santos | Lic Student | FCTUC, Final year project |
| • Nuno Miguel Sucena | Lic Student | FCTUC, Final year project |

Projects

- REC (PRAXIS 21) “Speech Recognition Applied to Telecommunications”

During the year of 1998 the work of the Signal and Image Processing Research Line has concentrated on the following 2 topics: Robust Speech Recognition and Speaker Independent Phoneme Recognition. In the first topic, a pre-processing model which simulates the operation of the periphery auditory system was built, integrated in an isolated digit recognizer working in the telephone network and tested. Results showed superior performance in relation to existing spectral pre-processing schemes. In the area of speaker independent phoneme recognition we obtained results showing native-language independence and acoustical environment independence in the circumscribed task of stop-consonant discrimination.

- PRODIGIOS (Praxis/3/3.1/TIT/39/94) Processamento Digital de Sinal de Audio e Vídeo”

Prodigios ended in December of 1998. The work of the Signal and Image Research Line in this project was on the area of multiresolution analysis. The work was directed to the resolution of the problem of filtering finite size signals near the borders and in the area of image analysis.

- SIGNAL MODELLING (internal project)

The research activity in this area has continued. Methods to model ARMA systems which globally minimize the quadratic error between a specified impulse response and the impulse response of the ARMA system with real and complex conjugate poles, were developed.

- COST 249 – Continuous Speech Recognition over the Telephone Line”

The Signal and Image Research Line of IT-Coimbra has participated in the fourth year of this COST 249 action together with 21 other research labs from European Universities and Telecommunications Operators.

- FCT/CAPES “Video Coding and Processing Based on the Analysis of Image Contents”

This project started in 1998 and involves the cooperation of IT and the Federal University of Rio de Janeiro (FURJ). 5 researchers of IT and FURJ participated in the project and, in the year of 1999, PhD students from both institutions will be exchanged.

PhD Theses

- Fernando Santos Perdigão (supervisor: Luís Vieira de Sá), University of Coimbra, concluded in 1998 (title: Auditory Models applied to Speech Recognition).
- Emanuel Gustavo Bebiano Castro Martins (supervisor: Sérgio Manuel Maciel de Faria and Vitor Manuel Mendes Silva), Universidade de Coimbra, in preparation (subject: Extraction of high resolution pictures from low resolution images).
- Eduardo Sá Marta, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, to conclude in 1999 (subject: Speaker Independent Phoneme Transmission).

- João Carlos Silvestre, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, in preparation (subject: Processing of Finite Size Signals in Multiresolution Analysis).
- Paulo Paiva Monteiro (supervisors: Luís Vieira de Sá and Joaquim Júdice) , Universidade de Coimbra, to start in 1999 (subject: IIR Digital Filter Design and Signal Modelling).

M.Sc. Theses

- Rui Baroteo Amaral, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, concluded in 1998 (title: Segmentation and Labelling of Telephone Speech Data).
- Nuno Serra Antunes, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, concluded in 1998. (title: Primary Access ISDN Network Interface for a Videotelephone).
- Nuno Miguel Morais Rodrigues (supervisors: Sérgio Manuel Maciel de Faria and Vitor Manuel Mendes Silva), Universidade de Coimbra, in preparation (subject: Low Bitrate Video Coding using Geometric Transformations).
- Carlos Miguel Ribeiro (supervisors: Sérgio Manuel Maciel de Faria and Pedro António Amado Assunção), Universidade de Coimbra, in preparation (subject: ADSL).

Publications

Papers in Journals

P. A. A. Assunção and M. Ghanbari, “A frequency domain transcoder for dynamic bit rate reduction of MPEG-2 bit streams”, *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 8, n. 8, pp. 953-967, December 1998.

P. A. A. Assunção and M. Ghanbari, “Buffer analysis and control in CBR video transcoding”, submitted to *IEEE Transactions on Circuits and Systems for Video Technology*.

Vitor Silva, Luís de Sá, “General method for perfect reconstruction subband processing of finite length signals using linear extensions”, accepted for publication, *IEEE Transactions on Signal Processing*, 1998.

Papers in Conference Proceedings

A. Navarro, Luis de Sá, “A simple TMS320C31 DSP – PC bus interface circuit”, *Proceedings of Melecon'98*, voll, pp. 530-533, Israel, May 1998.

Eduardo Sá Marta, Luis V. Sá, “Auditory Cells with Frequency Resolution Sharper than Critical Bands Play a Role in Stop Consonant Perception: Evidence from Cross-Language Recognition Experiments”, *Proc. NATO ASI on Computational Hearing*, Il Ciocco, Italy, July, 1998.

F. Perdigão, L. Sá, "A Peripheral Auditory Model as a Front End for Speech Recognition", *Proc. NATO ASI on Computational Hearing*, pp.179-184, Il Ciocco, Italy, July, 1998.

F. Perdigão, L. Sá, "A Computational Model of the Human Cochlea" (in Portuguese), *ACÚSTICA'98 - Congresso Ibérico de Acústica*, pp. 419-422, Lisbon, September, 1998.

F. Perdigão, L. Sá, "A Noise Suppression Technique using an Auditory Model", accepted for presentation at *2nd Conference on Telecommunications - ConfTele'99*, Sesimbra, April 1999.

F. Perdigão, L. Sá, "A Method for Noise Compensation based on an Auditory Front-End" submitted to *EUROSPEECH'99*, Budapest, Hungary, September 1999,

M.. Silveirinha, J. Simões, M. Veríssimo, E. Martins, L. de Sá, "PCI Bus Interface Card for Communication at 2Mbps, accepted for presentation at *2nd Conference on Telecommunications - ConfTele'99*, Sesimbra, April 1999.

N. Borges, R. Lopes, B. Henriques, P. Valente, R. Amaral, E. Martins, F. Perdigão, L. Sá, "Telephony Applications with Speech Recognition", *RECPAD'98 - 10th Portuguese Conference on Pattern Recognition*, pp. 217-220, Lisbon, Portugal, March 1998.

N. Rodrigues, S. Faria, "General Geometric Transform for Video Compression", accepted for presentation at *2nd Conference on Telecommunications - ConfTele'99*, Sesimbra, April 1999.

P. Assunção and M. Ghanbari, "Bit rate control of internetworking video transcoders", *5th IEEE International Conference on Electronics, Circuits and Systems, ICECS'98*, vol. 2, pp 247-250, Lisbon - Portugal, September 1998.

P. Assunção and M. Ghanbari, "A buffer control algorithm for CBR video transcoding", *IEEE International Conference on Image Processing, ICIP'98*, Chicago - USA, October 1998.

Pedro A. Amado Assunção, "QoS filters for flexible digital TV services", accepted for presentation at *II Conferência de Telecomunicações, CONFTELE'99*, Sesimbra – Portugal, April 1999.

Sérgio Faria, "Biorthogonal B-Spline filter banks", *RecPad'98, 10th Portuguese Conference on Pattern Recognition*, Lisboa, Portugal, March, 1998.

Vitor Silva, Luís de Sá, "Time-varying perfect reconstruction filter banks for finite length signals", *First International Symposium on Communications Systems and Digital Signal Processing*, pp.143-146, Sheffield, April 1998.

Miscellaneous

Fernando Perdigão:

- presented a contribution on auditory models as front-ends for speech recognition at the COST249 meeting held in London on the 8th and 9th of October 1998.
- presented of a peripheral auditory model for speech recognition at the 2nd Meeting of NATO IST-TG01 Oct. 1998.
- reviewer of papers submitted to the *2nd Conference on Telecommunications, ConfTele'99*, Sesimbra, Portugal.

Pedro A. Amado Assunção:

- reviewer for IEEE Transactions on Multimedia.

Luís Vieira de Sá:

- member of the Executive Board of Instituto de Telecomunicações.
- member of the Organizing Committee of the *Workshop on Mathematical Problems in Telecommunications*, Coimbra, September 1998
- reviewer and member of the Scientific Committee of “Caderno do CEFAT” from the Faculty of Engineering of Oporto University
- reviewer and member of the Scientific Committee of the *10th Portuguese Conference on Pattern Recognition*, Lisboa, Portugal, March 1998.
- reviewer of papers submitted to the *2nd Conference on Telecommunications - ConfTele'99*, Sesimbra, Portugal.
- reviewer of papers submitted to the Eurasip Conference on *DSP for Multimedia Communications and Services ECMCS'99*, Polland, 1999.
- presented 2 talks on “Speech recognition with HMMs” and “Decomposition of Finite Size Signals” at the Federal University of Rio de Janeiro, on June of 1998.
- presented the talk “Image Compression using Wavelets”, in the *IT Seminar on Theory and Applications of Wavelets*, Aveiro, December 1998.
- is the national delegate to COST249.

Vitor Silva:

- reviewer for IEEE Transactions on Signal Processing and IEEE Transactions on Circuits and Systems for Video Technology.
- reviewer of papers submitted to the 10th Portuguese Conference on Pattern Recognition, Lisboa, Portugal, March 1998.
- co-author of “Image Compression using Wavelets” talk presented in the *IT Seminar on Theory and Applications of Wavelets*, Aveiro, December 1998.

9.2.2 Optical Communications Research Line

Human Resources

Collaborators

- Henrique J. A. da Silva Ph.D. Associate Professor, FCTUC
- Álvaro M. F. de Carvalho Lic. Assistant, FCTUC

Other Collaborators

- Mário M. Freire M.Sc. Assistant, UBI
- António L. F. Marques M.Sc. Assistant, ISEC
- João M. P. C. Gil M.Sc. Assistant, IPL
- Paulo M. Mendes Lic. Assistant, IPCB
- João G. T. dos Reis Lic. PT
- Mário C. A. Reis Lic. EDP
- Luís M. M. Mendes Lic. Assistant, IPL
- Telmo R. C. Fernandes Lic. Assistant, IPL
- Mariette S. Silva Lic. Student FCTUC, final year project
- Fabrício A. Ferraz Lic. Student FCTUC, final year project
- Mónica C. Figueiredo Lic. Student FCTUC, final year project
- Raquel M. Carreira Lic. Student FCTUC, final year project
- Gabriel F. Guerra Lic. Student FCTUC, final year project
- Romero F. Silva Lic. Student FCTUC, final year project
- Vítor M. Martins Lic. Student FCTUC, final year project

Projects

- OPTICAL NETWORKS (internal project)

This project integrates the work under development by several members of the Optical Communications research line, and its objective is to build a computational infrastructure for simulation of optical networks employing emerging transmission and multiple access technologies. One Ph.D. and three M.Sc. theses are in preparation, in this context.

- COST 240 – “Techniques for Modelling and Measuring Advanced Photonic Telecommunications Components”

The Optical Communications Research Line of IT-Coimbra has participated in the final year of this COST action, in Working Group 1 (modelling and characterisation of semiconductor laser diodes and optical amplifiers).

- ITCOM (PRAXIS/3/3.1/TIT/35/94 “Integration of Technologies for Mobile Communications”

The Optical Communications research line participated in the final year of ITCOM, activity WP5100, which consisted in designing and building an optical transmitter and an optical receiver for a SCM system in the band of 2GHz, for the optical links between the central node and the base stations (*down link*). One M.Sc. thesis is in preparation, as a sub product of this activity.

- NEURALTEL “Applications of Neural Networks in Telecommunications”

International collaboration project of the LAESEC (Latin American and European Scientific and Educational Co-operation) network, framed by the European programme ALFA. The Optical Communications research line contributed for the R&D plan of this project in two application domains, "Telecommunications Networks" and "Signal Processing". One M. Sc. thesis is in preparation, in the frame of this project.

PhD Theses

- Mário Marques Freire (supervisor: Henrique J. A. da Silva), University of Coimbra, in preparation (subject: Non Linear Applications of Semiconductor Optical Amplifiers in Multichannel Optical Communications Systems).

M.Sc. Theses

- Álvaro M. F. Carvalho (supervisor: Henrique J. A. da Silva), University of Coimbra, in preparation (subject: Soliton Transmission in Strongly Perturbed Systems).
- Paulo M. Mendes (supervisor: Henrique J. A. da Silva), University of Coimbra, in preparation (subject: Performance Assessment of Optical Networks with CDMA).
- João G. P. T. dos Reis (supervisor: Henrique J. A. da Silva), University of Coimbra, in preparation (subject: Modelling and Characterisation of Spatial Optical Switches).
- Mário C. A. Reis (supervisor: Henrique J. A. da Silva), University of Coimbra, in preparation (subject: Measurement Techniques for Characterisation of Semiconductor Lasers).
- Luís M. M. Mendes (supervisor: Henrique J. A. da Silva), University of Coimbra, in preparation (subject: Transmission Interfaces for SCM Optical Communication Systems).
- Telmo R. C. Fernandes (supervisor: Henrique J. A. da Silva), University of Coimbra, in preparation (subject: Dynamic Carrier Assignment in Cellular Mobile Communication Systems).

Publications

Papers in Conference Proceedings

Álvaro M. F. de Carvalho, and Henrique J. A. da Silva, "Performance Assessment of 10 Gbit/s Dispersion Managed Soliton Communication Systems: An Analytical Approach", in *Proc. 9th Mediterranean Electrotechnical Conference (MELECON'98)*, Tel-Aviv, Israel, May 18-20, 1998, IEEE, Vol. II, pp.764-768.

Mário M. Freire and Henrique J. A. da Silva, "Performance Assessment of Dispersion-Supported Transmission at 10- and 20-Gb/s Using a Travelling-Wave Booster Amplifier", in *Proceedings of 9th Mediterranean Electrotechnical Conference (MELECON'98)*, Tel-Aviv, Israel, 18-20 May, 1998, IEEE, Vol. II, pp.779-783.

Mário M. Freire and Henrique J. A. da Silva, "Performance Implications of Partial Chirp Compensation in a Semiconductor Optical Booster Amplifier for Dispersion Supported Transmission at 10 Gbit/s", in *Bridging East and West Through Telecommunications, F-N Pavlidou (Ed.), International Conference on Telecommunications (ICT' 98)*, Porto Carras, Greece, June 21-25, 1998, Kings College London / IEE / Aristotle University of Thessaloniki / IEEE / URSI, Vol. I, pp. 76-80.

Mário M. Freire and Henrique J. A. da Silva, "Performance Assessment of Dispersion Supported Transmission at 20 Gbit/s Using a Semiconductor Optical Booster Amplifier", in *Long-Haul, ATM and Multi-Media Networks, Networks and Optical Communications 1998 (NOC'98)*, Vol. II, D. W. Faulkner and A. L. Harmer (Eds.), IOS Press, Amsterdam, 1998, pp. 228-235.

Álvaro M. F. de Carvalho and Henrique J. A. da Silva, "Design and Optimization of Dispersion Managed Soliton Communication Systems", in *Optimization'98*, Coimbra, Portugal, July 20-22, 1998, pp. 30.

Mário M. Freire, Luís N. Vicente, and Henrique J. A. da Silva "Least Squares Estimation of Multiple-Quantum-Well Laser Parameters from IM Response Measurements", in *Optimization'98*, Coimbra, Portugal, July 20-22, 1998, pp. 38.

Mário M. Freire, Luís N. Vicente, and Henrique J.A. da Silva, "Extraction of Intrinsic Parameters for Multi-Quantum Well Lasers from Measurements of IM Response", in *Workshop on Mathematical Problems in Telecommunications*, Coimbra, Portugal, September 28-29, 1998, pp. 55-58.

Telmo R.C.C. Fernandes and Henrique J.A. da Silva, "Dynamic Channel Assignment in Mobile Networks Using Neural Networks", in *Workshop on Mathematical Problems in Telecommunications*, Coimbra, Portugal, September 28-29, 1998, pp. 61-62.

Álvaro M.F. de Carvalho and Henrique J. A. da Silva, "Evaluation of the Continuum Energy generated in Periodically Amplified Soliton Links", in *Workshop on Mathematical Problems in Telecommunications*, Coimbra, Portugal, September 28-29, 1998, pp. 73-74.

Mário M. Freire and Álvaro M. F. de Carvalho, "Estimate of Blocking Probability in WDM Optical networks with Ring Topology and Wavelength Routing", in *Proceedings of the 1st (Portuguese) Conference on Computer*

Networks (CRC '98), Coimbra, Portugal, November 1-10, 1998, Fundação para a Computação Científica Nacional / Universidade de Coimbra, pp. 81-86.

Henrique J. A. da Silva and Mário M. Freire, "Multi-Quantum Well Laser Parameters for Simulation of Optical Transmission Systems up to 40 Gbit/s", in *Conference Record of the IEEE Global Telecommunications Conference (GLOBECOM'98): "The Bridge to Global Integration"*, Sydney, Australia, 8-12 November 1998, IEEE, Vol. 3, pp. 1467-1472.

Miscellaneous

Henrique J. A. da Silva:

- Member of the Organising Committee of the symposium *Frontiers of Science*, University of Coimbra, Portugal, June 15-17, 1998.
- Session Organiser in *Optimization'98*, Coimbra, Portugal, July 20-22, 1998.
- Member of the Scientific Committee of the *Workshop on Mathematical Problems in Telecommunications*, Coimbra, Portugal, September 28-29, 1998.
- President of the Organising Committee, member of the Programme Committee, and reviewer of papers submitted to the *1st (Portuguese) Conference on Computer Networks (CRC '98)*, Coimbra, Portugal, November 9-10, 1998.
- Reviewer of papers submitted to the *2nd Conference on Telecommunications, ConfTele'99*, Sesimbra, Portugal.
- National delegate to *working group 1* of COST 240.

9.2.3 Applied Mathematics Research Line

Human Resources

Collaborators

- | | | |
|--------------------------|-----|----------------------------|
| • Joaquim João Júdice | PhD | Full Professor, FCTUC |
| • Madalena Gomes Martins | PhD | Associate Professor, FCTUC |
| • Maria Celeste Gouveia | PhD | Associate Professor, FCTUC |
| • Paulo Eduardo Oliveira | PhD | Associate Professor, FCTUC |
| • João Luís Soares | BSc | Assistant, FCTUC |
| • Luís Filipe Portugal | MSc | Assistant, FCTUC |
| • Cristina Requejo Agra | MSc | Assistant, FCTUC |

Other Collaborators

- | | | |
|------------------------|-----|---------------------------|
| • Maria Leonor Alves | MSc | Assistant Professor, ISEC |
| • Luís Merca Fernandes | MSc | Assistant Professor, IPT |
| • João Manuel Patrício | BSc | Assistant Professor, IPT |

Projects

- PRAXIS 2/2.1/MAT/346/94: Solution of linear algebra and optimization problems and applications to structural engineering, genetics and finance.
- PRAXIS PCEX/P/MAT/38/96: Variational Models and optimization.
- Research Topics on Algebra

Preconditioning techniques for iterative methods. Error bounds for some iterative methods. Iterative methods for the solution of least squares problems. Solution of some matrix equations over arbitrary rings.
- Research Topics on Optimization

Development and implementation of interior-point methods and preconditioning techniques for linear network and equilibrium problems. Solution of global optimization problems using complementarity. Development, convergence analyses and implementation of interior-point algorithms for complementarity problems arising in variational models. Minimal spanning and Steiner tree problems with hop constraints.
- Research Topics on Probability and Statistics

Convergence of empirical process functions. Application to Statistics. Conditions for dependence. Estimation of covariance functions under dependence. Statistics for point processes.

PhD Theses

- J. L. Soares (supervisor: S. Ceria), University of Columbia, concluded in 1998 (Title: “Disjunctive Convex Optimization”).
- L. M. Fernandes (supervisor: J. J. Júdice), Departamento de Matemática, FCTUC, to be concluded in 1999.
- C. Requejo Agra (supervisor: L. Gouveia), Faculdade de Ciências, Universidade de Lisboa.
- L. F. Portugal (supervisor: J. J. Júdice), Departamento de Matemática, FCTUC.
- P. L. Tavares (supervisors: J. J. Júdice and J. Temido), Departamento de Engenharia Civil, FCTUC.
- I. Ribeiro (supervisors: J. J. Júdice and A. Faustino), Departamento de Engenharia Civil, FEUP.
- P. Monteiro (supervisors: J. J. Júdice and L. Sá), Departamento de Engenharia Electrotécnica, FCTUC.

M.Sc. Theses

- R. M. Gaspar (supervisor: P. E. Oliveira), Departamento de Matemática, FCTUC, to be concluded in 1999.
- J. Santos (supervisor: J. J. Júdice), Departamento de Matemática, Universidade de Aveiro, concluded in 1998 (title: “Quadratic Programming and Portfolio Selection Models”).

Publications

Papers in Journals

M. C. Gouveia, “On the Sylvester, Lyapunov and Stein equations over rings”, *J. Linear Algebra and its Applications*, to appear.

P. E. Oliveira, C. Suquet, “Weak convergence in $L^p(0,1)$ of the uniform empirical process under dependence”, *Statistics and Probability Letters*, 39(1998), 363-370.

W. Xinmin, M. M. Martins, “Further results on regular splittings and their applications to some iterative methods”, to appear.

F. Facchinei, J. Júdice and J. Soares, “An active-set Newton’s algorithm for large-scale nonlinear programs with box constraints”, *SIAM Journal on Optimization*, 8(1998), 158-186.

L. Green, P. Kolesar and J. Soares, “On determining optimal staffing requirements in service systems with time-varying demands”, *Operations Research*, to appear.

J. Júdice and M. C. Soares, "Solution of some complementarity problems arising in variational methods of mechanics", *Investigação Operacional*, 18(1998), 17-31.

L. Fernandes, A. Fischer, J. Júdice, C. Requejo and J. Soares, "A block active-set algorithm for large-scale quadratic programs with box constraints", *Annals of Operations Research*, 81(1998), 75-95.

L. Portugal, M. Resende, G. Veiga and J. Júdice, "A truncated primal-infeasible dual-feasible interior point network flow problem", *Networks*, to appear.

Papers in Conference Proceedings

D. J. Evans, M. M. Martins, "The accelerated overrelaxation quadrant interlocking iterative method", *Actas V Congresso de Matemática Aplicada*, pp.700-712.

C. Henriques, P. E. Oliveira, "Estimação de Covariâncias para Variáveis Associadas", *Actas V Congresso Anual da Sociedade Portuguesa de Estatística*, pp.483-488.

P. Jacob, P. E. Oliveira, "Histograms with associated sampling", *Proceedings of the Prague Stochastics'98*, pp.253-258.

L. Fernandes, I. Figueiredo and J. Júdice, "Computational methods for plate and shallow shell contact problems", *Computational Mechanics: New Trends and Applications*, edited by S. Idelsohn, E. Oñate and E. Dvorkin, CIMNE, Barcelona, 1998.

L. Costa, L. Fernandes, I. Figueiredo, J. Júdice and P. Oliveira, "Application of genetic algorithms to plate optimization", *Computational Mechanics: New Trends and Applications*, edited by S. Idelsohn, E. Oñate and E. Dvorkin, CIMNE, Barcelona, 1998.

Technical Reports and Papers Submitted to Publication

P. E. Oliveira, "A central-limit theorem for associated variables", *Pré-Publicações do Departamento de Matemática da Universidade de Coimbra*, 98-01.

P. E. Oliveira, "Mean Square error for histograms when estimating Radon-Nikodym derivatives", *Pré-Publicações do Departamento de Matemática da Universidade de Coimbra*, 98-07.

P. E. Oliveira, "Histograms and associated point processes", *Pré-Publicações do Departamento de Matemática da Universidade de Coimbra*, 98-10.

L. Fernandes, A. Friedlander, M. C. Guedes and J. Júdice, "Solution of a general linear complementarity problem using smooth optimization and its application to bilinear programming and LCP".

S. Ceria and J. Soares, "Disjunctive cut generation for mixed 0-1 programs: duality and lifting".

S. Ceria and J. Soares, "Convex programming for disjunctive optimization".

Miscellaneous

Group Seminars

- Miguel Constantino (Department of Statistics and Operations Research, University of Lisbon), "Atribuição de Folgas Semanais em Grandes Empresas", March 27, 1998.
- Rui Valadas (Department of Electronic Engineering and Telecommunications, University of Aveiro), "Dimensionamento de Redes de Telecomunicações de Banda Larga", April 3, 1998.
- Georg Heinig (Department of Mathematics and Computer Science, Kuwait University, Kuwait), "Vector Interpolation and Structured Matrices", April 8, 1998.

Organization of Conferences

- Workshop on Mathematical Problems in Telecommunications, Coimbra, September 1998: M. C. Gouveia - Chairman of the Organizing Committee; J. Júdice - Chairman of the Program Committee.
- Optimization 98, University of Coimbra, July 1998: J. Júdice — Chairman of the Program Committee.

9.2.4 Power Systems Research Line

Human Resources

Collaborators

- Eduardo de Sousa Saraiva PhD Full Professor, FCTUC
- António João Marques Cardoso PhD Assist. Professor, FCTUC
- André Manuel dos Santos Mendes MSc Assistant, FCTUC
- Sérgio Manuel Ângelo da Cruz MSc Student Assistant, FCTUC

Other Collaborators

- Luís Manuel Ramos de Oliveira MSc Student Assistant, UALG
- Manuel António Marques Esteves MSc Student Assistant, IPL
- Natália dos Santos Gameiro MSc Student Assistant, IPL
- Nuno José Cabete Gil MSc Student Assistant, IPL
- Ana Carla Vicente Vieira MSc Student Assistant, UALG
- Júlio Fernandes Tomé Lic Student FCTUC Final Year Project
- Pedro Miguel Castanheira Mendes Lic Student FCTUC Final Year Project
- Humberto Jorge Gomes Amorim Lic Student FCTUC Final Year Project
- Carlos Alberto Augusto Teixeira Lic Student FCTUC Final Year Project
- Acácio Manuel Raposo Amaral Lic Student FCTUC Final Year Project
- Jorge Vitor Ribeiro Mena Lic Student FCTUC Final Year Project

Projects

- PBIC/C/CEG/2441/95 ("Fault Analysis and Diagnostics in Electrical Variable Speed Drives")

Funded by FCT (1996/1998), this project was intended to explore adequate strategies for diagnosing the occurrence of faults in electrical variable speed drives, which are widely used in many sectors of activity. During this last year of the project the different parts of the whole project were assembled together, in order to fully investigate its global operation. Both simulation and laboratory or on-site experimental results demonstrate the effectiveness of the proposed diagnostics strategies, regarding the occurrence of faults in electrical variable speed drives.

- PEGO — Funded by PEGOP Energia Eléctrica S. A..

This project is related to the condition monitoring of three-phase induction motors, of 400 V and 6 kV, at Pego Power Plant. Several tests were conducted on-site and the corresponding Technical Reports were prepared.

- SOPORCEL — Funded by SOPORCEL Sociedade Portuguesa de Papel S. A

This project is related to the condition monitoring of three-phase induction motors of 400 V and 6 kV. Several on-site tests were conducted at Lavos Pulp and Paper Mills and the corresponding Technical Reports were prepared.

- PRAXIS/P/EEI/14151/1998 ("DSP-Based Winding Fault Diagnosis in Operating Three-Phase Power Transformers")

Submitted to FCT (1999/2000), the major aim of this project basically comprises the development of a prototype, able to provide a complete and reliable diagnosis of the operating condition of three-phase power transformers, particularly regarding the occurrence of winding faults.

MSc Theses

- André Manuel dos Santos Mendes (supervisors: António João Marques Cardoso and Eduardo de Sousa Saraiva), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, concluded in 1998 (subject: Fault Diagnosis in a Rectifier-Inverter System Used for Speed Control of Three-Phase Induction Motors).
- Sérgio Manuel Ângelo da Cruz (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, to be concluded in 1999 (subject: Rotor Cage Fault Diagnosis in Three-Phase Induction Machines).
- Luís Manuel Ramos de Oliveira (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Fault Analysis and Diagnostics of Three-Phase Power Transformers).
- Manuel António Marques Esteves (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Fault Analysis and Diagnostics of Three-Phase Slip-Ring Induction Motors).
- Natália dos Santos Gameiro (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Switched Reluctance Motors Fault Diagnosis).
- Nuno José de Abreu e Sousa Cabete Gil (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Inter-Turn Stator Winding Fault Diagnosis in Three-Phase Induction Motors).
- Luís Carlos Costa Maria (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Permanent Magnet Synchronous Machines Fault Diagnosis).
- Ana Carla Vicente Vieira (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Maintenance Organization and Management of an Educational Establishment).

- Pedro Miguel Martins de Pina Ribeiro (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Power Plants Maintenance).

Publications

Papers in Journals

A. J. M. Cardoso, L. M. R. Oliveira, N. S. Gameiro, P. M. M. G. Veloso, "Diagnóstico de Avarias em Transformadores Trifásicos", *Anais da Engenharia e Tecnologia Electrotécnica*, Nº 6, pp. 9-12, March, 1998.

A. J. M. Cardoso, S. M. A. Cruz and D. S. B. Fonseca, "Inter-Turn Stator Winding Fault Diagnosis in Three-Phase Induction Motors, by Park's Vector Approach", *IEEE Transactions on Energy Conversion*, Paper Nº PE-I166-EC-0-10-1997 (accepted for publication).

Papers in Conference Proceedings

J. M. N. Carvalheiro, P. M. P. Ribeiro, M. Gonçalves, A. J. M. Cardoso, "The Use of an Unified Diagnostic Approach to Predict the Operating Deterioration of Three-Phase Induction Motors", *First IEE/IMEchE International Conference on Power Station Maintenance (IEE Conference Publication Nº 452)*, pp. 157-160, Edinburgh, UK, 30 March - 1 April, 1998.

S. M. A. Cruz, A. J. M. Cardoso, "Rotor Cage Fault Diagnosis in Three-Phase Induction Motors, by Extended Park's Vector Approach", *Proceedings of the International Conference on Electrical Machines*, vol. 3, pp. 1844-1848, Istanbul, Turkey, September 2-4, 1998.

A. M. S. Mendes, A. J. M. Cardoso, E. S. Saraiva, "Voltage Source Inverter Fault Diagnosis in Variable Speed AC Drives, by Park's Vector Approach", *IEE 7th International Conference on Power Electronics and Variable Speed Drives (IEE Conference Publication Nº 456)*, pp. 538-543, London, UK, September 21-23, 1998.

A. J. M. Cardoso, L. M. R. Oliveira, "Condition Monitoring and Diagnostics of Power Transformers", *Proceedings of the 11th International Congress and Exhibition on Condition Monitoring and Diagnostic Engineering Management*, vol. 2, pp. 591-599, Launceston, Tasmania, Australia, December 8-11, 1998.

A. M. S. Mendes, A. J. M. Cardoso, "Voltage Source Inverter Fault Diagnosis in Variable Speed AC Drives, by the Average Current Park's Vector Approach", accepted for presentation at the *1999 IEEE International Electric Machines and Drives Conference*, Seattle, Washington, USA, May 9-12, 1999

Project Deliverables and Reports

A. J. M. Cardoso, A. M. S. Mendes, M. A. M. Esteves, "PEGOP - Central Termoeléctrica do Pego", Technical Report DIANA-PEGOP 02/97, Coimbra, Portugal, April 1998.

A. J. M. Cardoso, A. M. S. Mendes, S. M. A. Cruz, M. A. M. Esteves, "SOPORCEL - Fábrica em Lavos", Technical Report DIANA-SOPORCEL 01/98, Coimbra, Portugal, April 1998.

A. J. M. Cardoso, A. M. S. Mendes, S. M. A. Cruz, M. A. M. Esteves, "PEGOP - Central Termoelétrica do Pego", Technical Report DIANA-PEGOP 01/98, Coimbra, Portugal, July 1998.

A. J. M. Cardoso, A. M. S. Mendes, S. M. A. Cruz, M. A. M. Esteves, "PEGOP - Central Termoelétrica do Pego", Technical Report DIANA-PEGOP 02/98, Coimbra, Portugal, November 1998.

A. J. M. Cardoso, "Condition Monitoring of Electrical Motors and Generators for the Purposes of Diagnostics", ISO/TC 108/SC 5/AG C N17, 5th Plenary Meeting of ISO/TC 108/SC 5, Launceston, Tasmania, Australia, December 1998.

Miscellaneous

Eduardo de Sousa Saraiva:

- Member of the Editorial Council of *Anais da Engenharia e Tecnologia Electrotécnica* (up to Anais, Nº 6 - 1998).
- Member of the International Steering Committee and Conference Organising Committee of *ELECTRIMACS 99*.

António João Marques Cardoso:

- Supervisor of Provas de Aptidão Pedagógica e Capacidade Científica, Davide Sérgio Baptista da Fonseca, Universidade da Beira Interior, in preparation (subject: "Fault Tolerance in Electromechatronic Systems").
- Supervisor of Estágio Profissional, Engº José Ricardo de Oliveira (Centro Tecnológico da Marinha em São Paulo, Brasil), concluded in 1998 (subject: Rotor Cage Fault Diagnosis in Three-Phase Induction Motors, by Vibration Spectral Analysis).
- Supervisor of Estágio Formal (ORDEM DOS ENGENHEIROS), António Jorge Sousa Mendes, Santos Barosa — Vidros S. A., to be concluded in 1999 (subject: Maintenance Organization and Management of I. S. Machines).
- Presenter of a seminar "A Aplicação da Transformada Complexa Espacial (Vector de Park) no âmbito da Manutenção de Sistemas Electromecatrónicos" FEUP, Porto, Portugal, March 1998.
- Member of the International Steering Committee of the *International Conference on Condition Monitoring and Diagnostic Engineering Management (COMADEM)* and member of the Technical Committee of its 11th edition, COMADEM'98 (Launceston, Tasmania, Australia, 8-11 December 1998).
- Actively involved, as an expert, in the field of standardisation on condition monitoring and diagnostics, both at a national and international level, where he has been acting as a Convenor of ISO/TC 108/SC 5 Advisory Group C (*Condition monitoring of electrical motors and generators, for the purposes of diagnostics*) and Advisory Group D (*Condition monitoring and diagnostics of power transformers*), and also member of several Working Groups of ISO, IEC and CEN.

- Reviewer for *IEEE Transactions on Industry Applications* and *IEEE Transactions on Power Electronics*, among others.
- Member of the Editorial Board of the *International Journal of Condition Monitoring & Diagnostic Engineering Management*, published by COMADEM International, Birmingham, UK.
- Honorary Member of the International Biographical Centre Advisory Council, Cambridge, England.

9.3 Aveiro Pole

9.3.1 Radio, Microwaves and Millimetre waves Research Line

Human Resources

Collaborators

- José Carlos S. Neves PhD Full Professor, UA
- José Fernando da R. Pereira PhD Full Professor, UA
- José Carlos Pedro PhD Associate Professor, UA
- João Nuno Matos PhD Assistant Professor, UA
- Armando Carlos Rocha PhD Assistant Professor, UA
- José Fernandes PhD Assistant Professor, UA
- António Navarro PhD Assistant Professor, UA
- Nuno Borges Carvalho Eng. Assistant, UA
- Manuel Dinis Eng. Engineer, PT

Other Collaborators

- Carla Raquel Madureira M.Sc. Student
- Joana Catarina Mendes PhD Student Grant, PRAXIS XXI
- Ruben Leote Mendes MSc Student Grant, ERASMUS
- João Tavares MSc Student Grant, PRAXIS XXI
- Pedro Pinho MSc Student Grant, PRAXIS XXI
- António Morgado Engineer Grant, PRAXIS XXI
- Paulo Jesus Engineer Grant, IT
- José Ferreira Engineer Grant, IT
- Victor Santos PhD Student Grant, PRAXIS XXI
- Arlindo Marques MSc Grant, PRAXIS XXI
- José Emanuel Garcia BSc Grant, PRAXIS XXI
- Francisco Costa MSc PT, Training
- Mario Rui Santos MSc Student UA, First Year
- Eliseu Macedo MSc Student UA, First Year

- João Ferreira Eng. Engineer, IT
- Pedro Mónica Eng. Engineer, IT
- Paulo Silva Lic. Student UA, Final Year Project
- José Ruiivo Lic. Student UA, Final Year Project
- José Pimentel Lic. Student UA, Final Year Project
- Leonardo L. Pires Lic. Student UA, Final Year Project
- Emanuel I. R. Gomes Lic. Student UA, Final Year Project
- Helder Couteiro Student UA, Final Year project
- José Santos Silva Student UA, Final Year project
- Aldina Codesso Student UA, Final Year project
- Paulo Gaspar Student UA, Final Year project

Projects

- PRAXIS XXI - 3/3.1/TIT/35/94 - ITCOM: Integration of Technologies for Mobile Communications

Development of a discrete microwave power amplifier for ITCOM demonstrator base transmitter station. Development of a low-noise and a high-gain MMIC's for the optical return link. Test of the photo-receiver MMIC circuit. Transmission and first order diffraction phenomena on a ray tracing tool based on the image theory was implemented. Preliminary studies on strategies to include high order diffracted rays on the same simulator were also concluded. A 2GHz frequency synthesizer with a 1µs switching time and frequency step of 5MHz was developed and a prototype built and tested.

- LAMBADA

Support to the activities developed in the framework of the SAMBA (System for Advanced Mobile Broadband Applications) European project, namely: planning of the Aveiro field trials; participate in the EXPO '98 demonstrations; participate in the integration of the SAMBA Trial Platform in Hildesheim, Germany; perform the first system tests; set-up of all the necessary logistics and equipment; start the field trials in Aveiro; and contribution to various deliverables.

- BOLERO

Support to the activities developed in the framework of the ACCORD (ACTS Broadband Communication Joint Trials and Demonstrations) European project, namely: definition of the ACCORD joint trials; identification of the modifications needed to the SAMBA Trial Platform to enable the interconnection with the other demonstrators involved; contribution to the definition of the future target broadband system; contribution to the specification of the ACCORD multimode terminal; and contribution to several deliverables.

- LIMBO

Support to the activities developed in the framework of the SUCOMS (Superconducting Systems for Communications) European project, namely: definition of the field trial scenarios in the EXPO '98 campus; identification and familiarisation with the measurement tools available in TMN – Telecomunicações Móveis Nacionais; and elaboration of a report with the definition and steps for the trials.

- RUMBA

Identification of the potentials of the CTM (Cordless Telephone Mobility); advantages for the fixed network and implications; utilisation of DECT as an wireless extension of the fixed network; integration of DECT and GSM; identification of the dual mode requirements and its impact in the network; and study of handover between GSM and DECT.

- GPSREAL

Identification of the feasibility and advantages of implementing the differential GPS using the GSM network; design and built of a prototype; and execution of field trials to access and validate the concept.

- JNICT – 2496/TIT/95 - LIRA: Linearity and efficiency in RF Microwave Power Amplifiers

Theoretical studies of large signal intermodulation behaviour versus input drive in microwave power amplifiers. Development of design methods for simultaneous optimised linearity and efficiency in power amplifiers for telecommunications applications. Project's concluding remarks.

- PRAXIS XXI – 2/2.1/TIT/1562/95 - ISAC: Implementation Aspects of a Mobile Communication System payload with Dynamic Channel Allocation

Development of a physics based non linear device model using the drift diffusion approximation. First tests on the device simulator. Preliminary studies for the development of a Volterra based non linear circuit simulator for intermodulation distortion analysis of linearized satellite power amplifier structures.

- AGORA: Adaptive Array Antenna with Electronically Steerable Beam (With the financial support of Portugal Telecom)

The complete system was built and tested. A careful calibration process was made in order to get the system working properly. Several software applications were developed to control and test whole system. Extensive outdoors measurements have been made in the Campus of the University of Aveiro in order to test the whole system. The adaptive antenna was used as a base station in receiver mode, and an RF programmable synthesiser together with a $\lambda/4$ monopole were used as a transmitter mobile unit.

- SAMBA: System for Advanced Mobile Broadband Applications

Radio propagation simulations using measured antennas radiation patterns designed and fabricated for the SAMBA Trial Platform in the scenarios chosen for the field trials. This work was made to define the best location for the base stations and to predict the cell coverage to ensure the proper functionality of the system. Definition of the procedures for the integration of the radio functions of the Trial Platform and system tests in close co-operation with WP332. Co-ordination of the integration and test plan of the radio functions. Detailed measurement plan for the Aveiro trials (technical evaluation of the Trial Platform) and

of the demonstrations at the EXPO '98 concerning the radio part. Participation in the integration of radio functions of the Trial Platform in Hildesheim. Re-integration of the Trial Platform in Lisbon for EXPO '98 and again in Aveiro for technical evaluation and support of field trials concerning radio functions.

- RADICAL - High Data Rate Cellular Digital Mobile Radio

Characterisation of the radio propagation channel taking into account antenna configuration to evaluate single-carrier and multi-carrier transmission techniques for mobile broadband systems. A complex channel impulse model for the multipath radio channel was also refined. The characterisation of a diffuse reflection was completed as well as the climate aspects on the signal propagation in the MBS scenarios, focussing on the millimetrewave frequencies. A wideband propagation channel model that combines the deterministic and statistic approach was concluded. The radio propagation simulation tool was upgraded with additional features to better describe simulation scenarios and to reduce the computation time. This tool was also used to study the cellular coverage in MBS type environments, giving important indications on different options in what concerns the performance of single- and multi-carrier systems.

- DISERT

Preliminary studies to prepare the industrialisation of prototypes already developed and tested. Study, project, development and testing of receiver and transmitter optical modules for SMATV e CATV system.

PhD Theses

- Nuno Borges de Carvalho (supervisor: José Carlos Pedro), Universidade de Aveiro, to be concluded in 1999 (subject: Optimisation of Intermodulation Distortion in Multi-Carrier Power Amplifiers).
- Joana Catarina Mendes (supervisor: José Carlos Pedro), Universidade de Aveiro, to be concluded in 2002 (subject: Microwave Power Amplifier Linearization).
- Manuel Dinis (supervisor: José Neves), Universidade de Aveiro, to be concluded in 1999 (subject: Mobile Communications).
- Victor Santos (supervisor: José Neves), Universidade de Aveiro, in preparation (subject: Satellite Mobile Communications).
- António Morgado (Supervisor: José Fernandes), Universidade de Aveiro, in preparation, (subject: Adaptive antennas for mobile broadband communications)

M.Sc. Theses

- Raquel Castro Madureira (supervisor: José Carlos Pedro), Universidade de Aveiro, concluded in 1998 (subject: Modelação e Linearização de Lasers).
- Ruben Leote Mendes (supervisors: João Nuno Matos, Atílio Gameiro), Universidade de Aveiro, in preparation (subject: Digital Modulator/Demodulator).

- João Tavares (supervisor: António Navarro), Universidade de Aveiro, to be concluded in 1999 (subject: Video Transmission over Radio Channels).
- Pedro Pinho (supervisor: José Rocha Pereira), Universidade de Aveiro, to be concluded in 1999 (subject: Antenna for Mobile Terminal).
- Ilídio Chaves (supervisor: José Neves), Universidade de Aveiro, to be concluded in 1999 (subject: Satellite Mobile Communications).
- Paulo Marques (Supervisor: José Fernandes and José Neves), Universidade de Aveiro, concluded in 1998, (subject: Radio propagation channel modelling for broadband mobile communications).

Publications

Papers in Journals

N. B. Carvalho and J. C. Pedro, “Multi-tone Frequency Domain Simulation of Nonlinear Circuits in Large and Small Signal Regimes”, Accepted for publication, *IEEE Trans. on Microwave Theory and Techniques*, 1998.

J. C. Pedro, N. Carvalho, R. Madureira, “Nonlinear Distortion Model for VCO-PLL FM Transmission Systems” , accepted for publication, *IEEE Trans. on Circuits and Systems II*, 1998.

J. A. Garcia, A. Mediavilla, J. C. Pedro, N. B. Carvalho, A. Tazón and J. L. Garcia, “Characterizing the Gate to Source Nonlinear Capacitor Role on GaAs FET IMD Performance”, accepted for publication, *IEEE Trans. on Microwave Theory and Techniques*, 1998.

J. A. Garcia, A. Tazón, A. Mediavilla, I. Santamaria, M. Lázaro, C. J. Pantaleón, J. C. Pedro, “Modeling MESFET’s and HEMT’s Intermodulation Distortion Behavior Using a Radial Basis Function Network”, accepted for publication, *Intern. Journal of RF and Microwave Computer-Aided Engineering*, 1998.

C. Fernandes, J. Fernandes, “Performance of Lens Antennas in Wireless Indoor Millimeter Wave Applications”, accepted for publication, *IEEE Trans. on Microwave Theory and Techniques*, 1998.

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- P. Marques, J. Fernandes and J. Neves, "Complex Impulse Response Modeling for Wideband Radio Channels", *48th Vehicular Technology Conference*, Ottawa, Ontario, Canada, pp. 702-706, May 1998.
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R. Dinis, J. Conceição, A. Gusmão, J. Fernandes, "Adaptive Beamforming and Frequency-Domain Equalisation for Broadband Wireless Communications", *First Int. Symp. on Communications Systems & Digital Signal Processing*, Sheffield, UK, April 1998.

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Project Deliverables and Reports

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F. Hipólito, J. Ferreira, J. Fernandes, J. Garcia, M. Dinis and P. Silva, "Planning for the Aveiro trials", SAMBA/PT331022, August 1998.

J. Fernandes, C. Lomba, R. Valadas, "Comparative Analysis of the Infrared and Millimetre-Wave Transmission Technologies", ITCOM project Deliverable R6100.1, March 1998.

J. Fernandes, C. Fernandes, "Analysis of Wireless Indoor Systems II", ITCOM project Deliverable R6100.3, March 1998.

G. Andrade, M. Rui Santos, R. Madureira, J. Neves, "Caracterização, Escolha e Modelização dos Dispositivos Ópticos", Project DISERT, May 1998

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Miscellaneous

- José Neves was reviewer of papers submitted to *the URSI Commission F Open Symposium on Wave Propagation and Remote Sensing* held in Aveiro, September 1998.
- Manuel Dinis was reviewer of papers submitted to the *ACTS Mobile Communication Summit 98 Conference*, Sorrento, Italy.

9.3.2 Networks Research Line

Human Resources

Collaborators

- Luis Miguel da Silva Head of Research Line Director, PT - CET
- Rui T. Valadas PhD⁴ Assistant Professor, UA
- Amaro F. de Sousa MSc Assistant, UA
- Telma Mota MSc Engineer, PT – CET
- Nuno Silva MSc student Engineer, PT – CET
- José Pedro Fernandes MSc Engineer, PT – CET
- Bernardete Tavares MSc Engineer, PT – CET
- José Cabaça Lic. Engineer, PT - CET
- José Miguel Santos MSc Engineer, PT - CET
- Luis Cortesão M.Sc student Enginner, PT - CET
- José Miguel Almeida Lic. Engineer, PT – CET

Other Collaborators

- Paula Cristina Couto PhD student Grant, PRAXIS XXI
- António Duarte Nogueira PhD student Grant, PRAXIS XXI
- Susana Isabel Sargento PhD student Grant, PRAXIS XXI
- Luís António Pinheiro MSc student Engineer, PT
- Alberto J. Nascimento MSc student Engineer, TMN
- Luís Pedro Cardoso Researcher Grant, IT
- Elizabeth Fernandez Researcher Grant, IT
- Paulo Salvador Ferreira Researcher Grant, IT
- Carlos Lopes Borges Researcher Grant, IT
- Paulo Rocha Researcher Grant, IT
- Rui Machado Researcher Grant, IT
- Paulo Loureiro Researcher Grant, IT
- Paulo Pereira Researcher Grant, IT

⁴ Co-Head of Research Line

• Paulo Balão	Researcher	Grant, IT
• José Miguel Ramos	Researcher	Grant, IT
• Nuno Santos	Researcher	Grant, IT
• Luis Teixeira	Researcher	Grant, IT
• António Lopes	Researcher	Grant, IT
• Silvia de Francesco	M.Sc.	Grant, IT
• Silvia Martins	Researcher	Grant, IT
• Pedro Mónica	Researcher	Grant, IT
• Miguel Serrano	M.Sc	Consultant, PT - CET

Projects

- CESTA: Statistical characterisation and simulation of ATM traffic, sponsored by Portugal Telecom.

The project started in 1997. The main objective of the project is the development of a dimensioning tool for ATM networks that integrates traffic model fitting and selection procedures with optimisation routines for cost-effective dimensioning and resource management. The main results were: (i) development of simulators including rare event techniques, (ii) specification and initial developments of two software packages, one for traffic analysis and the other for network planning, (iii) measurements and characterisation of internet traffic, (iv) development of method for parameter estimation of IDP traffic, (v) implementation of method for parameter estimation of CMPP models, (vi) implementation of several equivalent bandwidth models, (vii) formulation and development of optimisation models for several network design problems, (viii) survey of ATM equipment.
- BBTráfego: Traffic Engineering for Broadband Access Networks, sponsored by Portugal Telecom

Defined a set of methods for dimensioning and resource management of access networks based on ATM technology, taking into account the network architecture, the traffic profile of different services, the quality of service and the grade of service required by the users. Started development of planning tool for access networks.
- GISA: Management of Integrated SDH and ATM networks, sponsored by Portugal Telecom, and related with MISA ACTS project.

This project addresses the study and experimentation of TMN management interfaces for network level management of SDH networks and ATM networks. Part of this activity was undertaken to address specific research topics of MISA ACTS project. The main results are: (i) Specification of Message Sequence Diagrams (MSCs) for the Path Provisioning functionality in MISA project; (ii) Evaluation of NEC and Alcatel Qnn SDH management interface specification; (iii) Design and development of a Qnn v1.3 agent simulator and a manager interfaced by a CORBA application, providing Path Provisioning (Trail Setup). Application of the simulator to a network scenario composed of 3 NEC SMS-600V nodes in a ring configuration; (iv) Design and development of a prototype for supporting the Network Provisioning

process, in particular, Routing Design (manual) and Capacity Assignment subprocesses (with SJM ring information used as a case study).

- GRESA: - Management of ATM Services and Networks, sponsored by Portugal Telecom, in collaboration with CET.

Finalisation of the design and implementation of a first operational version of RIA ATM OS Network Management System using as architectural solution TINA concepts and architectures, namely Resource Configuration Architecture and Connection Management Architecture. Field trial of this prototype in the context of MISA project for the management of VP connections in the RIA ATM network. For this purpose RIAATM OS was incorporated with a Q3 ATM agent for interoperation with a higher level OS, via Q3 TMN standard interface.

- VITAL - Development and validation of TINA (Telecommunications Information Networking Architecture) architectures, related with ACTS VITAL project. IT is a project partner associated to CET.

The main activities and results where: (i) collaboration with CET in the specification of the TINA connection management architecture (CMA); (ii) Development of two computational objects associated to this architecture; (iii) Integration, test and validation of CMA components; (iv) integration and test of Audio-Video Conference service developed by VITAL.

- LATIV: Development of TINA Applications, sponsored by Portugal Telecom, in collaboration with CET.

The main activities and results where: (i) specification and development of a *jukebox*; (ii) specification and development of a *Slide Show* service; (iii) Integration and test of the developed services within the service architecture developed by VITAL project.

- DimSDH – Planning and Dimensioning of SDH Networks, sponsored by Portugal Telecom.

As main result a first version of a Capacity Planning Tool prototype was developed. This tool supports the design of the network and facility infrastructures to meet a specified service at a desired cost. This first version was tested for NEC SDH equipment.

- SIG-WORLD

Evaluation of emerging architecture solutions in the GIS market and spatial databases capabilities (notably ORACLE SDC), envisaging future introduction on the on-going GIS application developments; Development of a georeferenced GIS data actualization application, using real time GPS integrated in a pen computer based field data collector

Ph.D. Theses

- Amaro Fernandes de Sousa (supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: Transport Protocols for Multimedia Communications in Broadband Networks).

- António Duarte Nogueira (supervisor: Rui Valadas), University of Aveiro, started in 1997 (subject: Statistical Characterization of ATM Traffic).
- Paula Cristina Couto (supervisor: Rui Valadas), University of Aveiro, in preparation, (subject: Wireless ATM Local Area Networks).
- Susana Isabel de Miranda Sargento, (supervisor: Rui Valadas), University of Aveiro, in preparation, (subject: Resource Management and Traffic Control in ATM Networks)

M.Sc. Theses

- Celso Ribeiro Lemos (supervisor: Rui Valadas), University of Aveiro, concluded in 1998, (subject: topological design of telecommunication networks).
- Jorge M. Carapinha (supervisor: Rui Valadas), University of Aveiro, concluded in 1998, (subject: ATM virtual private networks).
- Luís António Pinheiro (supervisor: Rui Valadas), University of Aveiro, to be concluded in 1999, (subject: dynamic routing in telecommunication networks).
- Alberto J. Nascimento (supervisor: Rui Valadas), University of Aveiro, to be concluded in 1999, (subject: teletraffic engineering for mobile communication networks).

Publications

Papers in Journals

C. Lemos, R. Valadas, "The MENTOR Algorithm for the Topological Design of Telecommunication Networks" (in Portuguese), *Journal of Electronics and Telecommunications Department of the University of Aveiro*, Vol. 2, No. 3, September 98, pp. 277-286.

E. Fernandez, R. Valadas, "Animated Demonstrator for the Programing Techniques for Discrete Event Simulators, Using MATLAB" (in Portuguese), *Journal of Electronics and Telecommunications Department of the University of Aveiro*, Vol. 2, No. 3, September 98, pp. 287-295.

J. Carapinha, R. Valadas, "Architectures for ATM Virtual Private Networks" (in Portuguese), *Journal of Electronics and Telecommunications Department of the University of Aveiro*, Vol. 2, No. 3, September 98, pp. 393-404.

J. Ruivo, J. Pimentel, H. Vale, R. Valadas, A. Duarte, "Traffic Analysis and Planning for DECT Networks" (in Portuguese), *Journal of Electronics and Telecommunications Department of the University of Aveiro*, Vol. 2, No. 3, September 98, pp. 335-343.

Papers in Conference Proceedings

R. Valadas, "Dimensioning and Resource Management of ATM Networks" (invited paper), *Proceedings of the Seventh IFIP/ICCC International Conference On Information Networks and Data Communications*, Aveiro, Portugal, June 15-18, 1998, pp. 209-220.

R. Valadas, P. Ferreira, C. Lopes, A. Oliveira, "Laboratory Experiments for Teaching Routing in Telecommunications Networks", *II Conference on Telecommunications*, Sesimbra, Portugal, 15-16 de Abril de 1999, accepted for publication.

R. Valadas, "Teaching the Fundamentals of Telecommunications Networks", *Proceedings of the Ninth Annual Conference of the European Association for Education in Electrical and Information Engineering, Enhancement of Education in Electrical and Information Engineering through Industry Co-operation and Research*, 18-20 May 1998, Lisboa, Portugal, EAEEIE98LISBOA, pp. 103-108.

Paulo Rocha, Rui Machado, Paulo Loureiro, Telma Mota , "Deployment of Services based on TINA", *II Conference on Telecommunications*, Sesimbra, Portugal, 15-16 April 1999, accepted for publication.

Paulo Pereira, Luis Miguel Silva, "RIAATM OS, a TINA based ATM Network Management System ", *II Conference on Telecommunications*, Sesimbra, Portugal, 15-16 April 1999, accepted for publication.

Project Deliverables and Reports

Contribution for *Deliverable D15* of ACTS VITAL project - "*Description of VITAL Third Trial*", October 98.

Contribution for *Deliverable D13* of ACTS VITAL project - "*Validation of VITAL Third Trial*", October 98.

Miscellaneous

- Rui Valadas reviewer for the *Seventh IFIP/ICCC International Conference on Information Networks and Data Communications*, for the *Telecommunications Systems Journal* (Baltzer Science Publishers), for the *II Conference on Telecommunications* (organized by IT) and for the *16th International Teletraffic Congress*.
- Rui Valadas presented invited talk on "Mathematical Problems in the Design of Broadband Telecommunications Networks", at the seminar *Mathematics in Telecommunications, What Problems?*, Coimbra, September 1998.
- Luis Miguel Silva reviewer for the *Seventh IFIP/ICCC International Conference on Information Networks and Data Communications*.

9.3.3 Optical Communications Research Line

Human Resources

Collaborators

- José Ferreira da Rocha PhD Full Professor, UA
- Mário Rui Ferreira Licenciante PT-CET Senior Engineer
- Atílio da Silva Gameiro PhD Assistant Professor,UA
- Rui Valadas PhD Assistant Professor,UA
- Rui Ribeiro PhD Assistant Professor,UA
- Paulo Monteiro MsC Assistant
- Teresa Almeida Licenciante PT-CET Researcher
- Mário Rui Ferreira PhD PT-CET Senior Engineer

Other Collaborators

- António Manuel Tavares Licenciante Grant Praxis XXI
- António Domingos Reis Licenciante Assistant of UBI
- António Teixeira Licenciante Grant Praxis XXI
- Artur Sousa MsC Researcher
- Pedro Tavares Licenciante Researcher
- Mário Lima MsC Grant Praxis XXI
- Pedro Ribau Licenciante Researcher
- Pedro Silva Licenciante Researcher
- Rui Alves Licenciante Grant Praxis XXI

Projects

- PRAXIS XXI - 3/3.1/TIT/35/94 - ITCOM: Integration of Technologies for Mobile Communications

The optical research line has concentrated its activities on the study of the influence of nonlinearities on the transmission of radio signals from multiple access systems over radio and in the development of infrared WLAN's. For the first the study dealt with FDMA and CDMA techniques. It was shown that CDMA is less affected than FDMA, and is highly dependent on the type of nonlinearity (compressing or expanding). This work was reported on a deliverable, April 98. In what concerns the second activity, the main results were development of infrared transceivers, medium access controller and Ethernet access point.

- PRAXIS XXI 2/2.1/TIT/9578/95 IRWLAN – Advanced Technologies for Wireless Infrared Local Area Networks

The project started in 1997. The main results were: (i) study and definition of physical layer frame format, (ii) comparison of modulation versus coding for adaptive data rates, (iii) market survey of integrated circuits for error correction coding, (iv) analysis of APPM modulation, (v) started development of encoder for convolutional codes. This project also includes contributions of the Integrated Circuits Research Line

- UPGRADE – ACTS Project

PT's participation in the project essentially consisted of the implementation and deployment of the Iberian optical soliton link between the Iberian capital cities of Madrid and Lisbon on the occasion of the World Expo 98. As an associate partner IT took on a very active role in the design and development of major optical front-end module subsystems. Such was the case with the transimpedance amplifier and active post-detection filters as part of the 10 Gb/s soliton receiver. The outcome of these activities was a reliable 10 GHz clock extraction circuit. Starting as simulation stage these tasks developed through a later integration phase when a series of lab tests were conducted. During these months a special test bench was developed featuring micro-positioning devices, thermal and drive control as well as processing electronics and software.

- COLORS – PDT&S Project – Funding Portugal Telecom

The project ended in December 98. The main results of the project were: development of a complete DS-SS link for transmission of basic rate ISDN signals operating at 1.5GHz. The prototype has been tested with real traffic, within the campus of University of Aveiro, and has proved to fulfill the specifications issued for Basic rate ISDN signals. This project involved members from the Optical Communications and RMOM research lines.

- CORAL – PDT&S Project – Funding Portugal Telecom

The project ended in December 98. The main results of the project were development of a precoder chip using FPGA technology. The precoder is intended to format the transmitted signal according to the Tomlinson-Harashima technique to overcome channels with multipath distortion; development of framer and deframer to be used within the link; development of channel estimation algorithms tested on a DSP evaluation board. A follow-up of this project is planned for 1999 to perform the integration of the subsystems developed.. This project involved members from the Optical Communications and RMOM research lines.

- Comunicações Rádio para acesso local de banda larga – Funding JNICT

This project runs in parallel with CORAL, and its main objective is to perform signal processing studies that are to be implemented in the cORAL project. During 1998, the studies dealt with channel estimation techniques. A review of the available channel estimation techniques was performed, and the one based on inversion of the correlation function was implemented.

- DAWN – Praxis Project

During 1998, the main activities carried out within this project were: Study of the critical parameters that affect the WDM systems, induced by their components, in order to identify the strategies to be used in the design of WDM networks; Simulation of WDM dispersion supported transmission systems, to optimize the optical filtering, maximizing the transmission distance and the bit rate for the available optical bandwidth.

PhD Theses

- António Domingos Reis (supervisors A. Gameiro and J. Rocha), University of Aveiro. To be concluded in 1999. (subject: synchronization techniques for high bit rates).
- Paulo Monteiro (supervisor J. Rocha), University of Aveiro. To be concluded in 1999. (subject: Multigigabit Optimum Optical Receivers).
- António L. Teixeira (supervisor J. Rocha), University of Aveiro. To be concluded in 1999. (subject: Optical Equalization for WDM Systems).
- Rui Alves (supervisor A. Gameiro), University of Aveiro. Intermediate Stage (subject: Coding Techniques for IR WLAN's)
- Mário Lima (supervisor J. Rocha), University of Aveiro. Started in 1998. (subject: Optical Equalization for WDM Systems).
- António Manuel Rodrigues Tavares (supervisors: Rui Valadas and Oliveira Duarte), University of Aveiro, in preparation (subject: Signal Processing Techniques to Combat Multipath Dispersion and Ambient Light Interference for Infrared Wireless Local Area Networks).

M.Sc. Theses

- Rui Silva (A. Gameiro), University of Aveiro, concluded in 1998 (subject: Spread Spectrum Systems for WLL).
- Isabel Borges (J. Rocha), University of Aveiro, concluded in 1998 (subject: Multiple access techniques in optical networks).
- Mário Lima (J. Rocha), University of Aveiro, concluded in 1998 (subject: Multiple optical clock recovery circuits).
- Albano Emanuel Loureiro (supervisor: Rui Valadas), to be concluded in 1999 (subject: Network Interfaces and Access Points for Wireless Infrared Local Area Networks)

Publications

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C. Lomba, R. Valadas, A. Duarte, "Experimental characterisation and modelling of the reflection of infrared signals on indoor surfaces", *IEE Proceedings J - Optoelectronics*, Vol. 145, No. 3, June 1998, pp. 191-197.

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A. Gameiro, "Baud Sampling Bit Synchronizer for Channels with Data Dependent Noise", *Electronics Letters*, vol. 34, n° 21, 1998, pp. 2000-2002.

Orlando Frazão, Pedro Tavares, António F. Cunha, L. Botelho Ribeiro, J. Ferreira da Rocha, "Extracção Óptica de Relógio para Redes de Elevado Débito", *Revista do Departamento de Electrónica e Telecomunicações da Universidade de Aveiro*, Vol.2, N°4, Janeiro de 1999.

P.J.Silva, P.Mendes, J.Ferreira da Rocha, J.C.Pedro, P.Tavares, P.S.André, N.B. Carvalho, "Automatização de Laboratórios de Medida de Componentes Ópticos e Electrónicos através de LABVIEW", *Revista do Departamento de Electrónica e Telecomunicações da Universidade de Aveiro*, Vol.2, N°4, Janeiro de 1999.

Mário J. N. Lima, Paulo P. Monteiro, J. Ferreira da Rocha, António J. Teixeira, J. Nuno Matos, "Design of Clock-Recovery GaAs ICs for High-Speed Communication Systems", *Proceedings of ICECS'98 - 5th IEEE International Conference on Electronics, Circuits and Systems*, pp. 205-208, 1998.

P. Monteiro, A. Borjak, F. da Rocha, J.J. O'Reilly, I. Darwazeh "10 Gbit/s Pulse Shaping Distributed-Based Transversal Filter Front-end for Optical Soliton Receivers", *IEEE Microwave and Guided Wave Letters*, Vol. 8, N° 1, pp. 4-6, January 1998.

Papers in Conference Proceedings

A.L.J. Teixeira, J.R.F. da Rocha, "Wavelength Allocation in dense-WDM dispersion managed solitons", *Laser and Electro-optics Society annual meeting, LEOS 98*, Orlando, Florida, USA

António L.J. Teixeira, R F S Ribeiro, J R F da Rocha, "Effects of non-ideal frequency modulation on multilevel dispersion supported transmission systems", *Conf. proceedings No. 451, pp.54-56, 6th IEE Conference on telecommunications*, Edinbough, Scotland, UK, 29 March to 1 April 1998

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Mário J. Lima, Paulo P. Monteiro, J. Nuno Matos, José F. da Rocha, António Teixeira, "Design and performance assessment of a multigigabit clock-recovery circuit", *1998 European Gallium Arsenide, and related III-V compounds, Application Symposium Proceedings*, pp.433-438, October 1998, Amsterdam.

Paulo P. Monteiro, Pedro L. Antunes, Mário J. Lima, José F. da Rocha, "Adjustable pulse shaping filter with active impedance matching for optical soliton communication systems", *1998 European Gallium Arsenide, and related III-V compounds, Application Symposium Proceedings*, pp.515-520, October 1998, Amsterdam.

Mário J. Lima, Paulo P. Monteiro, J. Ferreira da Rocha, António Teixeira, J. Nuno Matos, "Design of clock-recovery GaAs ICs for high-speed communication systems", *5th IEEE International Conference on Electronics Circuits and Systems Proceedings*, vol.3, pp.205-208, September 1998, Lisbon.

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A. Navarro, P. Silva, P. Ribau, J. Figueiredo, J. Matos and A. Gameiro, "Base station transceiver design in a digital wireless local loop system", *Proc. of 5th IEEE International Conference on Elect. Circuits and Systems*, Lisbon Sept. 1998, pp. 65-68.

J. Matos, A. Gameiro, R. Silva, J. Figueiredo, M. Burgos and P. Dorta, "RF/SS System for wireless local loop", *Proc. of 5th IEEE International Conference on Elect. Circuits and Systems*, Lisbon Sept. 1998, pp. 525-528.

R. Silva and A. Gameiro, "Dimensioning of Spread-Spectrum Systems for the Wireless Local Loop", *Proc. of IEEE Int. Conf. On Spread Spectrum Tech. And Appl., ISSSTA'98*, Sun City, South Africa, Sept. 98.

A. Navarro, P. Silva, P. Ribau, J. Matos and A. Gameiro, "A Radio channel precoding architecture for a digital wireless local loop system", *Proc. of Intern. Conf. on Signal Process. Appl. & Techn.*, ISCPAT'98, Toronto, Canada, Sept. 96, pp. 1550-1553.

A. Gameiro and R. Alves, "Error Correcting Techniques for WLAN's", *SPIE's International Symposium on Optical Science, Engineering, and Instrumentation*, Boston, Nov. 1998.

Pedro Tavares, Orlando Frazão, António Cunha, Luís Ribeiro, J.F. da Rocha, "Optical Synchronisation of RZ Signal Using External Cavity DFB Laser", *OPTILAS'98 - 6^o Encontro Latino-Americano de Óptica, Lasers e suas Aplicações*, Cartagena de Índias, Colómbia, 28 de Setembro a 2 de Outubro de 1998, Publicado nas "Memórias da Academia Colombiana de Ciências Exactas, Físicas e Naturais" (CD-ROM).

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A.Teixeira, G.Alves, J.Ferreira, J.P.Madaleno, J.Madaleno, O.Frazão, P.Jesus, P.André, P.Tavares, "General overview on the research activities on ITA", *Advanced Heterostructure Devices for Micro and Optoelectronics III*, Turim, Itália, 21-28 de Junho de 1998.

O.Frazão, P.Tavares, A.F.Cunha, L.Ribeiro, J.Ferreira da Rocha, "Recuperador Óptico de Relógio para Redes de Alto Débito", *FISICA'98 - XI Conferência Nacional de Física*, Maia, Portugal, 7-10 de Setembro de 1998, Livro de actas, pg. 607-608.

O.Frazão, P.Tavares, A.F.Cunha, L.Ribeiro, J.Ferreira da Rocha, "Oscilador Óptico de Alta Frequência para Extracção de Relógio", *PROTOFÍSICA'98 - 2ª Conferencia Nacional de Estudantes de Pós-Graduação em Física*, Aveiro, Portugal, 20-24 de Julho de 1998, Livro de resumos pg. 23.

P. S. André, A. Nolasco Pinto, J. L. Pinto e J. Ferreira da Rocha, Determinação da Dispersão Cromática em Fibras Ópticas, *ProtoFísica 98*, Aveiro, Portugal, Livro de resumos pp 13, Julho 1998.

A. Nolasco Pinto, P. S. André, J. L. Pinto e J. Ferreira da Rocha, Caracterização e Simulação do Canal Óptico para Sistemas de Comunicação Baseados em Solitões, *SPF - Física 98*, Maia, Portugal, Livro de resumos pp 633, Setembro 1998.

P. S. André, A. Nolasco Pinto, J. L. Pinto e J. Ferreira da Rocha, Caracterização e Modelização de um Laser DFB para Utilização em Comunicações Ópticas, *SPF - Física 98*, Maia, Portugal, Livro de resumos pp 631, Setembro 1998.

P. S. André, A. Nolasco Pinto, J. L. Pinto e J. Ferreira da Rocha, Extraction of Laser Rate Equations Parameters, *III RIAO & OPTILAS'98*, Cartagena de Índias, Colómbia, Livro de resumos pp 41, Setembro 1998.

P.Tavares, O.Frazão, P.Monteiro, L.Ribeiro, A.F.Cunha, Pedro Antunes, Mário Lima, J.Ferreira da Rocha, "Tecnologia Optoelectrónica para Redes de Elevado Débito", *CONGRESSO'98 - Congresso da Ordem dos Engenheiros 98*, Lisboa, Portugal, 18-19 de Junho de 1998, Livro de resumos.

A. Moreira, R. Valadas, A. Duarte, "Performance Evaluation of the IEEE 802.11 Infrared Physical Layer", *Proceedings of the First International Symposium on Communication Systems and Digital Signal Processing, CSDSP'98*, edited by Sheffield Hallam University Press Learning Centre, ISBN 0-86339-7719, Sheffield, UK, April 6-8, 1998, pp. 10-15.

C. Lomba, R. Valadas, A. Duarte, "A System using Combined Emitter and Receiver Diversity to Combat the Multipath Dispersion of the Diffuse Optical Channel", *Proceedings of the First International Symposium on Communication Systems and Digital Signal Processing, CSDSP'98*, edited by Sheffield Hallam University Press Learning Centre, ISBN 0-86339-7719, Sheffield, UK, April 6-8, 1998, pp. 427-432.

Tavares, R. Valadas, A. Duarte, "Performance of Wireless Infrared Transmission Systems considering both Ambient Light Interference and Inter-Symbol Interference due to Multipath Dispersion", *Proceedings of SPIE*

Symposium on Voice, Video, and Data Communications, Optical Wireless Communications, 2-5 November, 1998.

Miscellaneous

- A. Gameiro, Reviewer for *Wireless Communications*, Kluwer Academic Publishers, *Electronics Letters* and *ConfTele'99*.
- P. Monteiro, Reviewer for *Electronics Letters*.
- R. Ribeiro, Reviewer for *IEEE Photonics Letters* and *ConfTele'99*.
- Rui Valadas reviewer for the *International Journal of Wireless Information Networks* (Plenum Press) and for the *IEEE Communications Magazine*.
- Rui Valadas integrated the organizing committee of the *First International Symposium on Communication Systems and Digital Signal Processing*, CSDSP'98, April 6-8 1998, Sheffield, UK.

P. S. André, A. Nolasco Pinto, J. L. Pinto e J. Ferreira da Rocha, "Extraction of Laser Rate Equations Parameters", accepted for publication, *Proceedings of SPIE*, 1999.

P. J. Silva, P. Mendes, J. Ferreira da Rocha, J. C. Pedro, P. Tavares, P. S. André, N. B. Carvalho, "Automatização de Laboratórios de Medida de Componentes Ópticos e Electrónicos através de LabVIEW", *Revista do DETUA*, Vol 2, nº 4, 1999.

Papers in Conference Proceedings

A. Nolasco Pinto, P. S. André, J. L. Pinto e J. Ferreira da Rocha, "Caracterização e Simulação do Canal Óptico para Sistemas de Comunicação Baseados em Solitões", *Actas da SPF – Física 98*, pp. 633, Maia, Portugal, September 1998.

P. S. André, A. Nolasco Pinto, J. L. Pinto e J. Ferreira da Rocha, "Caracterização e Modelização de um Laser DFB para Utilização em Comunicações Ópticas", *Actas da SPF – Física 98*, pp. 631, Maia, Portugal, September 1998.

P. S. André, A. Nolasco Pinto, J. L. Pinto e J. Ferreira da Rocha, "Determinação da Dispersão Cromática em Fibras Ópticas", *ProtoFísica 98*, pp. 43, Aveiro, Portugal, July 1997.

P. S. André, A. Nolasco Pinto, J. L. Pinto e J. Ferreira da Rocha, "Extraction of Laser Rate Equations Parameters", *III RIAO & OPTILAS'98*, pp 41, Cartagena de Indias, Colombia, September 1998.

J. L. Pinto, M. Pousa, P. S. André, A. Nolasco Pinto, M. R. Ferreira, "Emissor para Sistemas de Transmissão Baseado na Tecnologia de Solitões", *Congresso 98 da Ordem dos Engenheiros – A Engenharia Portuguesa no Mundo*, Lisboa, Portugal, May 1998.

A. Teixeira, G. Alves, J. Ferreira, J.P. Madaleno, J. Madaleno, O. Frazão, P. Jesus, P. André, P. Tavares, "General overview on the research activities on ITA", *Euroconference on Advanced Heterostructure Devices for Micro and Optoelectronics III – ISI Foundation*, Turim, Italy, June 1998.

A. Nolasco Pinto, P. S. André, J. L. Pinto, F. da Rocha, "Short optical pulses generation by gain switching of a DFB laser diode", accepted for presentation at *Confetele'99*, Sesimbra, Portugal, April 1999.

A. Nolasco Pinto, P. S. André, J. L. Pinto, F. da Rocha, "Bit-error rate evaluation in soliton systems", accepted for presentation at *Confetele'99*, Sesimbra, Portugal, April 1999.

P. S. André, A. Nolasco Pinto, J. L. Pinto, F. da Rocha, "Extraction of DFB laser rate equations parameters for optical simulation purposes", accepted for presentation at *Confetele'99*, Sesimbra, Portugal, April 1999.

Project Deliverables and Reports

J. L. Pinto, A. Nolasco Pinto, Paulo S. André, "Projecto EMITON PO58 - Relatório Técnico Final", Instituto de Telecomunicações - SCCEO, Aveiro, December 1998.

Miscellaneous

- João Lemos Pinto, reviewer of papers submitted to the *Confetele'99*, Sesimbra, Portugal.

9.3.5 Integrated Circuits and Systems Research Line

Human Resources

Collaborators

- | | | |
|------------------------------|------------|--------------------|
| • Dinis Magalhães dos Santos | PhD | Full Professor, UA |
| • José Luis Vieira Cura | MSc | Assistant, UA |
| • Rui Luís Andrade Aguiar | MSc | Assistant, UA |
| • José Miguel Santos | Researcher | DID/CET (PT) |
| • José Cabaça | Researcher | DID/CET (PT) |

Other Collaborators

- | | |
|--------------------------|------------------------------------|
| • Eduardo de Vasconcelos | Research Student Grant, UA |
| • Armindo Carreiró | Research Student Grant, PRAXIS XXI |
| • David Marques | Research Student Grant, IT |
| • Luis Nero Alves | Research Student Grant, PRAXIS XXI |
| • António de Deus | Research Student Grant, IT |
| • Ivete Pinto | Research Student Grant, IT |
| • António Guimarães | Research Student Grant, IT |

Projects

- PRAXIS XXI 2/2.1/TIT/1592/95 GENCLOCK - Architectures for High-Speed Clock Generation and Synchronization.

During 1998, the project focused on the development of multi-point distribution systems, with special emphasis on architectural and modelling aspects. New generic and scaleable clock distribution architectures have been developed, and jitter modelling has been analysed for these (and other) distribution approaches.

- PRAXIS XXI 2/2.1/TIT/1578/95 IRWLAN - Advanced Technologies for Wireless Infrared Local Area Networks.

The project has developed several front-ends for IR optical communication, and has confronted the produced circuits with practical system results. A full IR receiver (comprising a front-end, a clock recovery system, an optimum demodulator and a decoder) has also been produced. Signal to Noise measuring units have been designed. This project is being developed with the cooperation of the Optical Communications Research Line.

- MICROSS

Solution study for a Micro Cross-Connect SDH 4/4 of small dimension and modular configuration up to 16 gates 155Mb/s (STM-1) or 4 gates 622Mb/s (STM-4). This project has finished at the end of the year.

- PlanSDH

A software tool for the dimensioning and optimisation of SDH networks. Basically the SDH network design involves: input parameters (e.g., a set of nodes, distance between nodes, a set of traffic matrices, type of routing, type of protection ...); constraints (e.g., equipment limitations, capacity restrictions,...) ; outputs (e.g., quantity and type of equipment units per node, cost of a particular solution, a set of documents describing the project solution,...).

PhD Theses

- José L. Cura (supervisor: Dinis M. Santos), Universidade de Aveiro , concluded in September 1998 (subject: Conversão Analógica-Digital de Integração de Alta Velocidade).
- Rui L. Aguiar (supervisor: Dinis M. Santos), Universidade de Aveiro, in preparation (subject: Multi-Point Clock Synchronisation and Generation for Integrated Circuits).

M.Sc. Theses

- David Marques (supervisor: Dinis M. Santos), Universidade de Aveiro, to be concluded in 1999 (subject: A transport system for mixed synchronous and asynchronous traffic).
- Eduardo de Vasconcelos (supervisor: Dinis M. Santos), Universidade de Aveiro, to be concluded in 1999 (subject: A CMOS 622Mb/s SDH system).
- Luis Nero Alves (supervisor: Dinis M. Santos), Universidade de Aveiro, to be concluded in 1999 (provisional subject: Implementation of CMOS-based Analogue Dividers).

Publications

Papers in Journals

Rui L. Aguiar, Dinis M. Santos, "Multiple Target Clock Distribution with Arbitrary Delay Interconnects", *Electronic Letters*, vol. 34, n° 22, pp. 2119-2120, October 1998.

Papers in Conference Proceedings

José L. Cura, Eduardo de Vasconcelos, Rui L. Aguiar, "A High Transimpedance-Bandwidth, High Dynamic Range, CMOS Front-End for Open Air Optical Links" *5th IEEE International Conference on Electronics, Circuits and Systems*, vol. 1, pp.309-312, Lisbon, Portugal, September 1998.

Rui L. Aguiar, Dinis M. Santos, "Wide Area Clock Distribution Using Controlled Delay Lines" *5th IEEE International Conference on Electronics, Circuits and Systems*, vol. 2, pp. 63-66, Lisbon, Portugal, September 1998.

Eduardo de Vasconcelos, Rui L. Aguiar, Dinis M. Santos, "A 0.7 μm CMOS Clock Recovery Circuit for 622Mb/s SDH Systems" *5th IEEE International Conference on Electronics, Circuits and Systems*, vol. 3, pp. 411-414, Lisbon, Portugal, September 1998.

José L. Cura, Dinis M. Santos, "A Novel 12-Bit, 3 μs , Integrating-Type CMOS Analog-to-Digital Converter", *SBCCI'98 - XI Brazilian Symposium on Integrated Circuit Design*, IEEE Computer Society, pp.74-77, Búzios, Brazil, September 1998.

Rui L. Aguiar, Dinis M. Santos, "A Physical Layer Controller for Wireless Infrared Networks", *SBCCI'98 - XI Brazilian Symposium on Integrated Circuit Design*, IEEE Computer Society, pp.82-85, Búzios, Brazil, September 1998.

V. Y. Chepel, M. Lopes, J. van der Marel, P. Crespo, D. Santos, L. Janeiro, V. N. Solovov, R. Ferreira Marques, A. J. Policarpo, "The Liquid Xenon Detector for PET: Recent Results", *IEEE Nuclear Science Symposium and Medical Imaging Conference*, Toronto, Canada, November 1998.

P. Crespo, V. Chepel, M. Lopes, J. Marel, D. Santos, L. Janeiro, V. Solovov, R. Ferreira Marques, A. Policarpo, "Pulse Processing for the PET Liquid Xenon Multiwire Ionisation Chamber", *IEEE Nuclear Science Symposium and Medical Imaging Conference*, Toronto, Canada, November 1998.

Rui L. Aguiar, J. L. Oliveira "Issues on Internet Evolution and Management", accepted for presentation at *ICEIS'99 - 1st International Conference on Enterprise Information Systems*, Setúbal, Portugal, March 1999.

David Marques, Rui L. Aguiar, Cipriano Lomba "An Efficient Transport System for Mixed Synchronous and Asynchronous Traffic", accepted for presentation at *Conftele'99 - II Conferência de Telecomunicações*, Sesimbra, Portugal, April 1999.

Armindo Carreiró, Rui L. Aguiar, Eduardo de Vasconcelos, Dinis M. Santos, Cipriano Lomba, "A High-Gain, High-Bandwidth Receiver for Atmospheric Optical Communications", accepted for presentation at *Conftele'99 - II Conferência de Telecomunicações*, Sesimbra, Portugal, April 1999.

Eduardo de Vasconcelos, José L. Cura, Rui L. Aguiar, Dinis M. Santos, "A Novel High-Gain, High Bandwidth CMOS Differential Front-End for Wireless Optical Systems", accepted for presentation at *ISCAS'99 - International Symposium on Circuit and Systems*, Orlando, Florida, May 1999.

Project Deliverables and Reports

Rui L. Aguiar, Armindo Carreiró, Eduardo de Vasconcelos, José L. Cura, Luis Nero, Dinis M. Santos, "IRWLAN Deliverable R4.1 - Front-End Topologies for Infra-Red Systems", May 1998.

Rui L. Aguiar, Dinis M. Santos, "GenClock Deliverable R4 - Problems and Techniques for Clock Distribution", May 1998.

David Marques, "Interface Digital - Especificações Temporais", Project IRWLAN, IT, February 1998.

Luis Nero Alves, "Análise de Ruído em Receptores Ópticos", IT, November 1998.

Luis Nero Alves, "Estudo Sobre Current Conveyors e suas Aplicações", IT, December 1998.

Miscellaneous

- Irlink - R&D project sponsored by ENT S.A., for the development of electronic systems for line-of-sight communications. Involvement: Dinis M. Santos, Rui L. Aguiar, José L. Cura, Eduardo de Vasconcelos, David Marques.
- Icolan - R&D project sponsored by Agência de Inovação, for the development of electronic systems for open air communications. Involvement: Dinis M. Santos, Rui L. Aguiar, José L. Cura, Eduardo de Vasconcelos, David Marques.
- DIFFERENCE - research project sponsored by ACTS (AC.207), for the analysis of new services on an advanced Internet infrastructure. Involvement: Rui L. Aguiar.
- Rui L. Aguiar reviewer of papers presented at *SBCCI'98 - XI Brazilian Symposium on Integrated Circuit Design*, IEEE Computer Society, Sep 98.
- Dinis M. Santos reviewer of papers presented at *ConfTele'99 - II Conferência de Telecomunicações*, Sesimbra, Portugal, April 1999.

Research topics not directly related to telecommunications activities:

- Front End and data readout for radiation detector electronics (project **PET**, in collaboration with LIP and FCTUC and FMUC). Involvement: Dinis M. Santos and José Rosado.
- Smart Power Integrated Circuits (in collaboration with IT/IST). Involvement: Dinis M. Santos and José L. Cura. Financing: PRAXIS. During this year a basic analogue and mixed-analogue digital library has been developed for usage in the project.

9.3.6 Integrated Communications and Multimedia Research Line

Human Resources

Collaborators

- Vasco F. Lagarto ⁵ M.Sc. Director for Research, PT-CET
- A. Manuel de Oliveira Duarte ⁶ PhD Associate Professor, UA
- Manuel Alberto R. O. Violas M.Sc. Assistant, UA,
- Amaro Fernandes de Sousa ⁷ M.Sc. Assistant, UA.

Other Collaborators

- Victor M.L. Marques M.Sc., Ph.D. Student Grant, PRAXIS + UA
- Ricardo V. Cadime M.Sc. Student Grant, ACTS project
- Fernando Azevedo Researcher Grant, ACTS project
- António Pinto Basto Researcher Grant, ACTS project
- F. Miguel Oliveira Researcher Grant, contract with PT
- César Dias Miranda Researcher Grant, contract with PT
- João C. Tedim Researcher Grant, UA
- Mário Jorge Oliveira Laboratory Tech. Grant, UA
- Jorge Miguel Jardim Lic. Student UA, Final Year Student
- Edna Maria Correia Lic. Student UA, Final Year Student
- Carla Isabel dos Santos Lic. Student UA, Final Year Student
- Nuno Miguel Sousa Lic. Student UA, Final Year Student

⁵ Co-coordinator

⁶ Co-coordinator

⁷ Is also a collaborator with the Networks Research Line

Projects

- BROADBANDLOOP (ACTS.038)

Project sponsored by the ACTS programme, European Union. The main objectives of the project are to define and demonstrate, in live field trials, a concept for a full service access network which migrates fibre gracefully into the local loop when bandwidth demand increases, with an offer of services that targets two customer groups: small to medium size businesses and residential customers. BBL supports the needs of network operators to provide both narrowband and broadband services such as high speed Internet Access and Video on Demand that are economically justified in a competitive environment. The field trial sites located in Denmark, Portugal and Poland, have been purposely selected to enable analysis of typical problems which may be encountered when legacy networks, such as those using the existing copper and/or coax for broadband access or those with little or old telephony infrastructures, are expanded for new service.

- AMIS (Funded by Portugal Telecom)

This project is aimed at the development of a software platform that provides non-technical users with easy and user-friendly publishing and editing facilities for web-like documents. The AMIS Service is a Web system that enables authors to create and publish documents using visual editors. The key factor behind this functionality is the utilisation of appropriate software agents and therefore one of the primary tasks of the project is to investigate intelligent and mobile agents capable of adding links to documents with a minimum effort on the part of the users who, as said before, are supposed to not have a profound technical knowledge about web publishing tools. In order to validate the AMIS Service, an experimental application is currently being launched involving a selected group of Secondary Schools in Portugal.

- SATURNO: Quality of Service and Interoperability in Multimedia Networks (Funded by Portugal Telecom)

This is a 2 year project sponsored by Portugal Telecom. The objective of the project is to study the problematic associated to the provision of quality of service and interoperability in multimedia networks. This involves the development of a set of multimedia communication protocols between a client and a server following a DAVIC like reference model and the identification of the appropriate interoperability tests; tests about the utilisation of different network protocols supporting quality of service in multimedia applications using such technologies as IP, RSVP and Winsock 2.0 over ATM.

- TERA - Techno Economic Results from ACTS (ACTS.364)

Project sponsored by the ACTS programme, European Union. TERA is the ACTS project responsible for the techno-economic evaluations of various multimedia services and network alternatives, under several field situations. Its mission is : (i) Consolidation of guidelines for implementation of new networks and services in ACTS concertation mechanisms ; (ii) Provision of a uniform and harmonized evaluation of the various ACTS trials with different focuses, enabling the construction of guidelines based on comparable

results ; (iii) Provision of techno-economic support for ACTS ; (iv) Promotion of techno-economic results in workshops and publications in international journals ; (v) Broadening the participation to non-EU Mediterranean countries. The target audience for this project comprises: the ACTS community, decision makers, network planners, business planners, regulators, equipment suppliers, etc.

- TELA: Telecommunications and Production Systems Competitiveness: the case of the district of Aveiro — PRAXIS XXI (Social and Human Sciences).

This is a project funded by PRAXIS XXI (Social and Human Sciences), involving a multidisciplinary team of researchers (members of the Department of Electronics and Telecommunications – Institute of Telecommunications and members of the Department of Environment and Planning) and also benefiting from the collaboration of Portugal Telecom through its R&D Centre in Aveiro and the University of St. Andrews, UK. The main objective of this project is to study the role of advanced telecommunications services as fundamental factors conditioning the competitiveness of the productive structures and trying to put forward a set of guidelines and recommendations for the elaboration of an integrated services telematic platform for the region of Aveiro.

- Acquisition of Know-How in Planning , Operation, Administration and Management of ATM Networks

This is an activity partially funded by the Research Institute of the University of Aveiro. Its implementation is carried out in co-operation with the Department of Electronics and Telecommunications, the Centre for Informatics and Communications of the University of Aveiro and the local branch of INESC (Institute for Computers and Systems Engineering). The main objective of this activity is to plan, to install, to configure and to operate an ATM network covering most of the University Campus and providing R&D facilities for a number of studies relative to broadband communications and services. Consideration is given to the requirements of as many as possible types of potential users of the network within the Campus. A survey of the relevant ATM standards and/or recommendations and of the available equipment from the main ATM vendors was done as a way to anticipate possible evolution and implementation scenarios. A number of training actions was carried out in order to disseminate the know-how acquired relative to planning, operation and management of ATM Networks.

- Regional Scientific and Technological Development (PRAXIS XXI, Social and Human Sciences)

A The main objective of the *Regional Scientific and Technological Development* project is the organisation of science and technology policy and the funding of scientific and technological development at the regional level. The approach includes the assessment of the participation of relevant actors and institutions in a regional research and innovation system. The conditions for developing the knowledge-base and for stimulating the interaction and flows of knowledge between users and producers of knowledge will be analysed. Research includes: Policies and Structures; Attitudes; Education and Information; and the Dissemination and Utilisation of Knowledge. Interaction between these main lines are foreseen (e.g. structures and flows of knowledge transfer; information and knowledge diffusion). The

case-study focus its attention on the Aveiro area. Previous experiences of success and failure of actor's and institutions intentions will be analysed and new types of interactions foreseen. An international comparative analysis of policies and structures for science and technology policies will be used for this special purpose.

PhD Theses

- Amaro Fernandes de Sousa (supervisors: A.Manuel de Oliveira Duarte and Rui Valadas), University of Aveiro, in preparation, expected conclusion in 2000, (subject: Transport protocols for multimedia communications in broadband networks).
- Manuel Alberto O. R. Violas (supervisors: A.Manuel de Oliveira Duarte and David Heatley, British Telecom Research Laboratories, UK), University of Aveiro, submitted, expected public presentation in May 1999, (subject: Optical Receivers for Several GigaHertz of Bandwidth).

M.Sc. Theses

- Nuno Miguel Bravo Lima Nunes Delgado (supervisor: A.Manuel de Oliveira Duarte), University of Aveiro, conclude in 1998, (subject: Digital Video Transmission using MPEG over Broadband Networks).
- Manuel António Esteves Batista (supervisor: A.Manuel de Oliveira Duarte), University of Aveiro, in preparation, (subject: New Telematics and Home Automation Technologies for the Support of Disabled People with Special Needs).
- Henrique Manuel Fadigas do Vale (supervisor: A.Manuel de Oliveira Duarte), University of Aveiro, concluded in 1998, (subject: Radio in the Access Network the Case for DECT Technologies).
- Ângelo J. S. Almeida (supervisor: A.Manuel de Oliveira Duarte), University of Aveiro, concluded in 1998, (subject: Access Networks A Comparative Study).
- José Morais (supervisor: A.Manuel de Oliveira Duarte), University of Aveiro, in preparation, (subject: CATV Networks Aspects of Planning and Dimensioning).
- Alfredo França, (supervisor: A.Manuel de Oliveira Duarte), University of Aveiro, concluded in 1998, (subject: Access Networks the case for xDSL Technologies).

Publications

Books and Book Chapters

Eduardo de Castro, A.Manuel de Oliveira Duarte, "Model for mixed demographic structure" chapter VII in Leif Imms (ed.), "Broadband Access Networks — Introduction Strategies and Techno-Economic Evaluation", Chapman and Hall, London, 1998.

Papers in Journals

Henrique M.F. Vale, Jorgen Bruhn, "Rádio na Rede de Acesso: Projecto DECT/WLL/Broadband - Um projecto entre a Universidade de Aveiro e a Ericsson Telecomunicações, Lda / *Radio in Local Loop: DECT/WLL/Broadband Project – A project between the University of Aveiro and Ericsson Telecomunicações,Lda*", Revista Comunicações da APDC / *Comunicações – APDC Magazine*, nº 12, pp.71-74, Janeiro - *January* 1998, (em Português / *in Portuguese*)

C. Lomba, R. Valadas, A. Duarte, "Combined Emitter and Receiver Diversity to Achieve Data Rates > 100Mbit/s on Diffuse Optical Channels", *Electronics Letters*, Vol. 34, Nº. 12, pp. 1243-1244, 11 Junho / *June* 1998

C.R. Lomba, R.T. Valadas, A.M. de Oliveira Duarte," *Experimental Characterisation and Modelling of the Reflection of Infrared Signals on Indoor Surfaces* ", *IEE Proceedings – Optoelectronics*, Vol. 145, No. 3, Julho / *June* 1998

José Ruivo, J. Miguel Pimentel, Henrique Vale, Rui Valadas, A. Manuel de Oliveira Duarte, "Análise e Planeamento de Tráfego em Redes DECT (Digital Enhanced Cordless Telecommunications / *Traffic Analysis and Planning in DECT's Network*", Revista do Departamento de Electrónica e Telecomunicações / *Department of Electronics and Telecommunications' Magazine*, Universidade de Aveiro, Vol. 2, nº 3, Setembro / *September* 1998, (em Português / *in Portuguese*)

Ricardo Cadime, Susana Sargento, Henrique Vale, Jorge Ferraz de Abreu, Miguel Ilídio Monteiro, A. Manuel de Oliveira Duarte, "Um Sistema Experimental de *Near Video on Demand* / *Near Video on Demand Experimental System*", Revista do Departamento de Electrónica e Telecomunicações / *Department of Electronics and Telecommunications' Magazine*, Universidade de Aveiro, Vol. 2, nº 3, Setembro / *September* 1998, (em Português / *in Portuguese*)

Benjamim M. Júnior, Victor Marques, Amaro F. de Sousa, A. Manuel de Oliveira Duarte, "Encaminhamento em Redes Heterogéneas – Rede da Universidade de Aveiro / *Routing in Heterogeneous Networks - the University of Aveiro Network*", Revista do Departamento de Electrónica e Telecomunicações / *Department of Electronics and Telecommunications' Magazine*, Universidade de Aveiro, Vol. 2, nº 3, Setembro / *September* 1998, (em Português / *in Portuguese*)

Eduardo Anselmo de Castro, Chris Jensen-Butler, A. Manuel de Oliveira Duarte, "Network Externalities, Telematics and Regional Economic Development" – *Discussion Paper Series nº 9819, University of St. Andrews, Department of Economics St.Salvator's College, St. Andrews, Fife KY16 9AL Scotland, October* 1998.

Rui T. Valadas, A. M. de Oliveira Duarte, António R. Tavares, Adriano C. Moreira, Cipriano T. Lomba, "The Infrared Physical Layer of the IEEE 802.11 Standard for Wireless Local Area Networks", *IEEE Communications Magazine*, Dezembro / *December* 1998

Papers in Conference Proceedings

Lídia J. Oliveira Loureiro Silva, Anabela M. de Sousa Pereira, A.J Ferrer Correia, A.Manuel de Oliveira Duarte, Carlos Leite, “O Professor e as Novas Tecnologias da Informação e da Comunicação: uma relação de sinergia ou o tombar do pedestal? — *The Teacher and the New Information and Communication Technologies: a synergistic relation or stepping down from the stall ?*”, 4ª Conferência Nacional de Ciências da Educação — 4th National Conference on Educational Sciences”, Aveiro, 18-20 de Fevereiro de 1998

Delgado N., Franceschini G., De Sousa A. F., Oliveira Duarte A. M., “An MPEG-4 DMIF Implementation over IP Networks”, submitted to *7th IFIP/ICCC Conf. On Information Networks and Data Communications (INDC'98)*, Aveiro, Portugal, 15-17 June, 1998.

Leif Aarhun Ims, Kjell Stordahl, Nils Kristian Elnegaard, Fernando Azevedo, Borgar Torre Olsen, “Broadband access network competition – analysis of technology and market risk”, *IEEE Globecom 98*, Sydney, November 8-12, 1998

Kjell Stordahl, Nils Kristian Elnegaard, Fernando Azevedo, Leif Aarhun Ims, Borgar Torre Olsen, “Evaluating broadband strategies in a competitive market using risk analysis”, *IEEE Networks 98*, Sorrento, October 18-23, 1998

Project Deliverables

The following list includes a selected choice of the most relevant deliverables issued in 1998 by the projects were this research line has been involved.

- Project ACTS.364 – TERA (Techno Economics Results from ACTS)

Del.1: Definition of inputs from field trials and projects in ACTS

Del.2: Description of integrated ACTS field trials

Del. 3: Progress report on dissemination

Del.4: Report on evaluation of ACTS field trials

- Project BBL (BROADBANDLOOP — ACTS.038)

Services and applications implementation report (phase 1)

Definition of Field Trial measurements

Life Cycle Cost calculations including field trials

Field trial description report phase 2

Network requirement specification revised

Installation report for field trial phase 1

Specification of network infrastructure for trials phase 2

Services & application evaluation report phase 1

Miscellaneous

- Thesis orientation outside the scope of the Institute of Telecommunications

Some of the research activities in IT have a cross-disciplinary nature. The following thesis represents the result of some of these type of activities and involve researchers from the Communication and Arts Department of the University of Aveiro:

Lídia de Jesus Oliveira Loureiro da Silva (supervisors: A.Manuel de Oliveira Duarte and Armando Jorge Oliveira) University of Aveiro, in preparation, expected conclusion in 2000, (subject: Cognitive and Social Impact of the Globalisation of Communication Networks).

- Creation of Experimental Telecommunications Infrastructures

This Research Line has promoted the submission of an application to the Research Institute of the University of Aveiro for the installation of an ATM network in the Aveiro Campus. This application was done jointly with INESC - pole of Aveiro, DETUA (Dep. of Electronics and Telecommunications) and CICUA (Informatics and Communications Centre). This application was successful. The equipment was acquired and most of its installation was completed in 1997-8 being now in operation and interworking with the already existing experimental telecommunications infrastructures.

- Vasco Lagarto: member of the Telematics Applications Programme Management Committee
- A. Manuel de Oliveira Duarte: coordinator of studies for the Master of Science course in Electronics and Telecommunications at the University of Aveiro.
- A. Manuel de Oliveira Duarte member of the review/editorial board of the following magazines:

Cadernos do Centro de Física , Acústica e Telecomunicações, Fac. Eng. Univ. Porto;

Revista do Departamento de Electrónica e Telecomunicações da Univ. Aveiro.