

INSTITUTO DE TELECOMUNICAÇÕES

Relatório Anual

1996

INDICE

1. INTRODUÇÃO.....	3
2. ORGANIZAÇÃO INTERNA.....	4
3. ACTIVIDADES EM PROJECTOS DE ÂMBITO NACIONAL.....	4
4. ACTIVIDADES EM PROJECTOS COMUNITÁRIOS	5
5. AVALIAÇÃO DE ACTIVIDADES NO ÂMBITO DO PROGRAMA PLURIANUAL	6
6. OUTRAS ACTIVIDADES	6
7. PROTOCOLOS DE CEDÊNCIA DE MEIOS HUMANOS E MATERIAIS.....	7
8. RECURSOS HUMANOS	7

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:

o Instituto Superior Técnico (IST),

a Universidade de Aveiro (UA),

a Faculdade de Ciências e Tecnologia da Universidade de Coimbra (FCTUC),

a Portugal Telecom, através do seu Centro de Estudos de Telecomunicações (CET).

O IT está organizado em 3 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 3 contratos celebrados em 1991. Este financiamento permitiu a construção de infraestruturas nos 3 Pólos e a aquisição de equipamentos para os respectivos laboratórios.

Tendo ficado terminadas em 1993 as actividades de instalação do Pólo de Aveiro e em 1994 as actividades de instalação do pólos de Lisboa e de Coimbra, os anos de 1995 e 1996 foram já caracterizados por uma actividade regular. Durante o ano de 1996 algumas das actividades mais marcantes envolveram os aspectos que a seguir se apontam e que se apresentam com pormenor nos relatórios das linhas de investigação.

2. Organização interna

Realizaram-se duas Assembleias Gerais, em Março e Novembro, destinadas respectivamente a aprovar o relatório de actividades e contas de 1995 e a aprovar o plano de actividades e orçamento para 1997;

Realizaram-se reuniões mensais da Comissão Executiva;

Realizaram-se reuniões com o Revisor Oficial de Contas para análise de balanços e definição de procedimentos contabilísticos;

Realizou-se uma reunião do Conselho Científico, em Novembro, para apresentação do trabalho desenvolvido no âmbito das Grandes Linhas de Investigação (GLI's) e preparação do plano de actividades para 1997 a submeter à Assembleia Geral.

3. Actividades em projectos de âmbito nacional

No âmbito do programa lançado pela JNICT para financiamento de projectos liderados por “Jovens Doutorados”, foram desenvolvidas actividades em 10 projectos (7 no Pólo de Lisboa, 1 no Pólo de Coimbra e 2 no Pólo de Aveiro); os primeiros relatórios anuais serão submetidos no início de 1997;

No âmbito do Programa PRAXIS XXI, medida 2 foram aprovados 12 projectos de investigação envolvendo o Instituto de Telecomunicações: 8 projectos 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 IT-Aveiro e em colaboração com a Universidade do Algarve, 1 projecto liderado pelo INESC e envolvendo o Pólo de Coimbra e 1 projecto liderado pelo IST envolvendo o Polo de Aveiro e 1 projecto envolvendo os Pólos de Lisboa e Aveiro do IT.

Foi iniciado um projecto de colaboração com as OGMA (Oficinas Gerais de Material Aeronáutico) envolvendo o Pólo de Lisboa do IT, visando o projecto de antenas e de circuitos de radiofrequência de um terminal portátil para recepção via satélite;

Foi desenvolvido um estudo de viabilidade de centros de radiocomunicação por solicitação do ICP (Instituto das Comunicações de Portugal), que será finalizado durante o 1º trimestre de 1997;

Foi mantida a colaboração do pólo de Aveiro com a empresa TEKA tendo sido implementado um sistema de distribuição de serviços de televisão (projecto DISERT);

Foram desenvolvidas actividades (estudos e construção de protótipos) no âmbito do projecto ITCOM (Integração de Tecnologias em Comunicações Móveis), envolvendo equipas dos 3 Pólos do IT, tendo sido elaborado o 1º relatório anual . Também dois grupos dos Pólos de Lisboa e Coimbra mantiveram actividade no âmbito do projecto PRODIGIOS (Processamento Digital de Sinais de Audio e Video) liderado pelo INESC;

Por encomenda da Portugal Telecom, através do Centro de Estudos de Telecomunicações, o Pólo de Aveiro desenvolveu actividades em 16 projectos de I&D cobrindo as áreas de Redes (8) Rádio Microondas e Ondas Milimétricas (4) sistemas de Circuitos Integrados (2), Comunicações Ópticas (1), Comunicações Integradas e Multimédia (1).

Por encomenda da Portugal Telecom, através do Centro de Estudos de Telecomunicações, o Pólo de Coimbra iniciou um projecto na área do reconhecimento automático da fala através da linha telefónica;

4. Actividades em projectos comunitários

As actividades de equipas do IT em projectos comunitários, em particular no programa ACTS (4º Programa Quadro da União Europeia), envolveram a participação nos projectos: FRAMES (na área das comunicações móveis), MOMUSYS (na área da codificação de imagem), UPGRADE (na área das comunicações ópticas), VITAL (na área dos serviços avançados de telecomunicações), TALISMAN (na área de protecção dos direitos de cópia

de sinais audio e video), SPEED (na área da transmissão óptica com altos débitos binários), BLISS (na área dos componentes ópticos activos), SAMBA (na área das comunicações móveis de banda larga, e ondas milimétricas) e CABSINET (na área da distribuição celular de televisão).

5. Avaliação de actividades no âmbito do programa plurianual

No início do mês de Setembro os 3 Pólos do IT foram visitadas por painéis de avaliadores estrangeiros, no quadro do processo de avaliação das Unidades de Investigação suportados pelo “Programa Plurianual de Financiamento das Unidades de I&D”:

ao Pólo de Lisboa foi atribuída a classificação de Excelente a que corresponde um financiamento anual para o período de 1996 a 1999 de 26 650 contos e possibilidade de celebração de um contrato programático, por um período de 3 anos, no montante máximo de 45 000 contos;

aos Pólos de Aveiro e Coimbra foi atribuída a classificação de Bom a que corresponde um financiamento anual para o período de 1996 a 1999 de 8 200 a cada polo.

6. Outras actividades

Foram iniciados os trabalhos de preparação da I Conferência Nacional de Telecomunicações que terá lugar em Aveiro nos dias 10 e 11 de Abril de 1997. Para esta conferência foram recebidas 147 comunicações que foram apreciadas por painéis envolvendo cerca de 20 investigadores e especialistas de várias universidades, institutos de investigação e de empresas nacionais;

Em Dezembro de 1996, o IT foi visitado por uma delegação do INRIA (Institut National de Recherche en Informatique et en Automatique). A esta visita seguiu-se um convite ao Prof. Carlos Salema para integrar um grupo ERCIM (European Research Consortium for

Informatics and Mathematics) que avaliou as actividades de investigação e desenvolvimento na Tunísia em Informática e Telecomunicações.

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

O Pólo de Lisboa recebeu a visita do Prof. Rama Kant Jha da Banaras Hindu University, India, pelo período de 1 ano tendo resultado desta colaboração o manuscrito de um livro a editar proximamente;

7. Protocolos de cedência de meios humanos e materiais

Continuaram os contactos com as instituições universitárias associadas visando a elaboração de protocolos de cedência de meios humanos e materiais que permitam regularizar aspectos do seu relacionamento com o IT. Espera-se poder finalmente concluir esta questão durante 1997.

8. Recursos humanos

Os recursos humanos do IT referidos a Dezembro de 1996 são os seguintes:

Pólo de Aveiro: 18 investigadores, docentes da UA, dos quais 13 doutorados , 22 investigadores do Centro de Estudos de Telecomunicações da Portugal Telecom, cerca de 40 outros colaboradores, na maioria estudantes de mestrado e doutoramento da UA e 20 alunos finalistas de licenciatura, em Projectos de Fim de Curso. O Pólo de Aveiro tem ainda a colaboração de 5 funcionários a tempo total e 3 a tempo parcial.

Pólo de Coimbra: 29 investigadores, docentes da FCTUC, dos quais 13 doutorados, 11 investigadores, docentes de outras instituições de ensino superior dos quais 2 doutorados, 15 bolseiros, alunos de pós-graduação da FCTUC, cerca de 15 alunos finalistas de licenciatura da FCTUC na preparação de Trabalhos

Finais de Curso. O Pólo de Coimbra tem ainda a colaboração de 3 funcionários administrativos a tempo inteiro e 1 funcionário técnico a tempo parcial.

Pólo de Lisboa: 46 investigadores, docentes do Instituto Superior Técnico, dos quais 36 são doutorados, 18 investigadores docentes de outras instituições de ensino superior, dos quais 3 são doutorados, cerca de 40 outros colaboradores, uma parte significativa dos quais são estudantes de mestrado e doutoramento, bem como algumas dezenas de alunos de licenciatura trabalhando em projectos do IT no âmbito da preparação dos respectivos Projectos Finais de Curso. O Pólo de Lisboa teve ainda a colaboração de 1 técnico de laboratório em tempo parcial e de 2 funcionários administrativos.

Para efeitos de avaliação externa este relatório é também apresentado em língua inglesa assim como, em anexo, a descrição detalhada das actividades desenvolvidas no âmbito das linhas de investigação nos três polos.

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Annual Report

1996

CONTENTS

1. Introduction	3
2. Internal management	3
3. National Projects	4
4. European Community Projects	5
5. Evaluation in the scope of “Pluri-annual” program	5
6. Other activities	6
7. Protocols with University Associates	7
8. Human resources	7
9. ANNEX	9
9.1 Lisbon Pole	10
9.1.1 Radio, Microwaves and Millimeter Waves Research Line	10
9.1.2 Integrated Circuits and Systems Research Line	27
9.1.3 Signal and Image Processing Research Line	36
9.1.3.1 Communication Theory and Pattern Recognition Group	36
9.1.3.2 Image Group	44
9.1.3.3 Radio Communication Systems Group	55
9.1.4 Optical Communications Research Line	59
9.1.5 Electronic and Opto-electronic Components Research Line	64
9.1.6 Power Systems Research Line	68
9.1.7 Networks Research Line	71
9.1.8 Integrated Communications and Multimedia Research Line	74
9.1.9 Technology and Materials Research Line	77
9.2 Coimbra Pole	81
9.2.1 Signal and Image Processing Research Line	81
9.2.2 Optical Communications Research Line	92
9.2.3 Applied Mathematics Research Line	99
9.2.4 Power Systems Research Line	108
9.3 Aveiro Pole	112
9.3.1 Radio, Microwaves and Millimetre waves Research Line	112
9.3.2 Networks Research Line	121
9.3.3 Optical Communications Research Line	125
9.3.4 Electronic and Opto-electronic Components Research Line	135
9.3.5 Integrated Circuits and Systems Research Line	137
9.3.6 Integrated Communications and Multimedia	141

1. Introduction

“Instituto de Telecomunicações” (IT) is a private non-profit organisation, the result from the 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 on every pole

Installation was concluded in Aveiro in 1993 and in Lisbon and Coimbra in 1994, the years 1995 and 1996 may be described as regular activity years. The key developments in 1996 are sketched below leaving the details for the report on each individual research line.

2. Internal management

Two meetings of the General Assembly took place, in March and in November, to approve the 1995 Annual Report and the Plan and Budget for 1996, respectively;

The Executive Board met monthly;

The Executive Board met the Official Auditor to examine the balance sheet and to set up improved accounting procedures;

The Scientific Board met in November, to prepare the Plan and Budget for 1997, to be submitted to the General Assembly.

3. National Projects

Following JNICT call for “Proposals lead by young doctors” IT was awarded 10 contracts (7 in Lisbon, 1 in Coimbra and 2 in Aveiro); work has started on all these projects and the first yearly reports are due in early 1997;

In the scope of Program PRAXIS XXI, Measure 2, IT had 12 research projects approved: 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 and 1 involving the IT-Aveiro and IT-Lisbon.

IT-Lisbon started a project with OGMA (Oficinas Gerais de Material Aeronáutico) to design antennas and radio frequency circuits for a portable satellite radio terminal;

IT-Lisbon carried out a feasibility study for radio communication centres for ICP (Instituto das Comunicações de Portugal), which should be concluded in the first trimester of 1997;

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

Activities on project ITCOM continued at the three poles and the first year report was concluded;

IT-Lisbon and IT-Coimbra continued their co-operation with INESC in the scope of project PRODIGIOS, led by INESC;

IT-Aveiro on contract with Portugal Telecom, was involved in 16 projects in the areas of networks (8), radio microwave and millimetre wave(4), integrated circuits and systems (2), optical communications (1), integrated communications and multimedia (1);

IT-Coimbra on contract with Portugal Telecom started a project in the area of automatic telephone speech recognition.

4. European Community Projects

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

FRAMES, in mobile and personal communications;

SAMBA, in wide band mobile communications in the millimetre band;

CABSINET, in cellular radio distribution of television signals;

MOMUSYS, in image coding;

TALISMAN, in copyright protection for audio and video signals;

BLISS, in active optical components;

UPGRADE, in optical communications;

VITAL, in advanced telecommunication services.

5. Evaluation in the scope of “Pluri-annual” program

In the beginning of October and in the scope of the evaluation of the Research Units supported by the “Pluri-annual Programme for R&D Unit Financing” henceforth referred to as the “Pluri-annual” the three IT sites were visited by teams of foreign scientific auditors and as a result:

IT-Lisbon was rated Excellent which corresponds to an annual sum, for the period 1996 to 1998, of 26 650 thousand escudos and the possibility of receiving a further amount of 45 000 thousand escudos, for a three year period;

IT-Aveiro and IT-Coimbra were both rated Good, which corresponds to annual sums, for the period of 1996 to 1999, of 8 200 thousand escudos each.

6. Other activities

The preparatory works for the First National Conference on Telecommunications, which will be held in Aveiro on the 10th and the 11th of April 1997 were started. The call for papers resulted in 147 papers being submitted. These papers were reviewed by a team of about 20 experts from universities, research units and industry;

In December IT-Lisbon was visited by a delegation of INRIA (Institut National de Recherche en Informatique et en Automatique). This visit was followed by an invitation to Prof. Carlos Salema to join an ERCIM (European Research Consortium for Informatics and Mathematics) team who performed an evaluation of the R&D activities in informatics and telecommunications in Tunisia (which took place in February 1997);

A number of Cost and Community project meetings in which IT research teams participated were organised and held;

In the scope of a PRAXIS XXI visiting scientist fellowship, Prof. Rama Kant Jha, from the Banaras Hindu University, worked in IT-Lisbon for a period of one year (September 1995 to September 1996) with Prof. Carlos Salema and Carlos Fernandes in the preparation of a book manuscript on Dielectric Antennas soon to be published;

7. Protocols with University Associates

Contacts with university associates aiming at establishing protocols for the assignment of human and material resources were pursued. These protocols are required for the formal relations between IT and its university associates. It is expected that this matter may finally settled during 1997.

8. Human resources

IT human resources referred to December 1996 are as follows:

- IT-Aveiro: 18 researchers (of which 13 hold a doctor degree), staff members from UA;
22 researchers staff members from PT;
about 40 researchers, most of which are PhD and MSc. students at UA
20 UA students doing their final year project;
2 part-time technicians;
5 administrative staff;
1 accountant;
- IT-Coimbra: 29 researchers (of which 13 hold a doctor degree), staff members from FCTUC;

11 researchers (of which 2 hold a doctor degree), staff members from other higher education establishments;
15 PhD and MSc. students from FCTUC;
15 FCTUC students doing their final year project;
3 administrative staff;
1 part-time technician;
- IT-Lisbon: 46 researchers (of which 36 hold a doctor degree), staff members from IST;

18 researchers (of which 3 hold a doctor degree), staff members from other higher education establishments

40 PhD and MSc. students from IST

50 IST students doing their final year project;

2 administrative staff (1 secretary and 1 accountant);

1 part-time technician.

A detailed description of the activities performed by the research lines in the three poles is presented in 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 A. C. Fernandes | Ph.D. | Associate Professor, IST |
| • Carlos R. Paiva | Ph.D. | Associate Professor, IST |
| • Maria João Rosário | Ph.D. | Assistant Professor, IST |
| • Luis M. Correia | Ph. D. | Assistant Professor, IST |
| • Custódio J. O. Peixeiro | Ph.D. | Assistant Professor, IST |
| • António L. Topa | M.Sc. | Assistant, IST |
| • João Caldinhas Vaz | M.Sc. | Assistant, IST |
| • Jorge Silva | Technician | Lab. Technician, IST |
| • Carlos Brito | Technician | Lab. Technician, IST |

Other Collaborators

- | | | |
|------------------------------|----------------|---------------------------------|
| • João Filipe Tomás Cordeiro | Ph.D. Student | Grant JNICT |
| • Tomasz Rutkowski | Ph.D. Student | Grant TEMPUS |
| • Fernando J. Velez | Ph. D. student | Assistant, Univ. Beira Interior |
| • Jorge Alves Torres | Ph.D.Student | Professor, ENIDH |
| • Fernando Fortes | Ph.D.Student | Grant, PRAXIS XXI |
| • Carlos da Silva Alves | M.Sc.,Research | Engineer, ANA |
| • António Bernardino | M.Sc. Student | Assistant, IPS |
| • Henrique José da Silva | M.Sc. Student | Assistant ISEL |

- Pedro M. Ramos M.Sc. Student Grant, PRAXIS XXI
- Ana M. Carvalho M.Sc. Student Grant, PRAXIS XXI
- Carlos A. Andrade M.Sc. Student
- José L. Pereira M.Sc. Student
- Luís M. Manica M.Sc. Student
- Judite J. Reis M. Sc. Student Engineer, TELECEL
- Pedro Vasconcelos M. Sc. Student Engineer, MARCONI
- Nuno C. Gonçalves M. Sc. Student Grant, JNICT
- Ana Domingues M. Sc. Student Engineer, TMN
- Dragana Kristic M. Sc. Student Engineer, TELECEL
- Miguel André Lopes Filipe M. Sc. Student Grant, IST
- Luís Manuel Anunciada M. Sc. Student Grant, IST
- Andreina Armogida Lic. Student Grant ERASMUS
- Afonso Nunes Lic. Student IST, Final Year Project
- Rui Natário Lic. Student IST, Final Year Project
- Mário Marques Lic. Student IST, Final Year Project
- Jorge M. Costa Lic. Student IST, Final Year Project
- Fernando M. Janeiro Lic. Student IST, Final Year Project
- João Luís Lic. Student IST, Final Year Project
- João Palma Lic. Student IST, Final Year Project
- Luis Mata Lic. student IST, Final Year Project
- Isabel Neto Lic. student IST, Final Year Project
- Gerardo Ângelo Lic. student IST, Final Year Project
- Valentina Garcia Lic. student IST, Final Year Project
- Lívio Santos Lic. student IST, Final Year Project
- Gaetano Scibilia Lic. student Pisa Univ., Italy, Final Year Project
(ERASMUS)
- Paulo O. Francês Research Student Grant, PRAXIS XXI

Projects

- PRAXIS XX1- 3/3.1/TIT/35/94 - ITCOM: Integration of Technologies for Mobile Communications. 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 the base station small linear array of microstrip patches. The omnidirectional array to be used in the mobile terminal is under test. Specification of helical type of antennas for the base station. Design and test of a low-noise down converter MMIC (2GHz→300MHz) with the LNA ($F < 2\text{dB}$) and mixer (cascode configuration). Design and test of a power amplifier MMIC (100mW @ 2GHz). MESFETs Non-linear Modelling for CAD.
- JNICT - PBIC/C/TIT/2531/95 - “Propagation in Photonics: Complex Media in Integrated Optics; Solitons in Optical Fibers.” The main goal of this Project is to study electromagnetic wave propagation in new optical waveguides containing complex media having in mind their application to Photonics. The special cases of complex media to be considered are the following: (i) chiral and pseudo-chiral media; (ii) anisotropic and bianisotropic media; (iii) nonlinear media (in optical fibers). The problems analyzed can be grouped into two main research areas: A. Integrated Optics. Rigorous treatment of new canonical problems in the field of open planar dielectric chiral, pseudo-chiral and anisotropic/bianisotropic structures. Radiation from abrupt discontinuities in dielectric chirowaveguides. B. Optical Fibers. Analytical and numerical methods to analyze the propagation of solitonlike pulses in optical fibers with Hamiltonian (*e.g.*, birefringence, higher-order dispersion) or dissipative perturbations (*e.g.*, losses, Raman effect). Special attention is paid to soliton switching in nonlinear fiber couplers using variational methods based on the Lagrangian formulation.
- JNICT - PBIC/C/TIT/2517/95 - MODPROP: Propagation Models for Urban Micro-cells in Mobile Communications Systems. Development of propagation models both for indoor and outdoor environments for mobile communications 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 and DCS.

- JNICT - PBIC/C/TIT/2507/95 - Active Printed Antennas. A few microstrip patch antenna prototypes have been designed fabricated and tested. Some active elements such as amplifiers and phase shifters have been studied and amplifiers were fabricated using hybrid and MMIC technology. Characterization of wire bondings in a broad frequency range is under development.
- JNICT - PBIC/C/TIT/2501/95 - Shaped beam antennas - impact on the propagation channel of millimetrewave mobile communication systems. Design of a set of shaped beam antennas to be used for indoor mobile or portable applications at 60 GHz. Evaluation of its performance with respect to coverage. Modelling of obstacles in indoor environments, and validation with measurements.
- PRAXIS XXI - 2/2.1/TIT/1663/95 - "Microwave and Optical Devices for Transmission and Switching Using Linear and Nonlinear Media" The basic goals of this Project can be summarized as follows: (i) To use the inverse-scattering theory (namely the Gel'fand-Levitan-Marchenko equation) for the design of planar optical waveguides containing chiral or anisotropic media. (ii) To study solitonlike pulse switching in N-core nonlinear fiber couplers using analytical (the variational approach based on the Lagrangian formulation) and numerical (the BPM method) techniques. (iii) To analyze electromagnetic wave propagation and radiation in planar chiral devices such as dielectric chiro-waveguides. The devices to be considered can be grouped into two main categories: (1) Linear devices used in Integrated Optics for transmission. (2) Photonic devices for power-controlled (*i.e.*, self-routing) and phase-controlled switching of solitonlike pulses in N-core nonlinear fiber couplers. The project has been selected to be funded by PRAXIS XXI the contract will be signed in 1997. Preliminary work has been done in the three topics.
- ACTS - AC 204 - SAMBA: System for Advanced Mobile Broadband Applications.

Comparison of cellular deployment characteristics between the 40 and 60 GHz bands for Mobile Broadband Systems. Development of algorithms for cellular planning, considering both the propagation and traffic constraints. Comparison of system deployment cost between the two frequency bands. Preliminary study and proposal of the antenna configuration to be used in the trial scenarios at 40 GHz - dielectric lens antennas. Design and construction of a first prototype of the feed for the portable terminal antenna. Evaluation of its performance, and investigation of strategies to improve the bandwidth. Construction and test of the preliminary prototype of the portable antenna unit. Preliminary studies of microstrip filters for 40GHz and of microstrip/WG transitions.

- COST 231: Evolution of Land Mobile Radio (including Personal) 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.
- COST 245 - Active and Phased Array Antennas. Participation in the three annual regular meetings in Leatherhead, England, (February), Noordwijk, The Netherlands (June) and Nice, France, (November).
- ICP - Feasibility Study of Radiocommunications Centres. Evaluation of the feasibility of the creation of Radio Communications Centers that implement a rational use of infrastructures, with shared use of equipment and antennas. Coverage studies were done, comparing the case of all antennas either mounted on the same mast or individual mounting, for frequencies ranging from 40 to 900 MHz. The analysis of the influence of the masts on the radiation pattern of the antennas was analyzed from the coverage point of view.
- OGMA: RF Modular Systems. Specification and system definition of a transceiver for POSAT 1 in cooperation with OGMA. Design and simulation of the power amplifier (140MHz/70W). Design of quadrifilar helical antennas to be integrated into a portable ground terminal for communication with satellites. Simulation results and preparation of scaled prototype.

- ANA - Coverage Studies in Aeronautical Communications. The problem of optimized location of base station in aeronautical communications with planes at both the ground and the flight levels is being analyzed for specific airports. Also, new solutions for antennas are being considered for coverage of control zones at flight levels.
- Mutual influence between the human head and the mobile phone (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. The influence of the human head on the mobile phone antenna characteristics, namely input impedance and radiation pattern, is being analyzed as well.
- 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.
- MMICs on BiCMOS technology (internal project). Design techniques for microwave power amplifiers using conventional BiCMOS technology.

Ph.D. Theses

- António Topa (supervisor: Afonso Barbosa; co-supervisor: Carlos Paiva), Instituto Superior Técnico, to be concluded in 1997 (subject: rigorous analysis of step discontinuities in planar dielectric chirowaveguides).
- Fernando J. Velez (supervisor: Luis M. Correia), Instituto Superior Técnico, in preparation (subject: cellular planning for mobile broadband systems in urban environments).
- João Filipe Tomás Cordeiro (supervisors: João Costa Freire and Custódio Peixeiro), Instituto Superior Técnico, in preparation (subject: active printed antennas)

- João Caldinhas Vaz (supervisor: J. Costa Freire), Instituto Superior Técnico, in preparation (subject: Monolithic Millimeterwaves Power Amplifiers)
- Jorge Torres (supervisor: J. Costa Freire), Instituto Superior Técnico, in preparation (subject: Multifunction Monolithic Microwaves Integrated Circuits)
- Fernando Fortes (supervisor: M. João Rosário), Instituto Superior Técnico, in preparation (subject: Monolithic Microwaves Power Amplifiers)

M.Sc. Theses

- Henrique Silva (supervisor: M. João Rosário / Custódio Peixeiro), Instituto Superior Técnico, in preparation (subject: Active printed Antennas)
- António da Silva Bernardino (supervisor: Prof. Maria João Rosário), Instituto Superior Técnico, concluded in 1996 (subject: Design of filters and mixers for Mobile Communication Receivers on 60GHz).
- Judite J. Reis (supervisor: Luis M. Correia), Instituto Superior Técnico, concluded in 1996 (subject: propagation models for mobile broadband systems in urban environments at the millimetre waveband).
- Ana Carvalho (supervisor: Carlos Paiva), Instituto Superior Técnico, concluded in 1996 (subject: Soliton propagation in birefringent optical fibers).
- Pedro Ramos (supervisor: Carlos Paiva), Instituto Superior Técnico, in preparation (subject: Soliton switching in nonlinear twin-core fiber couplers).

- Carlos Andrade (supervisor: Carlos Paiva), Instituto Superior Técnico, in preparation (subject: Leaky modes in chiral rib waveguides for Integrated Optics).
- José Pereira (supervisor: Carlos Paiva), Instituto Superior Técnico, in preparation (subject: Polarization-division-multiplexing with solitons in optical communication systems).
- Luís Manica (supervisor: Carlos Paiva), Instituto Superior Técnico, in preparation (subject: Wavelength-division-multiplexing with solitons in optical communication systems).
- Pedro Vasconcelos (supervisor: Luis M. Correia), Instituto Superior Técnico, in preparation (subject: characterization of the propagation channel in mobile broadband systems at the millimetre waveband).
- Nuno C. Gonçalves (supervisor: Luis M. Correia), Instituto Superior Técnico, in preparation (subject: propagation models for mobile communication systems in micro-cell structures at the UHF band).
- Ana Domingues (supervisor: Luis M. Correia), Instituto Superior Técnico, in preparation (subject: models for penetration and indoor propagation in mobile communication systems at the UHF band).
- Dragana Kristic (supervisor: Luis M. Correia), Instituto Superior Técnico, in preparation (subject: optimization of cellular planning for nonuniform traffic distributions in mobile communication systems at the UHF band).
- 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 millimetrewave mobile communications propagation channel)

Publications

Books and book chapters

Luis M. Correia, "Broadband Systems: Material Characterisation", Luis M. Correia and Per H. Lehne, "Broadband Systems: Outdoor Radio Channel", in Eraldo Damosso (ed.), *"Digital Mobile Radio: COST 231 View on the Evolution Towards 3rd Generation Systems"*, Springer-Verlag, Berlin, 1996

C. Salema, C. Fernandes, R. Jha, *"Dielectric Antennas - solid horns and lenses"*, submitted to Artech House, now under review.

Papers in Journals

D. Lemaire, C. Fernandes, A. Barbosa, P. Sobieski, "A method to overcome the limitations of G.O. in the design of axis-symmetrical lenses", *J. of Infrared and Millimetrewaves*, Vol. 17, No. 8, Aug. 1996.

P. M. Ramos and C. R. Paiva, "Influence of cross-phase modulation on self-routing pulse switching in nonlinear optical fibers," submitted in December 1996 to *Microwave and Optical Technology Letters*.

Peter F.M. Smulders and Luis M. Correia, "Characterization of the Propagation Channel at 60 GHz Band", accepted for publication at *IEE Electronics and Communications Engineering Journal*

Luis M. Correia and Ramjee Prasad, "An Overview of Wireless Broadband Communications", accepted for publication at *IEEE Communications Magazine*

Papers in Conference Proceedings

A. L. Topa, C. R. Paiva, and A. M. Barbosa, "Step discontinuity in a planar dielectric chiral slab: an improved analysis," *Proc. PIERS 1996*, Innsbruck, Austria, p. 495, July 1996.

P. M. Ramos and C. R. Paiva, "Combined effect of cross-phase modulation and higher-order dispersion on soliton switching in nonlinear fiber couplers," *Proc. PIERS 1997*, City University of Hong-Kong, p. 506, Jan. 1997.

A. L. Topa, C. R. Paiva, and A. M. Barbosa, "Radiation modes of an asymmetric chiral slab waveguide - a general approach to a new canonical problem," *Proc. PIERS 1997*, City University of Hong-Kong, p. 684, Jan. 1997.

A. L. Topa, C. R. Paiva, and A. M. Barbosa, "A linear-operator formalism for the analysis of inhomogeneous pseudo-chiral planar waveguides," submitted in December 1996 to *URSI North American Radio Science Meeting*, Montréal, Canada (July 1997).

P. M. Ramos and C. R. Paiva, "A new variational approach for the cross-phase modulation effect on self-routing pulse switching in nonlinear optical fibers," submitted in December 1996 to *CLEO/Pacific Rim'97*, Japan (July 1997).

C. A. Andrade, C. R. Paiva, A. L. Topa, and A. M. Barbosa, "Leaky modes in chiral rib waveguides," accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, Abril 1997.

P. M. Ramos and C. R. Paiva, "Soliton switching in twin-core nonlinear fiber couplers: a comparative study," accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, Abril 1997.

A. L. Topa, C. R. Paiva, and A. M. Barbosa, "A linear-operator formalism for the analysis of planar layered waveguides containing Ω -media: application to microwave devices," accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, Abril 1997.

A. M. Carvalho, J. L. Pereira, and C. R. Paiva, "Effect of higher-order dispersion on solitonlike pulse propagation in birefringent optical fibers," accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, Abril 1997.

Luis M. Correia, "Broadband Communications - COST 231 Working Group 3 Activities", *Future Trends in Mobility - COST 231 Final Workshop*, Turin, Italy, Apr. 1996

Nuno C. Gonçalves and Luis M. Correia, "Testing the COST 231 -WI Propagation Model in the City of Lisbon", *International Workshop on Mobile Communications*, Thessaloiniki, Greece, Sep. 1996

Luis M. Correia, "Mutual Influence between the Human Head and the Mobile Phone Antenna", *International Workshop on Mobile Communications*, Thessaloiniki, Greece, Sep. 1996

Luis M. Correia and Judite R. Reis, "Wideband Characterisation of the Propagation Channel for Outdoors at 60 GHz", *PIMRC'96 - IEEE 7th International Symposium on Personal, Indoor and Mobile Radio Communications*, Taipei, Taiwan, Oct.. 1996

Luis B. Mata, Pedro Rocha e Luis M. Correia, "Propagation Models for Mobile Communications in Indoor Environments" (in Portuguese), accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, Portugal, Abr. 1997

Nuno C. Gonçalves e Luis M. Correia, "Propagation Models for GSM e DCS in Urban Scenarios" (in Portuguese), accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, Abr. 1997

Luis M. Correia, Judite R. Reis and Paulo O. Francês, "Analysis of the Average Power to Distance Decay Rate at the 60 GHz Band", accepted for presentation at *IEEE 47th Vehicular Technology Conference*, Phoenix, Arizona, USA, May 1997

Pedro Vasconcelos and Luis M. Correia, "*Fading Characterization of the Mobile Radio Channel at the Millimetre Waveband*", accepted for presentation at *IEEE 47th Vehicular Technology Conference*, Phoenix, Arizona, USA, May 1997

Peixeiro, C., "Modelling of Microstrip Patch Antennas at 60 GHz", *Proc. COST 245/ESA Workshop on Active Antennas*, pp. 117-122, ESTEC, Noordwijk, The Netherlands, June 1996.

Peixeiro, C., P. Dufrane, Y. Guillerme, "Microstrip Patch Antennas for a Mobile Communication System at 60 GHz", *Proc. IEEE/APS Int. Symposium*, pp.78-81, Baltimore, Maryland, U.S.A, July 1996.

Peixeiro, C., P. Dufrane, Y. Guillerme, A. Boulouard, E. Delhaye, B. Byzery, "Microstrip Patch Antennas at 60 GHz for Race Project MBS", *Proc. 26th European Microwave Conference*, pp.933-937, Prague, Czech Republic, September 1996.

Cordeiro, J., C. Peixeiro, E. Delhaye, B. Byzery, A. Boulouard, "Modelling of Millimetre Wave Active Integrated Microstrip Patch Antennas", *Proc. JINA'96*, pp. 649-652, Nice, France, November 1996.

Armogida, A., and C. Peixeiro, "Microstrip Patch Antenna Array for a Mobile Communication System Base Station", submitted to the *1997 IEEE AP-S Int. Symposium*, Montreal, Canada, July 1997.

Rutkowski, T. and C. Peixeiro, "Microstrip Patch Array for the Mobile Terminal Omnidirectional Antenna of a Mobile Communication System", submitted to the 27th *European Microwave Conference*, Jerusalem, Israel, September 1997.

Cordeiro, J., C. Peixeiro and J. Costa Freire, "Design, Fabrication and Test of an Active Microstrip Patch Antenna", accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, April 1997.

N. Gonçalves, J. Diogo Pinto, C. Fernandes, "Modelling of buildings in mobile communications" (in Portuguese), Accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, April, 1997

C. Salema, C. Fernandes, R. Kijha, 'Design of rectangular cross section dielectric horns' accepted for presentation at *I Conferência Nacional de Telecomunicações*, Aveiro, April, 1997

M. João Rosário, J. Bernardino, F. Fortes, R. Kulke, Th. Sporkman, J. Costa Freire, 'Monolithic Single FET Mixers with Coplanar Technology to Convert between C and V band', Proc. IEEE MTT-S International Microwave Symposium Digest, S. Francisco, USA, pp.93-96, June 1996.

R. Kulke, Th. Sporkman, I. Wolff, M. João Rosário, F. Fortes, 'Active Coplanar Up-converter for High Gain V band Applications', Proc. IEEE MTT-S International Microwave Symposium Digest, S. Francisco, USA, pp.201-204, June 1996.

Jorge Torres, M. João Rosário, J. Costa Freire, 'Multifunction MMIC for Millimeter Wave Mobile Communications', Proc. SPIE International Symposium on Optical Science, Engineering and Instrumentation, Denver, USA, pp. 568-577, August 1996.

Jorge Torres, M. João Rosário, J. Costa Freire, 'Double Balanced Single Side Band Mixer for

Millimeter Wave Mobile Communications', Proc. SPIE International Symposium on Optical Science, Engineering and Instrumentation, Denver, USA, pp. 560-567, August 1996.

J. Caldinhas Vaz, F. Fortes, J. Costa Freire, 'Millimeter Wave Power Amplifier With Unconditionally Stable Devices', Proc. SPIE International Symposium on Optical Science, Engineering and Instrumentation, Denver, USA, pp. 70-75, August 1996.

J. Caldinhas Vaz, F. Fortes, J. Costa Freire, 'A monolithic 60GHz Power Amplifier with Feedback Stabilization', Proc. 26th European Microwave Conference, Prague, Czech Republic, pp.593-596, September 1996.

M. João Rosário, J. Costa Freire, 'High Performance Monolithic Frequency Doubler', Proc. 26th European Microwave Conference, Prague, Czech Republic, pp.689-691, September, 1996.

Carlos Alves, J. Costa Freire, 'A Free Run Sinusoidal L Band Monolithic Oscillator', Proc. 1996 Asia Pacific Microwave Conference, pp. - , December 1996.

Jorge Torres, J. Costa Freire, 'A Monolithic Pseudo Dual-Gate FET Down Converter for L-Band Satellite Mobile Communication System', Proc. 1996 Asia Pacific Microwave Conference, pp. - , December 1996.

Project Deliverables and Reports

C. Fernandes, "Report of visiting professorship at the Communications Laboratory of Dresden University of Technology", Comun. Lab DUT and IT Lisboa, Sep. 1996

Ana Domingues, Diana Caiado, Nuno C. Gonçalves, and Luis M. Correia, "Testing the COST

231 - WI Propagation Model in the City of Lisbon", *COST 231 Internal Report* TD(96)005, Jan. 1996.

Armogida, Andreina, *Design, Fabrication and Test of a Small Array of Microstrip Patches for a Mobile Communication System Base Station*, Laurea Degree Project, ERASMUS Project ICP 1208/06, December 1996.

Miscellaneous

- Carlos Paiva has been reviewer for the following journals: *Optics Letters*; *Journal of the Optical Society of America A*; *Journal of Electromagnetic Waves and Applications*.

- Luis M. Correia has been a member of the M. Sc. juries of Judite R. Reis and Fernando Velez

- Luis M. Correia has been National Delegate to Action COST 231

- Luis M. Correia has been reviewer of papers for *Wireless Personal Communications* (2 papers)

- Luis M. Correia has been co-editor, with Prof. Masao Nakagawa (Keio University, Japan), of a special issue of *Wireless Personal Communications on Wireless Broadband Systems*

- Luis M. Correia has been reviewer of a book for Kluwer Academic Publishers

Luis M. Correia has been member of the Technical Committee of *International Workshop on Mobile Communications*, Thessaloiniki, Greece, Sep. 1996

Luis M. Correia has been co-organizer, with Prof. Oreste Andrisano (Bologne University,

Italy), of a special session on “Millimetre Wave High Speed Networks” in *GLOBECOM'97*, Phoenix, Arizona, USA, 4-8 Nov. 1997

Carlos Fernandes has been Invited Professor, for one month, at the Communications Laboratory of Dresden University of Technology and has given a lecture on the subject: ‘Dielectric lens antennas: new solutions’ .

- Carlos Fernandes has been involved in the implementation and adjustment of a set up to measure millimeter wave antenna radiation characteristics in the reactive region.

- Carlos Fernandes has started the specification of a future 40 GHz set-up for antenna measurements, and CW propagation measurements.

- Afonso Barbosa has been National Delegate to Action *COST 245*.

- Afonso Barbosa has been member of the National Executive Committee of Instituto de Telecomunicações.

- Afonso Barbosa has been reviewer of papers of *Journal of Electromagnetic Waves and Applications*.

- Afonso Barbosa has been reviewer of papers submitted to the 26th *European Microwave Conference*, Prague, Czech Republic.

- Afonso Barbosa has been reviewer of papers submitted to *I Conferência Nacional de Telecomunicações*, Aveiro, Portugal.

- J. Costa Freire is a Member of the Management Committee of the European Microwave Conference

- J. Costa Freire was Referee of IEEE Transactions on Circuits and Systems, IEEE Mediterranean Electrotechnical Conference and European Microwave Conference

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)

Other Collaborators

- Rui P. Martins Ph.D Director FCT/Univ. Macau
- Maria H. Fino Ph.D Assistant Professor FCT/UNL
- Orlando Chou Research Assistant Univ. Macau
- Nuno Franca Ph.D. Student Research Assistant INETI
- Alexandre Almeida Ph.D. Student Grant, JNICT
- Bernardo Henriques Ph.D Researcher
- João Goes Ph.D. Student Grant, IST
- João P. Carreira Ph.D. Student Engineer ATMEL-ES2
- Jorge Guilherme Ph.D. Student Assistant, IPT
- Nuno Garrido Ph.D. Student Grant, PRAXIS XXI
- Nuno Horta Ph.D. Student Assistant FCT/UNL
- Paulo J. Santos Ph.D. Student Grant, PRAXIS XXI
- Rui Neves Ph.D. Student Grant, PRAXIS XXI
- Wang Ping Ph.D. Student Grant, IST
- José B. Silva M.Sc. Student Grant, IST
- Daniel Rocha Ph.D. Student Grant, PRAXIS XXI

- David Guilherme Research Student Grant, IST
- Marco Pereira M.Sc. Student
- Ricardo Reis Ph. D. Student Grant, IST
- Pedro Lopes Researcher Assistant, IST
- João Bello Researcher Assistant, IST
- Maria do Rosário Pinto Researcher Assistant, IST
- Eduardo Viegas Researcher Assistant, IST
- Guan Xiang Researcher Student Tsinghua University
- Rui Pereira Researcher Grant, IST
- Vujnovic Dusko M.Sc. Student Grant, IST
- Ana Marcelino Secretary Staff Member IST
- Paula Silva Secretary

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 for professionals.

- Development of an European-wide, diversified funding-base for the continuous development of state-of-the-art research and development projects.
- During 1996, research activities were carried-out in the following cooperative projects:
FASTPLEX (CERN): Signal Processing System for Trajectory Monitoring of Sub-Atomic Particles in High-Energy Physics Experiments, with the participation of CERN – Microelectronics Division (Switzerland), University of Brussels (Belgium) and NIEF (National Institute for High-energy Physics, The Netherlands). (1993/1995).
- **AMFIS (ESPRIT 8795):** Application-Oriented Analog-Digital Multi Function Integrated Systems, with the participation of Mietec Alcatel (Belgium), Landis & Gyr (Switzerland), CSEM (Switzerland), ABB Nera (Norway), Sintef (Norway), Austria Mikro Systeme (Austria), Italtel (I
- **ALCD (ESPRIT 8030):** Analog Library for CMOS Digital Technology, with the participation of European Silicon Structures (France), Bosch (Germany), Intracom (Greece), Univ. of Athens (Greece), Univ. of Pavia (Italy). (1993
- **RESEARCH GRANT AWARD FROM ROCKWELL**
 IST was awarded a Research Grant from Rockwell International, Digital Communications Division, VLSI Design Engineering, in support of our research activities in the area of mixed-signal integrated circuit design for communications.
- **PARTNERSHIP FOR NANOWATT RESEARCH WITH NOKIA MOBILE PHONES**
 A framework agreement has been established between Nokia Mobile Phones and the Instituto Superior Técnico for the research of new nanowatt circuits employing NMP's proprietary SSCT technique (Self-Controlled Charge Transfer). This technique has been successfully demonstrated by IST in the form of a CMOS prototype filter chip dissipating about 100 μ W.

- CREATION OF THE PORTUGUESE INTER UNIVERSITY NETWORK FOR THE PROMOTION AND DIFFUSION OF MICROELECTRONICS (RPM NETWORK)

The RPM network for the promotion and diffusion of microelectronics was created by Instituto Superior Técnico (IST), Instituto Tecnológico para a Europa Comunitária (ITEC), Universidade do Minho (UM) and Instituto para a Inovação e Desenvolvimento Tecnológico do Minho (IDITE Minho).

- SCCT TECHNOLOGY FOR NANOPOWER ELECTRONICS

Objectives: Research and development of new ultra low power CMOS circuits employing Self-Controlled Charge Transfer techniques for portable applications.

Sponsor: Nokia Mobile Phones.

- LOGADC: HIGH-FREQUENCY LOGARITHMIC CMOS ANALOG-TO-DIGITAL CONVERTER

Objectives: Research of new architectures for the realization of high-frequency logarithmic analog-to-digital converters in CMOS technology. It is envisaged the implementation of a fully differential 50 MHz, 8-bits, 60 dB ADC using a DMDP 0.8 μm CMOS technology.

Sponsor: Austria Mikro Systeme.

- DIGITAL HSADC

Objectives: High-frequency analog-to-digital converters for digital CMOS technology.

Participants: IST Centre of Microsystems and Telebrás of Brasil

Sponsor: International Telecommunications Union

- 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 of 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).

Ph.D. Theses

In Preparation

- N. Franca, automatic synthesis of circuit components for mixed-signal VLSI integration.
- N. C. Horta, automatic synthesis of data converter architectures from formal description of algorithms.
- W. Ping, analog 2D multirate signal processing techniques and integrated circuit design.
- A. Gano, design and applications of sensorial microsystems combining monolithic and thick film hybrid integrated technologies.
- A. Almeida, analog circuit techniques for neural networks and applications.
- P. Jorge Santos, decimation and interpolation switched-capacitor circuits for high-frequency application in radiocommunications.
- J. P. Carreira, current-mode data converters in sub-micron technologies.

- N. Garrido, design of adaptive analog filters for magnetic front-end read channels.
- R. Neves, signal processing and conversion techniques for narrow bandwidth applications.
- J. P. Oliveira, video frequency A/D converters using current processing techniques.
- J. Goes, high-resolution and high-speed analog-digital converters using linearization techniques.
- J. C. Guilherme, design techniques for logarithmic analog-digital conversion in CMOS technology.

M.Sc. Thesis

- José S. Barreiro, current-mode self-calibrated techniques for sigma-delta modulators.

Publications

Books and book chapters

M. H. Martins, J. E. Franca, A. S. Garção, "Symbolic Methods in Discrete-Time Circuit Design", Chapter 11 in *Symbolic Methods in Analog Circuit Design*, Edited by A. R. Vasquez et al., IEEE Press Book, 1996.

Papers in Conference Proceedings

1996

R. Neves, A. Petraglia, S. Mitra, J. E. Franca, "A New Mixed Analog-Digital Architecture for High-Frequency Narrow Bandwidth Channel Digitalization", in *Proc. IEEE International Symposium on Circuits and Systems, Atlanta (Georgia), May 1996*.

N. Paulino, J. E. Franca, "A CMOS Digitally Programmable Current Multiplier", in *Proc. IEEE International Symposium on Circuits and Systems, Atlanta (Georgia), May 1996*.

D. Rocha, C. Azeredo, J. E. Franca, "Architectures for A/D Conversion with Optimal Use of Oversampling", in *Proc. IEEE International Symposium on Circuits and Systems, Atlanta, (Georgia), May 1996.*

N. Horta, J. E. Franca, "High-Level Data Conversion Synthesis by Symbolic Methods", in *Proc. IEEE International Symposium on Circuits and Systems, Atlanta (Georgia), May 1996.*

P. F. Santos, J. E. Franca, "Switched-Capacitor Bandpass Decimator for High-Frequency Narrowband Channel filtering and Down Conversion", in *Proc. IEEE International Symposium on Circuits and Systems, Atlanta (Georgia), May 1996.*

J. P. Oliveira, J. Vital, J. E. Franca, "A Digitally Calibrated Current-Mode Two-Step Flah A/D Converter", in *Proc. IEEE International Symposium on Circuits and Systems, Atl*

M. Helfeinstein, J. E. Franca, G. S. Moschytz, "Design Techniques for HDTV SI Decimators", in Proc. IEEE International Symposium on Circuits and Systems, Atlanta (Georgia), May 1996.

J. Goes, J. Vital, J. E. Franca, "A CMOS 4-Bit MDAC with Self-Calibrated 14-Bit Linearity for High-Resolution Pipelined A/D Converters", in *Proc. IEEE Custom Integrated Circuits Conference, San Diego, May 1996.*

M. Helfeinstein, J. E. Franca, G. S. Moschytz, "Design Techniques for HDTV SI Decimators", in *European Workshop on Multirate Digital Signal Processing and Applications, Hamburg University of Technology, Germany, March 20-21, 1996.*

A. J. Correia, J. C. Guilherme, J. E. Franca, "Current-Mode Algorithmic Pipeline Analog-to-Digital Converter", in *Proc. IEEE Asia Pacific Conference on Circuits and Systems, Seoul, Korea, November 18-21, 1996.*

Sanjit K. Mitra, J. E. Franca, "Mixed Analog-Digital Multirate Signal Processing", in *Proc. Signal Processing VIII, Theories and Applications, Trieste, Italy, 10-13 Sptember 1996.*

C. Dupuy, J. E. Franca, C. Azeredo Leme, F. Maloberti, R. Rivoir, G. Torelli, Y. Papananos, "ALCD-Analog Libraries on CMOS Digital Process", in *Proc. International Conference on Electronics Circuits and Systems*, Rodos, Greece, October 13-16 1996.

Wang Ping, J. E. Franca, "A Very Compact 1.0- μm CMOS SC Multirate 2-D Image Filter", in *Proc. European Solid-State Circuits Conference, Neuchâtel*, Switzerland, 17-19 September 1996.

P. Dias, J. E. Franca, N. Paulino, Oscillation Test Methodology for a Digitally-Programmable Switched-Current Biquad", in *Proc. IEEE International Mixed-Signal Testing Work*.

U. Seng Pan, R. P. Matins, J. E. Franca, "Switched-Capacitor Finite Impulse Response Interpolators Without the Input Sampled-and-Hold Filtering Effect", in *Proc. IEEE Midwest Symposium on Circuits and Systems*, Iowa, August 19.

C. Azeredo Leme, J. S. Barreiro, J. E. Franca, "A Full 12-Bit Switched-Current $\Sigma\Delta$ Modulator With Self-Calibration", in *Proc. European Solid-State Circuits Conference, Neuchâtel (Switzerland)*, September 1996.

A. Petraglia, S. K. Mitra, J. E. Franca, "Efficient IIR Switched-Capacitor Decimators and Interpolators", in *Proc. VIII European Signal Processing Conference*, Trieste, Italy, 10-13 September, 1996.

U. Seng Pan, R. P. Martins, J. E. Franca, "New Impulse Sampled IIR Switched-Capacitor Interpolators", in *Proc. IEEE International Conference on Electronics, Circuits and Systems*, Rhodes, Greece, October 1996.

Papers in Journals

G. Gielen, J. E. Franca, "CAD for Data Converter Design", *IEEE Transactions on Circuits and Systems II: Analog and Digital Signal Processing*, Vol. 43, No. 2, pp. 77-89, February 1996.

A. Almeida, J. E. Franca, "Digitally-Programmable Analog Building blocks for the Implementation of Artificial Neural Networks", *IEEE Transactions on Neural Networks*, Vol. 7, No. 2, pp. 506-514, March 1996.

P. J. Santos, J. E. Franca, "Switched-Capacitor Decimators Combining Low Sensitivity Ladder Structures With Polyphase Networks", *IEEE Transactions on Circuits and Systems Part II: Analog and Digital Signal Processing*, Vol. 43, No. 1, pp. 31-38, January 1996.

W. Ping, J. E. Franca, "Two-Dimensional Switched-Capacitor Decimating Filters", *IEEE Transactions on Circuits and Systems - Part I: Fundamental Theory and Applications*, Vol. 43, No. 4, pp. 257-271, April 1996.

U. Seng Pan, R. P. Martins, J. E. Franca, "Switched-Capacitor Interpolators Without the Input Sampled-and-Hold Filtering Effect", *Electronic Letters*, 1996.

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

Other Collaborators

- Fernando Manuel Gomes de Sousa PhD. D. Student Professor, I.S.E.L.
- Luis R. Pontes M. Sc. Student, Grant, PRAXIS XXI
- Paulo Faria M. Sc. Student, Grant IST
- José António Moinhos Cordeiro M. Sc. Student, Grant IST
- Carlos A. M. B. Teixeira de Sousa M. Sc. Student, Grant IST
- Tiago Silva Lic. Student, Final Year Project

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. Participants from the group: José M. N. Leitão, José E. C. R. C. Sanguino, Luis R. Pontes.

- SARA – *Automatic Systems for Aerial Reconnaissance*. This project, which is coordinated by the Department of Mechanical Engineering of I.S.T., is also a multidisciplinary and multi-institutional project. Financial support is provided by the PRAXIS XXI program. The objective of the project is the development of an unmanned aircraft and involves data communication aspects (telemetry and images) and navigation techniques (differential GPS). Participants from the group: José M. N. Leitão, José E. C. R. C. Sanguino, Luis R. Pontes.
- mEEG - *Microstructural Characterization of Sleep EEG*. This project is supported by JNICT 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. Participants from the group: Ana L. N. Fred (project coordinator).
- ENN - *European Neurological Network*. Approved under 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 telecommunication aspects. Participants from the group: Ana L. N. Fred.
- SIN - *Integrated Systems for Communication and Navigation*. Approved by PRAXIS XXI during 1996, this project will start in January 1997. It 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. Participants from the group: 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.*** Like the previous one, this project was also approved by PRAXIS XXI during 1996, and will start in January 1997. Its goals are the development of image/pattern analysis techniques combining stochastic and structural models and methods. Application areas considered will include: medical imaging, remote sensing images, and financial document images. Participants from the group: José M. N. Leitão (project coordinator), Mário A. T. Figueiredo, Ana L. N. Fred, and José M. B. Dias.
- **HIPNOS - Automatic Sleep Classification.** Supported by PRAXIS XXI, this is a collaboration project involving the electroencephalography laboratory of the *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. Participants from the group: Ana L. N. Fred.
- **SAMI - *Segmentation and Analysis of Medical Images: A Content-Based Retrieval Approach.*** This project is supported by a NATO Collaborative Research grant (NATO #CRG 960010) and 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. Participants from the group: José M. N. Leitão, Mário A. T. Figueiredo.
- **TALISMAN – *Tracing Authors' Rights by Labelling Image Services and Monitoring Access Networks.*** This is an ACTS project funded by the European Union involving several European partners. The Portuguese participation is headed by Prof. Paula Queluz (IT's Image Group). Its goal is the development of a set of techniques, namely labelling and watermarking of digital images and video, allowing for the protection of author's rights in digital environments. Participants from the group: Mário A. T. Figueiredo.

Ph.D. Theses

- *José Eduardo Charters Ribeiro Cunha Sanguino* (supervisor: José M. N. Leitão), Instituto Superior Técnico. In preparation. Thesis subject: Positioning and navigation based on differential GPS.
- *Francisco Alberto Sena da Silva* (supervisor: José M. N. Leitão). Instituto Superior Técnico. In preparation. Thesis subject: Importance sampling for communication systems simulation.
- *Fernando Manuel Gomes de Sousa* (supervisor: José M. N. Leitão), Instituto Superior Técnico. In preparation. Thesis subject: Open loop structures for digital communications; DSP based implementations.

M.Sc. Theses

- *José António Moinhos Cordeiro* (supervisor: José M. B. Dias), Instituto Superior Técnico. Concluded in 1996. Thesis title: *Automatic Segmentation of Intracoronary Ultrasound Images*.
- *Paulo Carapinha Marques* (supervisor: José M. N. Leitão). Instituto Superior Técnico. Concluded in 1996. Thesis title: Long Distance Echo Cancellation Using Short Length Centered Adaptive Filters.
- *Maria Isabel Milho* (supervisor: José M. N. Leitão). Instituto Superior Técnico. Concluded in 1996. Thesis title: *Printed Character Recognition in Financial Documents*.
- *José Coutinho Gomes Antão* (supervisor: José M. N. Leitão). Instituto Superior Técnico. Concluded in 1996. Thesis title: *Source Coding for Data and Software Loading into Automatic Points of Sale (POS's)*.

- *Luis Rocha Pontes* (supervisor: José M. N. Leitão), Instituto Superior Técnico. In Preparation. Thesis subject: Fusion of differential GPS and radar information in the context of harbor navigation systems.
- *Paulo Faria* (supervisor: Ana L. N. Fred). Instituto Superior Técnico. In preparation. Thesis subject: Aided diagnostic system for neurological diseases.
- *Carlos Alberto Martin Benito Teixeira de Sousa* (supervisor: José M. B. Dias) In preparation. Thesis subject: synthetic aperture sonars.

Publications

(Alphabetically ordered with respect to the first author)

Papers in Journals

J. Dias, J. Leitão, “Wall position and thickness estimation from sequences of echocardiographic images”, *IEEE Transactions on Medical Imaging*, vol. 15, no. 1, pp. 25-38, January 1996.

M. Figueiredo, J. Leitão, “Unsupervised image restoration and edge location using compound Gauss-Markov random fields and the MDL principle”, *IEEE Transactions on Image Processing*, vol. 6, no. 5, May 1997 (to appear).

F. Nunes, P. Varela, *et al*, “A two-dimensional regularization algorithm for density profile evaluation from broadband reflectometry”, *Review of Scientific Instruments*, vol. 68, no. 1 (part 2), pp. 906-909, January 1997.

J. Leitão, M. Figueiredo, “Absolute phase image reconstruction: a stochastic nonlinear filtering approach”. *IEEE Transactions on Image Processing* (accepted after revisions).

Papers in Conference Proceedings

J. Dias, J. Leitão, “A method for computing the Fisher information matrix of a stationary Gaussian process”, *Proceedings of the European Signal Processing Conference - EUSIPCO'96*, pp. 240-243, Trieste (Italy), 1996.

M. Figueiredo, J. Leitão, “Unsupervised Contour Estimation”, *Proceedings of the IEEE International Conference on Image Processing – ICIP'96*, vol. I, pp. 821-824, Lausanne (Switzerland), September 1996.

M. Figueiredo, J. Leitão, “Adaptive parametrically deformable contours”, *Proceedings of the International Workshop on Energy Minimization Methods in Computer Vision and Pattern Recognition - EMMCVPR'97*, Venice (Italy), May 1997 (to be published by Springer-Verlag).

J. Filipe, A. Fred, M. Partinen, T. Paiva, “A Second Generation Expert System for the Diagnosis of Sleep Disorders using Polysomnographic Data”, *Proceedings of the International Conference on Information Systems Analysis and Synthesis*, pp 296-300, Orlando (USA), July 1996.

A. Fred, “Clustering of Sequences using a Minimum Grammar Complexity Criterion”, In *Grammatical Inference: Learning Syntax from Sentences*, Laurent Miclet & Colin Higuera (Editors), Springer-Verlag, pp 107-116, 1996.

A. Fred, J. Leitão, “Parsing in Attributed Grammars: Application to Automatic Sleep Analysis”. *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing - ICASSP' 96*, pp 3466-3469, Atlanta (USA), May 1996.

A. Fred, T. Paiva, “Sleep Dynamics and Sleep Disorders: a Syntactic Approach to Hypnogram Classification”, *Proceedings 10th Nordic-Baltic Conference on Biomedical Engineering and 1st International Conference on Bioelectromagnetism*, pp 395-396, Tampere (Finland), June 1996.

A. Fred, “Heuristic Syntax-Directed Translation”, *Proceedings of the International Conference on Information Systems Analysis and Synthesis*, pp 301-306, Orlando (USA), July 1996.

A. Fred, “Expert Systems: Conceptual, Methodological and Management Aspects”, *1st Workshop on ENN*”, Treysa, 1996.

A. Fred, J. Leitão, “A Minimum Code Length Technique for Clustering of Syntactic Patterns”, *Proceedings of the 13th IAPR International Conference on Pattern Recognition*, pp 680-684, Vienna (Austria), 1996.

N. Gracias, J. Lima, M. Figueiredo, A. Fred, “Adaptive Contour Estimation with Genetic Algorithms”, *Proceedings of the IEEE International Conference On Systems Man and Cybernetics*, Beijing (China), October 1996.

P. Marques, F. Sousa, J. Leitão, “A DSP-based long distance echo canceller using short length centered adaptive filters”, *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing – ICASSP’97*, vol. 3, pp. 1885-1888, Munich (Germany), April 1997.

F. Nunes, J. Leitão, “Doppler shift robust receiver for mobile satellite communications”, *Proceedings of the IEEE CLOBECOM’96*, pp. 405-409, London (United Kingdom), November 1996.

F. Nunes, J. Santos, M. Manso, “Plasma density profile evaluation in broadband reflectometry using a neural network”, *Proceedings of the SOFT’96 Conference*, Lisbon (Portugal), 1996 (to be published by Elsevier Science Publishers in 1997).

T. Paiva, J. Telles, A. Fred, “Automatic Classification of Data”, *Proceedings 13th Congress of the European Sleep Research Society*, vol. 1, pg. 164 (abstract), Brussels (Belgium), 1996.

Miscellaneous

- José M. B. Dias is one of two Portuguese delegates in COST'75 – *Advanced Weather Radar Systems*.

Refereeing activities

José M. N. Leitão: reviewer for the *IEEE Transactions on Signal Processing*, the *IEEE Transactions on Pattern Analysis and Machine Intelligence*, the *IEEE Transactions on Biomedical Engineering*, and *Neural Networks*.

Mário A. T. Figueiredo: reviewer for the *IEEE Transactions on Image Processing*, the *IEEE Transactions on Signal Processing*, the *IEEE Transactions on Information Theory*, and the *International Workshop on Energy Minimization Methods in Computer Vision and Pattern recognition*.

Ana L. N. Fred: reviewer for the *International Journal of Pattern Recognition and Artificial Intelligence*.

José M. B. Dias: reviewer for the *IEEE Transactions on Signal Processing*.

9.1.3.2 Image Group

Human Resources

Collaborators

- Carlos Eduardo do Rego 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

- Carlos Guilherme de Moraes Pires Research Assistant Professor, ISCTE
- Manuel Menezes de Sequeira Ph.D. Student Assistant, ISCTE
- Paulo Jorge Lourenço Nunes Ph.D. Student Grant, JNICT
- Luís Ducla-Soares Ph.D. Student Grant, JNICT
- Gabriel Antunes Abrantes M.Sc. Student Grant IST
- Pedro Ortigão Research Grant IST
- Bruno Lourenço Trindade Lic. Student Final Year Project
- Mário Ferreira Godinho Lic. Student Final Year Project

Projects

- PRODÍGIOS - Processamento Digital de Audio e Vídeo (sponsored by JNICT - Programa Base): Research on audio-visual processing, coding and digital transmission, notably for low bitrates. Partners: IT, INESC and Grundig. Duration: 3 years starting in March 1995. During 1996, most of the work was done on video analysis for coding, notably towards the segmentation of video sequences and the extraction of features relevant to improve the final coding performance. A general video analysis scheme entitled Integrated Segmentation and feature extraction Tools - IST has been proposed.

- Normalization of Advanced Methods for Video Representation (sponsored by JNICT): Participation in the audio-visual representation standardisation activities of ISO/MPEG, notably MPEG4. Duration: 3 years starting in December 1995. During 1996, significant work was done regarding the definition of the MPEG-4 requirements and the starting of specification of MPEG-4 profiles. Papers were contributed to the MPEG requirements group giving important input to this direction setting subgroup of MPEG. Of major impact were the Proposal for 'MPEG-4 general requirements' and the 'What about profiles in MPEG-4' documents. The latter has started a general discussion about profiles whose importance was neglected before. Other more technical contributions notably regarding contour coding were also made.
- MOMUSYS (ACTS 098) - Mobile Multimedia System (sponsored by the European Commission DG XIII): 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: 3 years starting in November 1995. Note: participation through IST. During 1996, our activity was mainly concentrated on the specification of the requirements for the internal field trials (mobile remote security surveillance and traveller' AV information services scenarios), on the relation between the MOMUSYS and the MPEG-4 activities, on the development of an MPEG-4 viewer for Windows platforms and on the implementation of the MOMUSYS MPEG-4 Video Verification Model.
- TALISMAN (ACTS) - Tracing Authors' Rights by Labelling Image Services and Monitoring Access Network (sponsored by the European Commission DG XIII): 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. With the increasing availability of digitally stored information and the development of new multimedia broadcasting services, security questions are becoming ever more urgent. The acceptance of new services depends on whether suitable techniques for the protection of information providers' interests are available. One problem that has not found a

solution yet is how to implement copyright protection for digitally stored data. This is the objective of the TALISMAN project to provide Europe with mechanisms enabling copyright protection for digital broadcast sources. The TALISMAN project is setting up an evolutive and open framework based upon authors' societies, contents providers and broadcasters' requirements, allowing integration of a hierarchy of solutions for protecting video contents. Instances of such solutions encompassing low end systems based upon header description associated with the bitstream (called labelling) up to high end sophisticated, holographically inlayed, undeletable systems (called watermarking) will be developed within the TALISMAN project. Associated hardware implementation to support and exploit such realisations in a cost efficient way will be provided. The main work carried out during 1996 can be summarised as follows: *detailed specifications of all devices (labeller, watermarker, monitor, copyright authorities, registration database) together with the detailed specification of their interactions; *specifications to be proposed to DAVIC; *labelling and watermarking software development on workstations (ongoing work).

- MANADIX (HCM) - Motion Analysis for Advanced Image Communication Systems (sponsored by the European Commission DG XII): Research on local and global motion detection and compensation and video segmentation. Partners: European industry and university laboratories. Duration: till the end of 1996 (total of 4 years). Note: participation through IST. During 1996, the following topics have been considered: i) motion estimation for coding in the context of an object-based representation scheme, e.g. shape coding; ii) motion analysis for video segmentation, and iii) motion analysis for feature extraction in view of object characterisation. The three tasks were developed having in mind the standardisation process in progress in MPEG, named as MPEG-4. Since MPEG-4 wants to establish a flexible environment, that can be customised for specific applications, provides content-based interactive capabilities with most data types and over most types of available networks, and can be adapted in the future to take advantage of new developments in coding technology, it is essential to develop new methodologies, e.g. coding, analysis, in order the representation process is directed to the objects in the scene and not to a frame just understood as a collection of pixels. This new approach to information representation allows for much more interactivity, for versatile re-use of data, and for intelligent schemes to manage bandwidth, processing resources (e.g. memory,

computing power) and error protection. It also eases the integration of natural and synthetic audio and video material, as well as other data types, such as text overlays and graphics.

- ISO/MPEG-4 (no sponsor): Research and standardisation of advanced audio-visual representation methodologies, notably content-based. Participation of hundreds of universities and companies from all over the world. During 1996, work has mainly addressed requirements definition, profiles specification, contour coding, object-based error-resilient tools and the participation in the collaborative efforts of implementing the Video and SNHC Verification Models.

Ph.D. Theses

- Maria Paula dos Santos Queluz, (supervisor: Prof. Paul Delogne), Université Catholique de Louvain, concluded in 1996 (subject: Multiscale motion estimation and video compression).
- Carlos Guilherme Morais Pires (supervisor: Prof. Carlos Salema), Instituto Superior Técnico, concluded in 1996 (subject: Implementation of a MPEG-2 video coder prototype).
- Manuel Menezes Sequeira (supervisor: Prof. Carlos Salema), Instituto Superior Técnico, in preparation (subject: Image segmentation based on texture and motion).
- Paulo Luis Serras Lobato Correia (supervisor: Prof. Fernando Pereira), Instituto Superior Técnico, in preparation (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).

M.Sc. Thesis

- Pedro Miguel Damásio Geada (supervisor: Prof. Fernando Pereira), Instituto Superior Técnico, concluded in 1996 (subject: Wireframe based coding of videotelephony sequences).

Publications

Books and Book Chapters

Carlos Salema, Carlos Fernandes and Prof. Rama Kant Jha, from the Hindu University, Baranas, India, prepared the manuscript "Dielectric Antennas: Horns and Amplitude Shaping Lenses" which was submitted to Artech House for publication. At present the last chapter of the manuscript is under revision by the publisher's reviewers.

Papers in Journals

F. Pereira, "*MPEG-4: what should it do for us ?*", ACcenTS Newsletter, May 1996

F.Pereira, R.Koenen, "*Very low bitrate audio-visual applications*", Signal Processing: Image Communication Journal, vol.9, n°.1, pp. 55-77, November 1996.

T.Alpert, V. Baroncini, D. Choi, L. Contin, R. Koenen, F. Pereira, H. Peterson, "*Subjective evaluation of MPEG-4 video codec proposals: methodological approach and test procedures*", *Signal Processing: Image Communication, MPEG-4 Special Issue*, vol. 9, n° 4, May 1997.

R. Koenen, F. Pereira, C. Chiariglione, "*MPEG-4: Context and Objectives*", *Signal Processing: Image Communication, MPEG-4 Special Issue*, vol. 9, n° 4, May 1997.

L.Torres, M.Kunt, F.Pereira, "*Second generation video coding schemes and their role in MPEG-4*", Special Issue on *Multimedia Applications, Services and Techniques* from *European Transactions on Telecommunications*, to be published in 1997.

F.Pereira, T.Alpert, “*MPEG-4 Video Subjective Tests Procedures and Results*”, to be published in the MPEG-4 Special Issue of *IEEE Transactions on Circuits and Systems for Video Technology*.

M. Menezes de Sequeira, D. Cortez, “*Partitions: A Taxonomy of Types and Representations and an Overview of Coding Techniques*”, *Signal Processing: Image Communication, MPEG-4 Special Issue*, to be published in June 1997.

Papers in Conference Proceedings

F.Pereira, “*MPEG-4: a new challenge for the representation of audio-visual information*”, keynote speech at Picture Coding Symposium, Melbourne - Australia, March 1996.

P.Correia, P.Nunes, F.Pereira, “*Video analysis and coding for the emerging MPEG-4 standard*”, 8th Portuguese Conference on Pattern Recognition, Guimarães - Portugal, March 1996.

C. Pires, C. Salema, L. Chiariglione, “*Televisão Digital MPEG-2 de 4 a 10 Mbit/s: arquitectura de um protótipo hardware*”, Workshop 85 Years of IST, Lisbon - Portugal, April 1996.

P. Nunes, F. Pereira, “*Boundary detection in textured images using Markov random fields modelling*”, IMAGECOM’96, Bordeaux - France, May 1996.

L.Torres, M.Kunt, F.Pereira, “*Second generation video coding schemes and their role in MPEG-4*”, European Conference on Multimedia Applications, Services and Techniques, Louvain-la-Neuve - Belgium, May 1996.

F. Pereira, “*The MPEG-4 standard: evolution or revolution ?*”, Survey lecture at Radio Science and Telecommunications’ 96, Lulea - Sweden, June 1996.

F.Pereira, “*Very low bitrate video coding and MPEG-4: still a good relation*”, VIII European Signal Processing Conference, Trieste - Italy, September 1996.

L.Ducla-Soares, F.Pereira, “*Protecção de informação de vídeo através de códigos entrópicos bidireccionalmente descodificáveis*”, I Conferência Nacional de Telecomunicações, Aveiro - Portugal, 10-11 April 1997.

P.Geada, F.Pereira, “*Codificação de imagens videotelefónicas baseada em modelos*”, I Conferência Nacional de Telecomunicações, Aveiro - Portugal, 10-11 April 1997.

P.Nunes, P.Correia, F.Pereira, “*Coding video objects with the emerging MPEG-4 standard*”, I Conferência Nacional de Telecomunicações, Aveiro - Portugal, 10-11 April 1997.

P. Correia, F. Pereira, “*Video analysis for coding: objectives, features and methods*”, 2cd Erlangen Symposium 'Advances in Digital Image Communication', Erlangen - Germany, April 1997.

C.Pires, C.Salema, “*Digital TV: statistical characterization of MP@ML MPEG2 video bitstreams*”, I Conferência Nacional de Telecomunicações, Aveiro - Portugal, 10-11 April 1997.

Project Deliverables

P.Nunes et al., “*Description of common software platform*”, Project ACTS MOMUSYS, Deliverable 2, May 1996.

P.Nunes et al., “*Description of video codec structure*”, Project ACTS MOMUSYS, Deliverable 3, May 1996.

F. Pereira, R. Koenen, “*Proposal for MPEG-4 general requirements*”, Document MPEG96/1086, Tampere-Finland, July 1996.

T. Alpert, L. Contin, R. Koenen, F. Pereira, “*Evaluation protocol for the MPEG-4 error robustness subjective test*”, Document MPEG96/996, Tampere-Finland, July 1996.

R. Koenen, F. Pereira, T. Alpert, L. Contin, “*Proposal for evaluation of object-based quality*”, Document MPEG96/990, Tampere-Finland, July 1996.

F. Pereira, “*What about profiles in MPEG-4*”, Document MPEG96/1226, Chicago-USA, September 1996.

Ferran Marqués, Paulo Nunes, "Description of the Core Experiment S4b: Multi-Grid Chain Coding Method", Doc. ISO/IEC JTC1/SC29/WG11 M1326, Chicago MPEG meeting, September 1996.

Paulo Nunes, Ferran Marqués , "Results for the Core Experiment on Multi-Grid Chain Coding", Doc. ISO/IEC JTC1/SC29/WG11 M1327, Chicago MPEG meeting, September 1996.

M.P. Queluz, M. Figueiredo, “Moments based feature extraction method”, doc. AC019-IST-TEL-PI-R-002-a1, November 1996.

M.F. Erny, C. Simon, M.P. Queluz, M. Figueiredo, “Labelling basic principles”, doc. AC019-THO-RGS-DR-P-D30-b1, November 1996.

Miscellaneous

Main Research Topics:

- Object-based video representation - Object-based video representation methods have been studied (work mainly done by P.Nunes and L.Ducla-Soares). This new approach to video information representation allows for much more interactivity, for versatile re-use of data, and for intelligent schemes to manage bandwidth, processing resources (e.g. memory, computing power) and error protection. It also eases the integration of natural and synthetic audio and video material, as well as other data types, such as text overlays and graphics.

- Video analysis for coding - During the last year, P.Correia tried to make a very systematic analysis of the video analysis problem, notably segmentation, by identifying the video analysis objectives, features and methods when content-based coding is targeted considering various types of applications such as real-time communications and interactive database access. The aspects related to user interaction were also considered.

- Contour coding - A contour coding method that tries to meet some of the requirements of the MPEG-4 standard, currently under development, namely efficient coding, and low delay was proposed (work mainly done by P.Nunes). The proposed approach for shape coding allows several modes of operation depending on the application requirements namely lossless and near-lossless coding modes. For the lossless case a pure differential chain code method is proposed while for the near-lossless case a Multi-Grid Chain Code (MGCC) technique is adopted. Also both INTRA and INTER prediction modes can be used. For the INTER mode, motion compensation is applied without coding the residues.

- Facial animation using 3D wireframe models - Work towards the implementation of the MPEG-4 3D Facial Animation SNHC Verification Model has been done. We started by developing the face model (complete head), and its animation according to the SNHC VM description (work mainly done by G.Abrantes).

- F.Pereira *chairman* of "Very low bitrate coding" session, at Picture Coding Symposium, held in March 1996, in Melbourne - Australia.

- F.,Pereira member of the international experts panel at Picture Coding Symposium, held in March 1996, in Melbourne - Australia.

- F.Pereira member of the Program Committee of IMAGECOM'96 held in Bordeaux - France, in May 1996.

- F.Pereira member of the Program Committee of the European Conference on Multimedia Applications, Services and Techniques (ECMAST'96), held in Louvain-la-Neuve - Belgium, in May 1996.

- F.Pereira coordinator of the special session on “Very low bit rate image coding” held at European Conference on Multimedia Applications, Services and Techniques (ECMAST’96), Louvain-la-Neuve - Belgium, May 1996.
- F.Pereira member of the International Steering Committee of the European Signal Processing Conference (EUSIPCO’ 96), held in Trieste - Italy, in September 1996.
- F.Pereira revisor for IEEE International Conference on Image Processing (ICIP), held in Lausanne-Switzerland, in September 1996.
- F.Pereira member of the Program Committee of the European Conference on Multimedia Applications, Services and Techniques (ECMAST’97), to be held in Milan - Italy, in May 1997.
- F.Pereira member of the *Steering Committee* of the Workshop on Image Analysis for Multimedia Interactive Services, to be held in Louvain-la-Neuve - Belgium, in June 1997.
- F.Pereira guest editor of the Special Issue on MPEG-4 of IEEE Transactions on Circuits and Systems for Video Technology, to be published in February 1997.
- F.Pereira revisor for the Journal of Real-Time Imaging, published by Academic Press.
- F.Pereira revisor for IEEE Journal on Selected Areas in Communications.
- F.Pereira guest editor of the Special Issue on MPEG-4 of Signal Processing: Image Communication Journal, to be published in May 1997.
- F.Pereira associate editor of IEEE Transactions of Circuits and Systems for Video Technology since October 1996.
- C.Pires auditor of ACTS program - Multimedia line - by invitation of the Commission of European Communities.

- C.Pires technical auditor for JNICT, in the context of the EUREKA programme.

- C.Pires participated in a course on MVP-C80 programming Texas Instruments European Customer Training Center, Milan (April 1996).

- C.Pires made the Military Service from 8.6.96 a 8.11.96 at the Centro de Informática do Exército teaching Introduction to Networks and Informatics to the military staff.

- Prof. Rama Kant Jha received a PRAXIS visiting scientist scholarship and spent the academic year 1995/96 at IT (Lisbon).

- Carlos Salema coordinated the ITCOM project and acted as Chairman of the Executive Committee.

9.1.3.3 Radio Communication Systems Group

Human Resources:

Collaborators:

- | | | |
|--|-------|----------------------|
| • Prof. Américo Manuel Carapeto Correia | Ph.D. | Assistant Prof., IST |
| • Prof. Francisco António Bucho Cercas | Ph.D. | Assistant Prof., IST |
| • Prof. Jorge Manuel Nunes Pereira | Ph.D. | Assistant Prof., IST |
| • Eng. Antonio José Castelo Branco Rodrigues | M.Sc | Assistant, IST |

Other Collaborators:

- | | | |
|--|---------------|-----------------------|
| • Prof. Augusto Afonso de Albuquerque | Ph.D. | Full Professor, ISCTE |
| • Eng. José Pedro Cabral Diogo Pinto | M.Sc. Student | Grant, JNICT |
| • Eng. José Patrício da Silva Ascensão | M.Sc. Student | Grant, Gov. Madeira |
| • Eng. Pedro Joaquim Amaro Sebastião | M.Sc. Student | |
| • Cristina Maria Oliveira Silva Parente | Lic. Student | Final Year Project |
| • Isabel Maria Capucho Luís | Lic. Student | Final Year Project |
| • Ana Isabel Andrez Duarte | Lic. Student | Final Year Project |
| • Rui Filipe Gonçalves Soares Lopes | Lic. Student | Final Year Project |
| • Nuno Moisés de Sá Vilariga | Lic. Student | Final Year Project |
| • Carlos Miguel de Oliveira Silva | Lic. Student | Final Year Project |
| • Pedro Jorge Ferraz Marques | Lic. Student | Final Year Project |
| • José Maria S. Tito Martins | Lic. Student | Final Year Project |
| • Sérgio Manuel Rocha Marques | Lic. Student | Final Year Project |
| • António Pedro Miranda | Lic. Student | Final Year Project |
| • Pedro Henrique Caramujo | Lic. Student | Final Year Project |
| • António Ricardo Salles Monteiro Trindade | Lic. Student | Final Year Project |

Projects

- ACTS 090 - FRAMES “*Future Radio Wideband Multiple Access Syst*” :the design of reed-solomon hopping sequences pointing out their main capabilities and possible applications in the design of fma (frames multiple access) was done. The detailed description of non-linear tch block codes was presented. The evaluation of modulation/coding schemes for umts satellite channels was presented.
- COST 231 “*Evolution of Land Mobile Radio (including personal) Communications*”, preparation of the final report which will be published under the title: *Digital Mobile Radio: COST 231 View on the Evolution towards 3rd Generation System*, Edited by E. Damosso, Springer-Verlag.
- COST 252 “*Evolution of Satellite Personal Communications from 2nd to Future Generations Systems*”. This project started at the 3rd October 1996 and is the continuation of the similar COST 227 project aimed at studding the main factors involved in future global mobile satellite communications such as orbit planning, handover and air interface optimization.
- COST 255 “*Radiowave Propagations Modeling for new SATCOM Services at KU-BAND and Above*”. This project started at the 21st May 1996 aims to produce similar results as the previous project, however puts a lot more emphasis in the propagation sector, for example defining an appropriate propagation model for this kind of communications.

Ph.D. Thesis

- António José Castelo Branco Rodrigues (supervisor: Prof. Carlos Eduardo do Rego Costa Salema), Instituto Superior Técnico, in preparation (subject: Multi-h CPM in Terrestrial and Satellite Mobile Fading Channels).

M.Sc. Theses

- José Pedro Cabral Diogo Pinto (supervisor: Prof. Carlos Eduardo do Rego Costa Salema), Instituto Superior Técnico, in preparation (subject: Efficient Modulation and Coding for Wideband Satellite Mobile Fading Channels).
- José Patrício da Silva Ascensão (supervisor: Prof. Carlos Eduardo do Rego Costa Salema), Instituto Superior Técnico, in preparation (subject: High Spectral Efficient Systems for the Radio Interface of Future Mobile Systems).
- Pedro Joaquim Amaro Sebastião (supervisor: Prof. Francisco António Bucho Cercas), Instituto Superior Técnico, in preparation (subject: Performance Evaluation of TCH Codes).

Publications

Book Chapters

Rodrigues, contribution to chapter “Advanced Radio Interface Techniques and Perform” in *Digital Mobile Radio: cost 231 View on the Evolution towards 3rd Generation System*, Edited by e. damosso, springer-verlag, 1996.

Papers in journals

A. M. C. Correia, A. A. Albuquerque, “FH-SSMA with Band-Efficient Modulations over Cellular Fading Channels”, *ETT*, Vol. 7, No.2, pp. 145-155, March/April 1996.

Papers in conference proceedings

A. Rodrigues, A. A. Albuquerque, “Diversity Techniques with Multi-h CPM for Satellite Mobile Systems”, *VTC '96*, pp. 551-555, 28th April - 1st April 1996.

A. M. C. Correia, “Simulation of commutation signalling to combat ISI”, *ISSSTA '96* Vol. 1/3, pp. 204-208, September 1996.

A. M. C. Correia, “ Coded commutation signalling “, *ICPM.SC’96*, pp.362-366, December 1996.

Project Deliverables

J. Diogo Pinto, A. Correia, A. Rodrigues, F. Cercas, “*Modulation, Coding and Multiple Access Techniques for the Satellite Universal Mobile Telecommunication System*”, AC090/IST/AI1/DN/I/001/a1.

Francisco Cercas, Américo Correia, “*Introduction to ARQ and TCH codes*”, AC090/IST/AI1/DN/I/002/a1.

Francisco Cercas, “*TCH Codes*”, AC090/IST/AI1/DN/I/003/a1.

Miscellaneous

- A. Correia, Reviewer of the Special Issue on CDMA Communications, of the “*Wireless Personal Communications*” from Kluwer Academic Publishers.
- F. Cercas, National Portuguese Delegate 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*”
- A. Rodrigues, National Portuguese Delegate to the COST 231 project “*Evolution of Land Mobile Radio (including personal) Communications*”.

9.1.4 Optical Communications Research Line

Human Resources

Collaborators

- António Moreira Ph.D. Associate Professor, IST
- Adolfo Cartaxo Ph.D. Assistant Professor, IST
- João Pires Ph.D. Assistant Professor, IST

Other Collaborators

- Paulo Goulart M.Sc. Student
- José Morgado M.Sc. Student
- João Correia M.Sc. Student Grant, JNICT
- Luis Cautela M.Sc. Student

Projects

- ACTS 049-*SPEED* (“*Superhighway by Photonically and Electronically Enhanced Digital Transmission*”): The work developed within this project included the analysis of the impact of different optical multiplexing techniques on optical transmission system operating at 40 Gb/s and research on partial response techniques for 20 and 40 Gbit/s optical transmission. Using numerical simulation we optimised the implementation of partial response codes in dispersion supported transmission systems using practical filters at the transmitter and at the receiver. Receiver sensitivities at 20 Gbit/s and 40 Gbit/s using duobinary and modified duobinary coding for transmission over standard monomode fibre presented. The comparison between these codes and binary coding has been done.
- JNICT 2525-*Optical switching in the Access Network*: The work developed within this project included the study of the feasibility of an all-optical access network, analysis and

performance evaluation of an optical ring network using optical add-and-drop nodes and characterisation and measurement of different optical switches.

- JNICT 2499-TÓPICO (*“Multigigabit Optical Transmission Using Electrical Processing”*): We optimised by simulation the 10 Gbit/s binary linear and non-linear transmission over standard monomode fibre with electrical signal processing at the receiver to compensate the fibre dispersion. The electrical signal processing is realised by means of a first-order lowpass filter whose cutoff frequency is optimised. The optimisation was carried out for a simplified transmitter model and the laser rate equations. Exact semi-analytical methods of system sensitivity computation for binary, duobinary and modified duobinary codes were derived. The optimisation of 20 Gbit/s binary transmission with electrical compensation of fibre dispersion was also accomplished. The exact performance achieved by other line codes like duobinary, and modified duobinary as well as their optimisation was also investigated. A small-signal optical fibre analysis which takes into account the dispersion and nonlinearity of the optical fibre has been performed and some applications of this theory have been outlined.

M.Sc. Theses

- Paula Laurêncio (supervisor: João Pires), Instituto Superior Técnico, concluded in 1996 (subject: *Study of the Influence of Fibre Four-Wave Mixing on Optical Communication Systems Using Frequency Division Multiplexing*).
- João Ferreira (supervisor: João Pires), Instituto Superior Técnico, concluded in 1996 (subject: *Performance evaluation of a cascade of optical amplifiers in a DPSK direct detection optical system*).
- Luís Cancela (supervisor: João Pires), Instituto Superior Técnico, in preparation (subject: *Coherent Crosstalk in Optical Space Switches*).

- Paulo Alexandre S. Goulart (supervisor: Adolfo Cartaxo), Instituto Superior Técnico, concluded in 1996 (subject: *Optimization of 10 Gbit/s transmission over standard monomode fibre*).
- José Vicente P. Morgado (supervisor: Adolfo Cartaxo), Instituto Superior Técnico, in preparation (subject: *Analysis and Simulation of Laser Phase Noise Influence on Direct Detection Fibre Optic Systems*).
- João M. Bôto Correia (supervisor: Adolfo Cartaxo), Instituto Superior Técnico, in preparation (subject: *Simulation and Analysis of Direct Detection Optical Communication Systems*).

Publications

Books and book chapters

Paulo Goulart, Adolfo Cartaxo, “Optimization of 10 Gbit/s linear transmission over standard single mode fiber using distributed feedback lasers”, in *Applications of Photonic Technology*, 2nd edition, edited by G. Lampropoulos *et al.*, Plenum Press, 1997.

Adolfo Cartaxo, Paulo Goulart, “Validation of small-signal analysis for nonlinear dispersive fiber systems using numerical simulation”, in *Applications of Photonic Technology*, 2nd edition, edited by G. Lampropoulos *et al.*, Plenum Press, 1997.

Papers in Conference Proceedings

João J. O. Pires and Mike J. O’Mahony, “Impact of multipath coherent crosstalk on the size of optical space switches,” *Proc. First Optoelectronics and Communications Conference*, pp. 318-319, Japan, July 1996.

João Correia, Adolfo Cartaxo, “Rigorous assessment of intersymbol interference impact on the performance of optically preamplified receivers”, *9th Annual Meeting IEEE Lasers and*

Electro-Optics Society, 1996 Annual Meeting / IEEE Press, Library Congress: 95-82414, vol. 2, pp. 252-253, 1996.

João Correia, Adolfo Cartaxo, “Rigorous assessment of the impact of intersymbol interference on the performance of optically preamplified receivers”, to be presented at *I Conf. Nacional das Telecomunicações*, Aveiro, 1997.

João Correia, Adolfo Cartaxo, “Duobinary coding for dispersion supported transmission at 20 Gbit/s”, to be presented at *I Conf. Nacional das Telecomunicações*, Aveiro, 1997.

Paulo Goulart, Adolfo Cartaxo, “Optimization of 20 Gbit/s nonlinear transmission over standard single-mode fiber,” to be presented at *I Conf. Nacional das Telecomunicações*, Aveiro, 1997.

Project Deliverables

João Correia, Paulo Goulart, Adolfo Cartaxo, Paulo Monteiro, José F. da Rocha, *Partial response techniques for dispersive optical transmission*, Deliverable nº8 of ACTS 049 project SPEED (Superhighway by Photonically and Electronically Enhanced Digital transmission), October 1996.

João Correia, Adolfo Cartaxo, *Optimisation of duobinary coding for transmission over standard monomode fibre at 20 Gbit/s*, in Deliverable nº5 of ACTS 049 project SPEED (Superhighway by Photonically and Electronically Enhanced Digital transmission), May 1996.

Paulo Goulart, Adolfo Cartaxo, *Optimisation of 10 Gbit/s optical transmission with electrical equalisation in the receiver*, Deliverable I/96 of PBIC/C/TIT/2499/95 project TÓPICO (Transmissão Óptica multigigabit por segundo usando Processamento eléctricO), December 1996.

Adolfo Cartaxo, Paulo Goulart, *Small signal-analysis of nonlinear dispersive optical communication systems*, Deliverable II/96 of PBIC/C/TIT/2499/95 project TÓPICO

(Transmissão Óptica multigigabit por segundo usando Processamento eléctricO), December 1996.

João Correia, Adolfo Cartaxo, *Optical transmission at 20 and 40 Gbit/s using partial response coding*, Deliverable III/96 of PBIC/C/TIT/2499/95 project TÓPICO (Transmissão Óptica multigigabit por segundo usando Processamento eléctricO), December 1996.

João Correia, Adolfo Cartaxo, *Derivation and application of semi-analytical method of error probability computation in direct detection optical communication systems*, Deliverable of JNICT Grant FMRH/BIC/1648/95, December 1996.

João Correia, Adolfo Cartaxo, *Influence of laser chirp on direct detection optical communication system performance*, Deliverable of JNICT Grant FMRH/BIC/1648/95, December 1996.

João Pires, Wilfried Idler, António Teixeira, Rui Ribeiro, Ferreira da Rocha, *Report on TDM versus WDM*, Deliverable nº9, ACTS 049 project SPEED, December 1996.

9.1.5 Electronic and Opto-electronic Components Research Line

Human Resources

Collaborators

- | | | |
|---|-------|--------------------------|
| • Artur Fernando Delgado Lopes Ribeiro | Ph.D. | Assistant Professor, IST |
| • Jorge Manuel Torres Pereira | Ph.D. | Associate Professor, IST |
| • Carlos Alberto Ferreira Fernandes | Ph.D. | Assistant Professor, IST |
| • António Manuel da Cruz Serra | Ph.D. | Assistant Professor, IST |
| • Manuel José Freire Fonseca da Silva | Lic. | Assistant, IST |
| • Maria da Conceição F. Líbano Monteiro | Lic. | Assistant, IST |
| • Francisco André Corrêa Alegria | Lic. | Assistant, IST |

Other Collaborators

- | | | |
|--|---------------|----------------------|
| • Mouhaydine Tlemçani | M.Sc. Student | Assistant, Un. Évora |
| • Raul Daniel Lavado Carneiro Martins | M.Sc. Student | |
| • Hugo Daniel Santos Meinedo | Lic. Student | Final Year Project |
| • João Carlos Simões Proença Henriques | Lic. Student | Final Year Project |
| • João Carlos Simões Proença Henriques | Lic. Student | Final Year Project |
| • Paula Cristina Ferreira Marques da Silva | Lic. Student | Final Year Project |
| • Sofia Margarida Jerónimo Mendes Paiva | Lic. Student | Final Year Project |

Projects

- ACTS AC065 - BLISS (“Broadband Lightwave Sources and Systems”) The participation of this group in the Acts-Bliss project is mainly concerned to the modelling work of the cross-talk problem in the optical transceivers being fabricated by other partners in the consortium. To accomplish this several modelling tools developed by our group are currently used. During 1996 the electrical cross-talk due to capacitive coupling and/or

conduction currents through the substrate of the optical integrated circuit was modelled by using analytical and numerical methods like the finite element method. The Bliss project started in September 1995 and will be concluded in 1998.

Ph.D. Thesis

- Manuel José Freire Fonseca da Silva (supervisor: António Cruz Serra), Instituto Superior Técnico in preparation (subject: Design of an Automatic Impedance Measurement System).

M.Sc. Theses

- Maria da Conceição F. Líbano Monteiro (supervisor: António Cruz Serra), Instituto Superior Técnico in preparation (subject: Implementation of a Real Time Sound Analyser).
- Francisco André Corrêa Alegria (supervisor: António Cruz Serra), Instituto Superior Técnico in preparation (subject Development of an Automatic Calibration System for Analog or Digital Measurement Instruments by Using Computer Vision Techniques).
- Mouhaydine Tlemçani (supervisor: António Cruz Serra), Instituto Superior Técnico in preparation (subject Implementation of a Telemeasurement System for remote metrological stations).
- Raul Daniel Lavado Carneiro Martins (supervisor: António Cruz Serra), Instituto Superior Técnico in preparation (subject Development of an Automatic Measurement System to Calibrate Analog to Digital Converters).

Publications

Papers in Journals

C. F. Fernandes, "On the Performance of MQW-DFB InGaAsP Lasers in the Near Threshold Regime", *Microwave and Optical Technology Letters*, vol.12, N°2, pp 97-104, June 1996.

C. F. Fernandes, "Mode Spectrum and Threshold Gain Calculations in DFB Lasers", *Microwave and Optical Technology Letters*, vol.12, N°6, pp.363-366, August 1996.

Papers in Conference Proceedings

M. Fonseca da Silva, A. Cruz Serra, "Capacitance measurement method", *IEEE Africon'96 Proceedings*, vol. 1, catalog number 96CH35866, pp. 247-250, Stellenbosch, África do Sul, Setembro 1996.

H. Ramos, P. Girão, A. Cruz Serra, "Impact of virtual instrumentation in teaching automated measurement systems", *IEEE Africon'96 Proceedings*, vol. 2, catalog number 96CH35866, pp. 978-981, Stellenbosch, África do Sul, Setembro, 1996.

M. Fonseca da Silva, A. Cruz Serra, "Automatic capacitance measurement system", *IMEKO TC-4, 8th International Symposium on New Measurements and Calibration Methods of Electrical Quantities and Instruments Proceedings*, pp. 57-60, Budapeste, Hungria, Setembro, 1996.

F. Correa Alegria, A. Cruz Serra, "Multifunction I/O boards for the IBM PC AT", *IMEKO TC-4, 8th International Symposium on New Measurements and Calibration Methods of Electrical Quantities and Instruments Proceedings*, pp. 302-305, Budapeste, Hungria, Setembro, 1996.

J. Pereira, A. Ribeiro, C. Fernandes, A. Cruz Serra, "Large Signal Transient Response of Long-Wavelength Injection Lasers", *IEEE Melecon'96 Proceedings*, vol. 2, catalog number 96CH35884, pp. 680-683, Bari, Italy, May, 1996.

A. Lopes Ribeiro, C. F. Fernandes, "Near Threshold Regime in Quantum Well Lasers", *IEEE Melecon'96 Proceedings*, vol. 2, catalog number 96CH35884, pp. 428-431, Bari, Italy, May, 1996.

Miscellaneous

- As a member of the "Technical Committee on Measurements of Electrical Quantities" (TC-4) of the "International Measurement Confederation" (IMEKO) António Manuel da Cruz Serra participated in the "International Programme Committee" of the "8th International Symposium on New Measurements and Calibration Methods of Electrical Quantities and Instruments", that took place in Budapest, Hungary in September.,1996.

9.1.6 Power Systems Research Line

Human Resources

Collaborators

- António Victor A. Anunciada Ph.D. Assistant Professor, IST
- Maria Beatriz Vieira Borges Ph.D. Assistant Professor, IST
- Maria Inês C. Simas Freire Ph.D. Associate Professor, IST
- Mário J. Almeida Lança Ph.D. Full Professor, IST
- Nuno Pereira Lic. Assistant, IST

Other Collaborators

- Pedro Santos Ph.D. Student Assistant, I. Pupilos do Exército
- João Beirante M.Sc Student
- Maria Manuel Sousa M.Sc Student INETI
- Raul Monteiro M.Sc Student Assistant, I.P.Tomar
- António Vasco Anunciada Lic. Student Final year project
- João Garcia Lic. Student Final year project
- Luis Barbosa Lic. Student Final year project
- Francisco Nunes Senior Eng. Correios de Portugal
- Saulo Finco BSc C.T.I., Campinas, S. Paulo, Brazil

Projects

- CIIP- Intelligent Power Integrated Circuits - Project PRAXIS XXI Integrated circuits for application on high efficiency power circuits, including the power MOS devices: development of design techniques in order to improve the switching characteristics of the power transistors development and modification of transistor models in order to improve the reliability of the device simulation for use in SPICE and SABER (in cooperation with Prof. Frank Behrens and Saulo Finco).

- SWITCH- Topologies and Control of High Frequency Switch Mode Converters (DC and DC/AC) Analysis and conclusion of the development of phase modulation bridge converter; simulation and study of a new topology of power converters - interrupted supply soft switching.
- HARDIS Development of a very high power 3 ph bridge inverter (300KVA) for an interactive, rotative UPS. Characterization of typical harmonic content of mains supply current on telecom and computer plants.
- GSM.SITE Thermal study of small telecom plants. Study of power conversion and thermal management of remote telecom plants supplied by solar cells. Cooperation with Movex in the design of a telecom metallic container.

M.Sc. Thesis

- Saulo Finco (supervisors: M. I. Castro Simas, Frank Behrens), Universidade Federal de Campinas, Feb. 1996.

Publications

Papers in Conference Proceedings

Nuno F. Pereira, Beatriz V. Borges, “*Supra Resonant Fixed Frequency Full Bridge DC-DC Resonant Converter with Reduced Switching Losses*”, IEEE Intelec 96 Conference, Oct. 96.

Victor Anunciada, João Santana, “*A New Configuration of Low Cost Diesel UPS System*”, IEEE Intelec 96 Conference, Oct. 96.

V. F. Pires, J. F. Silva, Victor Anunciada, “*Twelve Pulse Parallel Rectifier with a New Topology for the Output Low-Pass Filter*”, IEEE Power Electronics Specialists Conference, 1996.

V. F. Pires, J. F. Silva, Victor Anunciada, “*Rectificador Dodecafásico Paralelo com Nova Topologia de Filtragem Passa-Baixo*”, Congresso da Ordem dos Engenheiros.

M. I. Castro Simas, “*Intelligent Power Devices*”, 2nd. Workshop IBERCHIP, S. Paulo, Brazil, Feb. 1996, (invited paper).

9.1.7 Networks Research Line

Human Resources

Collaborators

- José Manuel R. L. Brázio Ph.D. Associated Professor, IST
- João Luis C. C: G. Sobrinho Ph.D. Researcher, IT

Other Collaborators

- Rui Jorge H. C. Lopes M.Sc. Student Grant, PRAXIS XXI
- Manuel Afonso Barbosa M.Sc. Student

Projects

- COST 228 "Simulation of Terrestrial/Satellite Networks": In the framework of the participation in the COST228 project, and in the continuation of the work done in this project in 1995, research was performed in the area of simulation of cellular mobile communication systems. Most of the work done concerned the use of the simulator previously developed for assessing service quality in a cellular mobile communications system.
- Multiple Access for Wireless Networks: New activities were started in the area of multiple access for wireless networks, concerning the study of the performance of standardised access schemes (RTS/CTS) in an environment with multiple cells and hidden terminals.
- ITCOM: Activity was started in the ITCOM project for the development of an experimental wireless setup demonstrating the integration of real time data in the proposed IEEE 802.11 standard. In this particular application, the transmission of

digitised voice is being contemplated. The work involves the study and implementation of the changes to be made to an IEEE 802.11 controller developed at Universidade de Aveiro in order to support real time traffic access procedures.

M.Sc. Thesis

- Rui Jorge Henriques Calado Lopes, *Modelização Orientada para Objectos de um Sistema de Comunicações Móveis Celulares, com Aplicação a Simulação Distribuída*, (“Object-Oriented Modelling of a Cellular Mobile Communications System, with Application to Distributed Simulation”), Instituto Superior Técnico, 1995, (advisor: Prof. José M. Brázio).

Publications

Papers in Journals

J. Sobrinho, J. Brázio, "Performance Analysis of a Multiple Access Protocol for Wireless Data Networks with Bi-Directional Traffic", *Computer Networks and ISDN Systems*, Jan. 1996.

Papers in Conferences Proceedings

J. Brázio, N. Silva, "Performance Evaluation of a Multi-Layer Location Update Method", *Records of the 1996 IEEE Vehicular Technology Conference*, Atlanta, GA, USA, Apr. 28-May. 1, 1996.

N. Silva, J. Brázio, "Reduction in Location Management Signaling Costs by the Use of Subpopulation-Taylored Location Area Sizes," *Proc. ICUPC'96*, Cambridge, MA, USA, Sep. 29-Oct. 2, 1996.

F. Velez, J. Brázio, " A Computational-Geometry-Based Tool for the Cellular Design of Millimeterwave Mobile Communications Systems in Urban Environments," *1st. CGC Workshop on Computational Geometry*, Baltimore, MA, USA, Oct. 11–12, 1996.

J. Brázio, F. Velez, "Design of Cell Size and Frequency Reuse for a Millimeterwave Highway Coverage Cellular Communications System," *Proc. PIMRC'96*, Taipei, Taiwan, Oct. 15–18, 1996.

R. Lopes, J. Brázio, "An Object-Oriented Framework for the Modeling and Simulation of a Mobile Cellular Radio System", *Proc. Object-Oriented Simulation Conference 97, OOS'97*, Phoenix, AZ, USA, Jan 1997 (to appear in 1997).

N. Silva, J. Brázio, "Capacity of a Metropolitan Area Network-Based Architecture for the Support of Personal Communication Systems," *Proc. IEEE 47th Vehicular Technology Conference (VTC'97)*, Phoenix, AZ, USA, May 5–7, 1997 (to appear in 1997).

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. Campos Gonçalves Sobrinho Ph. D. Researcher, IT

Other Collaborators

- Paulo Guilherme Gonçalves Chainho M. Sc. Student
- João Paulo Costa Rebelo M. Sc. Student
- Kindoki Kimanima M. Sc. Student Grant, Rep. Angola
- Rogério Paulo C. Lam Lic. Student Final Year Project
- Duarte Silva Lic Student Final Year Project

Projects

- TELEMATICS, HC1014 - ENN (“European Neurological Network”). Within the project this group dealt with the communications infrastructure. Several technologies have been studied, including ISDN, ATM and Frame Relay, to set up a network interconnecting the main medical research laboratories. These laboratories are spread over Europe from Finland to Portugal (Lisboa and Açores). Due to budget constraints, a network based on ISDN has been agreed upon and will be built during 1997. In particular, inverse multiplexing techniques are envisaged to support applications with large bandwidth requirements.
- ACTS, AC204 - SAMBA (“System for Advanced Mobile Broadband Applications”). The main contribution, within this project, is focused on the interworking of the mobile with fixed broadband networks. Several options have been discussed along with the requirements for the mobile network. Constraints, including delay, capacity and

availability, are analysed to evaluate the feasibility of several degrees of integration of the mobile network in the fixed network structure.

Ph. D. Thesis

- António Carlos Matias Almeida (supervisor: Carlos A. Carvalho Belo), Instituto Superior Técnico, in preparation (subject: quality of service in broadband networks).

M.Sc. Theses

- Paulo Guilherme Gonçalves Chainho (supervisor: Carlos A. Carvalho Belo), Instituto Superior Técnico, concluded in 1996 (title: “Modelação de um Sistema para o Suporte de Serviços de Telecomunicações Orientados para os Requisitos Empresariais”)
- João Paulo Costa Rebelo (supervisor: Carlos A. Carvalho Belo), Instituto Superior Técnico, concluded in 1996 (title: “Aproximação de Processos ON-OFF por um processo MMPP para análise do atraso médio numa fila de espera ATM.
- Kindoki Kimanima (supervisor: Carlos A. Carvalho Belo), Instituto Superior Técnico, in preparation (subject: analysis and implementation of multicast protocols).

Publications

Papers in Conference Proceedings

Paulo Chainho, Carlos Belo, “Mirror Agent Society - TINA Agency for the Market Requirements”, TINA’96 Conference, eds. Ken Birman and Joachim Claus, VDE-VERLAG GMBH, pp. 251-264, Berlin, 1996.

Project Deliverables

“Analysis of a Communication Network to Support a Neurological Distributed Work Environment”, Deliverable D5.1, ENN, December 1996.

“Network Specification and System Requirements”, Deliverable A0204/TLN/TN/DS/P/001/a1, SAMBA, December 1996.

9.1.9 Technology and Materials Research Line

Human Resources

Collaborators

- L. Alcácer Ph.D. Full Professor, IST
- J. M. F. Morgado Ph.D. Assistant Professor IST

Other Collaborators

- A. C. Ribeiro M.Sc. Student Grant, PRAXIS XXI
- Ana Charas M.Sc. 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 synthesis of semiconducting materials (polymers and oligomers), namely poly(thienylvinylene), PTV, derivatives, and their characterisation by conventional methods. A detailed study was performed on the influence of the processing temperature of the (poly(p-phenylene-vinylene), PPV, precursor, on the electroluminescent properties and on the LED characteristics of the ITO/PPV/M (M=Ca, Al) type devices. This work was performed in collaboration with the Optoelectronics Group of the Cavendish Laboratory in Cambridge.
- PRAXIS XXI nº 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 synthesis of new charge transfer complexes containing transition metal bis-dithio(seleno)lenes. Single crystals of these materials were obtained and the determination of their crystal structure and the detailed study of their electric and magnetic properties is under way.

- JNICT PBIC/C/CTM/1965/95 — SYNTHESIS AND CHARACTERISATION OF LUMINESCENT POLYMERS Two series of polymer electrolytes containing luminescent centers, namely Eu^{3+} ions, were synthesized and characterized. One of the series was based on polymer-salt complexes in which the polymer (poly(ethyleneimine)) acts as a complexing agent to the rare-earth ion (Eu^{3+}). The other was based on ORMOLYTES (ORGANICALLY MODIFIED silicate electrolyTES) obtained via sol-gel. Thin films of these materials were characterized by thermal and morphological studies (DSC, DTA, TGA, X-ray and SEM). The study of the luminescent properties was started.
- HC&M-CHRX-CT93-0148 CONJUGATED LADDER-TYPE OLIGOMERS AND POLYMERS CONTAINING FUSED SIX-AND FIVE-MEMBERED RINGS. The work done by the team in the framework of this Human Capital and Mobility of Researchers Network consisted in the preparation of electronic device structures and characterisation of materials under working conditions. MISFET devices were obtained from electropolymerisation of benzodithiophene. The polymer was spin coated between two gold pads (source and drain). The gate was a layer of n^{++} -Si separated from the gold pads by a layer of silicon dioxide. From I - V measurements, a conductivity of 10^{-9} - 10^{-10} S cm^{-1} was observed with or without iodine doping. Schottky diode structures prepared using the same polymer were also investigated.

M.Sc Theses

- Antonieta Caneco Ribeiro (Supervisor: L. Alcacer); Instituto Superior Tecnico. In preparation. Subject: Ionic Conducting Polymers for Microsystems
- Ana Maria Matos Charas (Supervisor: J. Morgado); Instituto Superior Tecnico. In preparation. Subject: Electroluminescent Devices based on Conducting Polymers

Publications

Papers in Journals

Jorge Morgado, Isabel C. Santos, M. Teresa Duarte, Luís Alcácer and Manuel Almeida, "Synthesis and structure of a new nickel (II) complex $[\text{NBu}_4]_2[\text{Ni}\{\text{Se}_2\text{C}_2(\text{CN})_2\}_2]$ "; *J. Chem. Soc., Chemical Communications*, 1837 (1996).

Papers in conference Proceedings

J. Morgado, J. Grüner, M. G. Harrison and R. H. Friend; "Luminescence Efficiencies of Poly (P-Phenylene Vinylene) and Performance of PPV Based LED's"; XV Encontro Nacional da Sociedade Portuguesa de Química, Porto, 22-25 de Maio, 1996.

Morgado, I. C. Santos, M. T. Duarte, R. T. Henriques, L. F. Veiros, M. Almeida e L. Alcácer; "Síntese, Estrutura, Propriedades Eléctricas e Magnéticas do Composto $(\text{PeT})_3[\text{Ni}(\text{mnt})_2]_2$ "; XV Encontro Nacional da Sociedade Portuguesa de Química, Porto, 22-25 de Maio, 1996.

A. Charas, J. Morgado, P.T. Gomes e L. Alcácer; "Síntese e Caracterização do Poli (3-Hexiltienileno Vinileno)"; XV Encontro Nacional da Sociedade Portuguesa de Química, Porto, 22-25 de Maio, 1996.

J. Morgado, J. Grüner, M. G. Harrison and R. H. Friend; "Charge Injection and characteristics of PPV based LED's. A Reinvestigation"; Gordon Research Conference on Electronic Processes in Organic Materials, Proctor Academy, Andover, New Hampshire, USA, July 21-26, 1996.

J. Morgado, M. T. Duarte, L. Alcácer, I. C. Santos, R. T. Henriques and M. Almeida; "New Compounds Based on Tetrathiafulvalene and $\text{Au}(\text{pds})_2^-$, pds=pyrazine-2,3-diselenolate"; International Conference on Synthetic Metals, Snowbird, Salt Lake City, USA, July 28-August 2, 1996, to be published in *Synthetic Metals*.

J. Morgado, J. B. Christensen, R. T. Henriques, L. Alcácer and M. Almeida; "Electrical and Magnetic Properties of the New Conductors: (TMDTP)₂AsF₆ and (TMDOP)₂AsF₆"; International Conference on Synthetic Metals, Snowbird, Salt Lake City, USA, July 28-August 2, 1996, to be published in *Synthetic Metals*.

E. Ribera, C. Rovira, J. Veciana, V. N. Laukhin, E. Molins, E. Canadell, M. Almeida and J. Morgado; "Unusual Transport and EPR Properties of the (BET-TTF)-XF₆ Family Salts (X=P, As)"; International Conference on Synthetic Metals, Snowbird, Salt Lake City, USA, July 28-August 2, 1996.

S. C. Moratti, S. J. Walcott, T. M. Yong, R. Cervini, A. B. Holmes, J. Grüner, J. Morgado and R. H. Friend; "Organic EL Devices based on a Semi-Conjugated Polymer"; Proceedings of the 8th International Workshop on Electroluminescence, Berlin, August 13-15, 1996, p 201-206.

Participation in International Scientific Meetings

Electronics with Molecular Materials: From Synthesis to Device"- Discussion Meeting na "The Royal Society", London, June 4 and 5, 1996.

Gordon Rsearch Conference on Electronic Processes in Organic Materials", Proctor Academy, Andover, New Hampshire, USA, July 21-26, 1996.

International Conference on Science and Technology of Synthetic Metals - ICSM'96", Snowbird, Salt Lake City, USA, July 28-August 2, 1996.

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 |
| • Eduardo Sá Marta | M.Sc | Assistant, FCTUC |
| • Fernando Perdigão | 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 | Assistant Professor, IPL |
| • António Navarro | PhD | Assistant Professor, ISBB |
| • João Carlos Silvestre | PhD Student | Grant, PRAXIS XXI |
| • Pedro Assunção | PhD Student | Assistant, IPL |
| • Fernando Lopes | PhD Student | Assistant, ISEC |
| • Maria Beatriz Henriques | Lic. Student | Grant, IT |
| • Paulo Valente da Cruz | Lic. Student | Grant, IT |
| • Rui Amaral | M.Sc Student | Grant, PRAXIS XXI |

• Paulo Plácido	M.Sc Student	Grant, PRAXIS XXI
• Filipe Neves	M.Sc Student	Grant, PRAXIS XXI
• Nuno Serra Antunes	M.Sc Student	Grant, PRAXIS XXI
• Rui Coimbra Lopes	Lic. Student	Final Year Project
• Nuno Miguel Borges	Lic. Student	Final Year Project
• Gonçalo Marques Redinha	Lic. Student	Final Year Project
• Luís Miguel de Sousa	Lic. Student	Final Year Project
• João António Marques	Lic. Student	Final Year Project
• Manuel Jorge Catarino	Lic. Student	Final Year Project
• Carla Sofia Sebastião	Lic. Student	Final Year Project
• José Fernando Morais	Lic. Student	Final Year Project
• José Miguel Jorge	Lic. Student	Final Year Project
• Paulo Oliveira	Lic. Student	Final Year Project
• Paulo Jorge Bernardino	Lic. Student	Final Year Project

Projects

- PHONEME RECOGNITION - In previous years of research, a set of auditory mechanisms have been identified as being determinant in the process of human recognition of plosive consonants. In 1996 phenomenological models for some of these mechanisms were implemented, including a fuzzy-logic model for the "ascending sequence" cells in the auditory cortex AI area. By combining the output of this model with the output of an evaluator for the perception of the existence/absence of an initial unvoiced segment, we achieved discrimination of labial against dental/glottal consonants with an error of just 2%. This result was achieved in a multi-microphone database including 40 Portuguese speakers and 10 foreign speakers. Obtaining such good results with just a very partial implementation of the (previously researched) overall perceptual structure leads us to expect final results well beyond the state-of-the-art, although in a very circumscribed task (plosive consonant discrimination in E-set conditions).

- **SPEECH DATABASE ANNOTATION** - Following our previous studies on speech segmentation in acoustical subwords, a set of acoustic-phonemic segments was identified which characterize the 10 Portuguese digits (0 to 9). A maximum likelihood algorithm is firstly used to segment the digits. Then a fuzzy sets based classifier labels these segments. A careful refinement of this combined method has allowed us to annotate automatically the isolated digits part of TELEFALA (a Portuguese telephone speech database). The performance of this method has been evaluated and compared to manual speech annotation.
- **KEYWORD SPOTTING IN AUTOMATIC SPEECH RECOGNITION** - During the year of 1996 new models of isolated digits were created using a much larger training set. For this purpose a semi-automatic segmentation tool was developed. In addition, hesitations, silences and other strange or out of vocabulary utterances were extracted from the TELEFALA database in order to create “garbage models” as required by word spotting techniques.
- **PRE-PROCESSING SYSTEMS BASED ON AUDITORY MODELS** - Several physical models to simulate the vibration of the basilar membrane of the cochlea were studied. The feedback effect of outer hair cells (OHCs) has been considered as well as a model for the middle ear which takes into account the cochlea input impedance. One of studied models was chosen and emulated by a cascade of digital filters. Prony’ method and the iterative pre-filtering algorithm were both used in the implementation of the filter bank. Several techniques for spectral pre-processing, based on fast Fourier transforms, linear prediction and cepstral analysis, were compared to the implemented cochlear models. Experiments have been set up in order to assess the expected superiority of auditory models in regard to noise suppression.
- **ADVANCED TELEPHONIC INFORMATION SERVICES (SAIT)** - This project initiated in 1996 under a research contract between IT and Portugal Telecom. The aim of the project is to demonstrate a prototype service of information retrieving through the telephone, using speech recognition. An important feature of this system is its ability to integrate keyword spotting techniques. The specification of a menu guided information

system was completed. The development of the automatic telephone interface with message playing and message recording is under way as well as the dialogue design.

- VIDEO CODING FOR MOBILE COMMUNICATIONS - This a new activity, initiated in 1996, of the Signal and Image research line. The aim is the study of algorithms of both source and channel coding for mobile communications. International standards for cellular networks, like IS54, JDC, GSM, DCS-1800 and IS95 have been studied. Transmission errors of MPEG-2 and ITU H.263 encoded video signals using digital modulation schemes have been studied as subject to channel hostilities. Error correcting codes specially suitable for this application are being considered.
- PRODIGIOS (Praxis/3/3.1/TIT/39/94) - Prodigios started in 1995 and it is a project on Digital Signal Processing of Audio and Video with the participation of IT (Lisbon and Coimbra) and INESC. In the year of 1996 the Signal and Image Research Line worked on the area of signal decomposition in frequency subbands. A video compression system based on the decomposition of image regions using filter banks of the wavelet type was developed. This study was directed to the resolution of some problems related to the application of FIR digital filters to finite size signals as well as to the optimization of the impulse response of the prototype filters following some coding efficiency criteria. Work on vector quantization with multiple codebooks for subband coding has also been undertaken.
- MANADIX - Motion Analysis for Advanced Image Communication - The activity of the Manadix project, an European Research Network under the HCM programme, came to an end in the year of 1996. The Signal and Image Research Line has contributed to the aim of the project with studies on video coding for low bit rates using geometric transform motion compensation. In the framework of the project a proposal was assembled for a follow up activity in the areas of image segmentation and visual information extraction.
- ARMA AND MA MODELLING - This research activity consists in finding the parameters of an ARMA (or AR) system, given its time domain input and output. Some

interesting forms of expressing the input-output relation of an ARMA systems have led to its modelling in periodic regime. The present research aims to tackle, by better methods, the "direct modelling problem" for ARMA systems in which a quadratic fitting error to the impulse response is to be globally minimized.

Ph.D. Theses

- Vitor Mendes Silva, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, Concluded in 1996 (subject: Multiresolution Decomposition of Signals: Application to Image Compression).
- Eduardo Sá Marta, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, in preparation (subject: Speaker Independent Phoneme Transmission).
- Fernando Perdigão, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, in preparation (subject: Pre-Processing Based on the Human Auditory System).
- João Carlos Silvestre, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, in preparation (subject: Processing of Finite Size Signals in Multiresolution Analysis).

M.Sc. Theses

- Emanuel Gustavo Martins, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, concluded in 1996 (subject: Tree Structured Vector Quantization Schemes for Subband Video Coding).

- Helena Marto, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, concluded in 1996 (subject: Audio and Video Multiplexing System for an ISDN Videotelephone).
- Filipe Neves, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, in preparation (subject: A System for Collecting of a Portuguese Speech Database over the Telephone Line).
- Rui Baroteo Amaral, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, in preparation (subject: Segmentation and Labelling of Telephone Speech Data).
- Nuno Serra Antunes, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, in preparation (subject: Primary Access ISDN Network Interface for a Videotelephone).
- Paulo Plácido, (supervisor: Luís Vieira de Sá) , Universidade de Coimbra, in preparation (subject: KeyWord Spotting Techniques in Speech Recognition).

Publications

Papers in Journals

Sergio M. M. de Faria and M. Ghanbari, “A low bit rate video codec with spatio-temporal geometric transforms”, *IEE Proceedings Part-I: Vision, Image and Signal Processing*, vol. 143, no. 3, June 1996.

Vitor Silva e Luís de Sá, “Analytical optimization of CQF filter banks”, *IEEE Transactions on Signal Processing*, vol. 44, n°. 6, pp. 1564-1568, June 1996.

Papers in Conference Proceedings

A. Navarro and C.R. Allen, "Adaptive Classifier Based on K-means Clustering and Dynamic Programming", Int. Conf. on Image Processing Methods, San Jose-USA, February 1997.

A. Navarro and C.R. Allen, "Distortion Compensation Method Applied to Hand-written Character Recognition", to appear in the Conference Proceedings of RecPad'97.

A. Navarro and C.R. Allen, "Dynamic Programming and Clustering", to appear in Fourth International Conference on Document Analysis and Recognition, Ulm, Germany, August 1997.

A. Navarro and L. Sa, "Interfacing a TMS320C31 DSP to the PC Bus, to appear in I Conferência Nacional de Telecomunicações, 1997.

C.R. Allen and A. Navarro, "The Recognition of Roman Handwritten Characters Using Dynamic Information Recovery", to appear in IEE International Conference on Document Analysis and Recognition, July 14-17, Dublin, Ireland, 1997.

Eduardo Sá Marta, Fernando Perdigão, LuisVieira de Sá, "Psychophysical Evidence for a Sampling Process, Related to Properties of Onset Cells, in Stop Consonant Perception", ESCA Tutorial and Research Workshop, United Kingdom, June 1996.

Emanuel Martins, Vitor Silva e Luís de Sá, "Subband Vector Quantization of Image Sequences", Proceedings of RecPad'96, pp. 319-323, March, 1996.

F. Perdigão; E. Marta; L. Sá, "A Time-Domain Model Based on a Physical Description of the Cochlea", Proceedings of RecPad'96, March 1996.

João Silvestre, Luís de Sá, "Signal Extensions in perfect reconstruction Filter Banks", Digital Compression Technologies and Systems for Video Communications, SPIE Proc., Vol 2952, pp 159-162, Berlin, 1996.

João Silvestre, Luís de Sá, "Um método iterativo para Extensão de Sinais em Codificação por Subbandas", to appear in I Conferência Nacional de Telecomunicações, 1997.1

João Silvestre, Vitor Silva, Luís de Sá, "An Iterative Method for Signal Extension in Subband Coding", to appear in the Conference Proceedings of RecPad'97.

Nuno Antunes, M. Veríssimo, Luis de Sá, " Interface Dinâmica para Acesso RDIS Primário (2.048 Mbit/s)", to appear in I Conferência Nacional de Telecomunicações, 1997.

P. Assunção and M. Ghanbari, "Multi-Casting of Mpeg-2 Video with Multiple Bandwidth Constraints", 7th International Workshop on Packet Video", 1996, March, Brisbane, Australia.

P. Assunção and M. Ghanbari, "Post-processing of mpeg2 coded video for transmission at lower bit rates", IEEE-International Conference in Acoustics and Signal Processing, 1996, May, Atlanta, USA.

Paulo Paiva Monteiro, Luís Vieira de Sá, "A New Method to Evaluate in Closed-form the Response of a Stable Continuous-time ARMA system to a Periodic Input Avoiding Fourier Series", to appear in the Conference Proceedings of RecPad'97.

R. Amaral, F. Perdigão, P. Placido, E. Sá Marta, L. Vieira de Sá, "Automatic Segmentation and Labelling of a Portuguese Telephone-Speech Digit Database", to appear in the Conference Proceedings of RecPad'97.

R. Amaral, F. Perdigão, P. Placido, E. Sá Marta, L. Vieira de Sá, "Sistema Automático de Segmentação e Etiquetagem de uma Base de Dados de Fala Telefónica em Português", to appear in I Conferência Nacional de Telecomunicações, 1997.

Sérgio M. de Faria and M. Ghanbari, "Low bit rate video coding using bi-directional spatial transform motion compensation", Picture Coding Symposium - March 1996, Melbourne, Australia.

Sérgio M. de Faria and M. Ghanbari, "Biorthogonal B-Spline filter banks for very low bit rate video coding", European Signal Processing Conference - EUSIPCO 96 - September 1996, Trieste, Italy.

Sérgio M. de Faria and M. Ghanbari, "Bidirectional geometric transform motion compensation for low bit rate video coding European Symposium on Advanced Imaging and Network Technologies - October 1996, Berlin, Germany.

Sérgio M. de Faria and M. Ghanbari, "Geometric Transform Motion Compensation for Low Bit Rate Video Coding" to appear in the Proceedings of RecPad'97.

Sérgio M. de Faria and M. Ghanbari, "B-Spline filter banks for very low bit rate coding", IEEE International Symposium on Circuits and Systems, ISCAS-96 - May 1996, Atlanta, USA.

Project Deliverables

Luís de Sá et al, "Project SAIT - Progress Report", IT-Coimbra internal report n° 14 (contribution contract SAIT/RT3, tasks M2 & M3), December 1996.

Luis de Sá, “Analogue Multipliers Circuits”, tutorial included in the intensive course of the TEMPUS project "Modernisation of Teaching in Electronic Systems for Telecommunications Networks", April 1996.

Miscellaneous

- Eleven students of the Department of Electrical Engineering started to work in the Signal and Image Laboratory in several final year projects.

- Sérgio Maciel Faria has completed his PhD thesis "Very Low Bit Rate Video Coding using Geometric Transform Motion Compensation" in the University of Essex, England, UK.

- Luis Alberto Cruz is continuing his PhD studies in the Rensselaer Polytechnic Institute, U.S.A., in the area of “Vector Quantization of Motion Information”.

- Pedro Assunção, continued his PhD studies in the University of Essex, UK, on the area of “Video Transmission over ATM Networks”.

- Fernando Lopes initiated in the University of Essex, UK, a PhD programme on Video Coding.

- The Signal and Image Research Line collaborated with the Optics Communications Research Line in Project TEMPUS (JEP 7589/94) - "Modernization of Teaching in Electronic Systems for Telecommunications Networks". Two students from Poland worked in the Signal & Image Laboratory during a period of 5 months.

- In the year of 1996, PRAXIS XXI has approved the project “Applications of Speech Recognition in Telecommunications” led by INESC with the participation of the Signal and Image Research Line. The project is expected to start in early 1997.

- The Signal and Image Research Line has participated in the COST249 action related to “Continuous Speech Recognition over the Telephone Line”. Luis Vieira de Sá has participated in the 2 meetings organized by the action, in Stocholm and in Zurich.

- Luís Vieira de Sá has been a member of the National Management Committee of IT.

9.2.2 Optical Communications Research Line

Human Resources

Collaborators

- Henrique J. A. da Silva Ph.D. Assistant Professor, FCTUC
- Lúcia Maria R. A. Martins M.Sc. Assistant, FCTUC
- Álvaro M. F. de Carvalho Lic. Assistant, FCTUC

Other Collaborators

- Mário Marques Freire Ph.D. Student Assistant, UBI
- Alexandre M. d'Orey G. Melo Ph.D. Student Assistant, ISEC
- João C. Ramos Perdigoto M.Sc. Assistant, ISEC
- Henrique M. N. M. Costa M.Sc. Engineer, PLASFIL
- António L. Ferreira Marques M.Sc. Student Assistant, ISEC
- João M. Abrantes Martins M.Sc. Student Engineer, Portugal Telecom
- Mário M. C. Alves dos Reis M.Sc. Student Engineer, CENEL
- João M. Pissarra C. Gil M.Sc Student Grant, PRAXIS XXI
- Paulo Mateus Mendes M.Sc Student Grant, PRAXIS XXI
- José M. L. Vieira Vilela Research Student Grant, PRAXIS XXI
- Luís Miguel Moreira Mendes Research Student Grant, PRAXIS XXI
- Telmo R. C. Cunha Fernandes Lic. Student Final Year Project
- Carlos M. N. Gaspar Ribeiro Lic. Student Final Year Project
- Tiago Miguel Falcão de Sá Lic. Student Final Year Project

Projects

- ITCOM - Integration of Technologies for Mobile Communications. The Optical Communications Research Line participates in activities 3100 and 5100. WP3100 is concerned with the design and implementation of a system for measuring the impulse response and fading in radio propagation channels. WP5100 consists in designing and building an optical transmitter and an optical receiver have been designed for a SCM system in the band of 2GHz for the optical link between the central node and the base stations (*downlink*), included in the cellular subsystem.
- TEMPUS JEP 7589/94 - "Modernisation of Teaching in Electronic Systems for Telecommunications Networks". Joint participation with the Signal and Image Processing Research Line. This is a project in collaboration with the *Institut National des Télécommunications* (INT), Évry, France, and with the University of Mining and Metallurgy (UMM), Krakow, Poland. It started in September 1994, and will be concluded in September 1997. Two BSc. Students from UMM developed their final year project at IT-Coimbra, in 1996. Four members of the teaching staff from UMM visited IT-Coimbra for periods of around six weeks, in order to prepare new teaching programmes. Researchers of IT-Coimbra acted as tutors in an intensive course which took place in Krakow, Poland, in April 1996.

Ph. D. Theses

- Lúcia M. R. A. Martins (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, in preparation (subject: Management of Wide Band Integrated Communications Networks).
- Mário Marques Freire (supervisor: Henrique J. A. da Silva), Universidade da Beira Interior, in preparation (subject: Non Linear Applications of Semiconductor Optical Amplifiers in Multichannel Optical Communications Systems).

M.Sc. Theses

- João C. R. Perdigoto (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, Concluded in 1996 (subject: Performance Analysis of Transport Networks Based on the Synchronous Digital Hierarchy).
- Henrique M. M. Costa (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, Concluded in 1996 (subject: Non Linear Phenomena in Single Mode Semiconductor Lasers).
- António L. F. Marques (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, in preparation (subject: Drive Circuits for Injection Laser Diodes).
- Álvaro M. F. Carvalho (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, in preparation (subject: Solitons in Multichannel Optical Communications Systems).
- João M. A. Martins (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, in preparation (subject: Modelling and Simulation of Digital Switches).
- João M. P. C. Gil (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, in preparation (subject: Wide Band Characterisation of Radio Propagation in Urban and Domestic Environments).
- João G. P. T. dos Reis (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, in preparation (subject: Modelling and Characterisation of Passive Optical Switches).
- Mário C. A. Reis (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, in preparation (subject: Measurement Techniques for Characterisation of Semiconductor Lasers).

- Paulo Mateus Mendes (supervisor: Henrique J. A. da Silva), Universidade de Coimbra, in preparation (subject: Modelling and Simulation of Multichannel Optical Communication Systems).

Publications

Papers in Journals

A. Melo and H. Silva, "Implementação da Estrutura Óptima para Recepção de Rádio Digital por Satélite", *Anais da Engenharia e Tecnologia Electrotécnica - Ordem dos Engenheiros*, Year I, N.º 1, June 1996, pp 17-20.

M. Freire, A. Carvalho, and H. Silva, "Performance Implications of Three-Mirror Fabry-Perot Demultiplexers for 10 Gbit/s WDM Dispersion Supported Transmission with 0,5 nm Channel Spacing", *IEEE Photonics Technology Letters*, Vol. 8, N° 9, pp 1261-1263, September 1996.

M. Freire, J. Carvalho, A. Carvalho, and H. Silva, "Impact of Double Cavity Fabry-Perot Demultiplexers on the Performance of Dispersion Supported Transmission of Three 10 Gbit/s WDM Channels Separated 1nm", *European Transactions on Telecommunications*, February 1997.

Papers in Conference Proceedings

A. Melo and H. Silva, "Optimization of QPSK demodulators for digital satellite radio", *8th Mediterranean Electrotechnical Conference (MELECON '96)*, Bari - Italy, May 13-16, 1996, paper T10.P4.

M. Freire, A. Carvalho, and H. Silva, "Performance Implications of Three-Mirror Fabry-Perot Demultiplexers for Dispersion Supported Transmission of Two and Three 10 Gbit/s Channels Separated 0,5 nm", *Proc. CLEO/Europe - EQEC'96*, Hamburg, Germany, pp. CThI 48, 1996.

L. Mendes and H. Silva "Transmissor LASER e Receptor Óptico Sintonizado para um Sistema SCM em 2GHz", accepted for poster presentation in the I National Conference on Telecommunications (I CNT), 10/11 April, 1997.

A. Marques, L. Mendes, and H. Silva, "Circuito de Controlo de Temperatura de Precisão para LASERs Semicondutores", accepted for poster presentation in the 1st. National Conference on Telecommunications (I CNT), 10/11 April, 1997.

J. Gil, H. Silva, and N. Riley "Sistema de Medição da Resposta a Impulso e de Desvanecimento do Canal no Interior de Edifícios, na Banda de 2.4GHz", accepted for presentation in the 1st. National Conference on Telecommunications (I CNT), 10/11 April, 1997.

J. Reis, and H. Silva "Análise e Simulação de Comutadores e Matrizes de Comutação Ópticos Baseados em Acopladores Direccionais", accepted for poster presentation in the 1st. National Conference on Telecommunications (I CNT), 10/11 April, 1997.

C. Ribeiro, T. Sá, J. Vilela, and H. Silva, "Interface ATM para PC", accepted for poster presentation in the 1st. National Conference on Telecommunications (I CNT), 10/11 April, 1997.

C. M. Freire and H. Silva, “Melhoria de Desempenho da Transmissão Suportada por Dispersão de Quatro Canais WDM a 10 Gbit/s Usando Filtros de Interferência como Desmultiplexadores”, accepted for poster presentation in the 1st. National Conference on Telecommunications (ICNT), 10/11 April, 1997.

M.Freire e H. Silva, “Performance Assessment of High Density Wavelength Division Multiplexing Systems with Dispersion Supported Transmission at 10 Gbit/s”, accepted for presentation at the IEEE Symposium on Computers and Communications (ISCC '97), Alexandria, Egypt, 1-3 July 1997.

Project Deliverables

J. Gil and H. Silva, “System for Measurement of Impulse Response and Fading in Indoor Radio Propagation Channels”, internal report of IT-Coimbra (contribution to WP3100, project ITCOM), December 1996.

L. Mendes and H. Silva, “Laser Transmitter and Tuned Optical Receiver for a SCM System at 2 GHz”, internal report of IT-Coimbra (related to WP5100, project ITCOM), December 1996.

H. Silva, “Coherent Optical Communications”, tutorial included in the intensive course of the TEMPUS project "Modernisation of Teaching in Electronic Systems for Telecommunications Networks", April 1996.

Miscellaneous

- The Optical Communications Research Line of IT-Coimbra participated in two unsuccessful joint applications for funding in the frame of the PRAXIS XXI programme, namely:

- REDOPTICA (Re-Configurable Optical Transport Network), with the Optical Communications Research Line of IT-Lisboa;

- PRISMA (Transmission Interface for Cordless Multimedia System), with Grundig Indústria Portugal and Instituto Pedro Nunes.

9.2.3 Applied Mathematics Research Line

Human Resources

Collaborators

• Maria Teresa Martins	Ph.D.	Associate Professor, FCTUC
• Joaquim Joao Judice	Ph.D.	Associate Professor, FCTUC
• Maria de Nazare Lopes	Ph.D.	Associate Professor, FCTUC
• Maria Esmeralda Goncalves	Ph.D.	Associate Professor, FCTUC
• Madalena Gomes Martins	Ph.D.	Associate Professor, FCTUC
• Maria Celeste Gouveia	Ph.D.	Associate Professor, FCTUC
• Paulo Eduardo Oliveira	Ph.D.	Associate Professor, FCTUC
• Luis Nunes Vicente	Ph.D.	Assistant Professor, FCTUC
• Maria do Ceu Pinto	M.Sc.	Assistant, FCTUC
• Joao Manuel Patricio	M.Sc.	Assistant, FCTUC
• Cristina Maria Martins	M.Sc.	Assistant, FCTUC
• Joao Luis Soares	Lic.	Assistant, FCTUC
• Ana Paula Nascimento	M.Sc.	Assistant, FCTUC
• Maria Cristina Requejo	M.Sc.	Assistant, FCTUC
• Luis Filipe Portugal	M.Sc.	Assistant, FCTUC

Other Collaborators

• Maria Leonor Alves	M.Sc.	Assistant Professor, ISEC
• Luis Merca Fernandes	M.Sc.	Assistant Professor, I.P.S.

Projects

- ALGEBRA - Research activities in this area included : (i) Preconditioning technics to accelerate the convergence of iterative methods. Error bounds for some iterative methods. Iterative methods for the solution of least squares problems. (ii) Drazin invertibility of Toeplitz matrices over commutative rings. Applications to the computation of companion matrices. (iii) Relations between SP-classes of dynamic algebras and the principle of Vopenka. Analysis of the algebraic universality of the category of dynamic algebras.
- OPTIMIZATION - Research activities in this area included: (i) Development and implementation of interior-point methods and preconditioning techniques for linear network and equilibrium problems. (ii) Solution of global optimization problems using complementarity. (iii) Development, analysis of local and global convergence, and implementation of interior-point and trust-region methods for optimal control and engineering design problems. (iv) Minimal spanning tree problem with hop constraints.
- PROBABILITIES AND STATISTICS - Research activities in this area included: (i) Tests and forecasting in conditionally heteroscedatic models for time series. Nonlinear models: statistical and probabilistic analysis. (ii) Convergence of the empirical process functions. Applications to statistics. Conditions for dependence.
- PRAXIS 2/2.1/MAT/346/94 - Solution of linear algebra and optimization problems and applications to structural engineering, genetics, and finance.

Ph. D. Theses

- M. Fernandes, (supervisor: J. J. Judice), Departamento de Matematica da FCTUC, in preparation (subject: Global optimization and complementarity).
- M. Martins, (supervisors: E. Goncalves and N. M. Lopes), Departamento de Matematica da FCTUC, in preparation (subject: Nonlinear models for time series).

- P. Nascimento, (supervisors: M. Hallin and N. M. Lopes), Univ. Livre de Bruxelles, in preparation (subject: Semiparametric statistics).
- L. Soares, (supervisors: S. Ceria), Univ. de Columbia, in preparation (subject: Disjunctive programming).
- F. Portugal, (supervisor: J. J. Judice), Departamento de Matematica da FCTUC, in preparation (subject: Interior-point methods for linear network problems).

M.Sc. Theses

- J. Corado, (supervisor: J. J. Judice) IST Lisboa, concluded in 1996 (subject: Portfolio selection models).
- M. Costa, (supervisor: E. Goncalves), Departamento de Matematica da FCTUC, concluded in 1996 (subject: Jackknife estimation).
- Cruz, (supervisors: A. M. Faustino and J. J. Judice), Univ. Porto, in preparation (subject: Linear and quadratic bilevel).
- Fonseca, (supervisor: J. J. Judice), Departamento de Matematica da FCTUC, in preparation (subject: Quadratic programming and applications).
- M. R. Gama, (supervisor: P. E. Oliveira), Departamento de Matematica da FCTUC, in preparation (subject: Density estimation using orthogonal functions and wavelets).
- M. R. Henriques, (supervisor: P. E. Oliveira), Univ. Porto, concluded in 1996 (subject: Weak convergence of the empirical process).

- M. Morgado, (supervisor: N. M. Lopes), Departamento de Matematica da FCTUC, concluded in 1996 (subject: Linear and nonlinear regression).
- C. Requejo, (supervisor: L. Gouveia), Univ. Lisboa, in preparation (subject: Minimal spanning tree problem with hop constraints).
- C. Ribeiro, (supervisor: M. C. Guedes and J. J. Judice) Univ. Porto, concluded in 1996 (subject: Bilinear and enumerative techniques for linear complementarity problems).
- Santos, (supervisor: J. J. Judice) Univ. Aveiro, in preparation (subject: Portfolio selection models).
- C. Soares, (supervisor: J. J. Judice) Departamento de Matematica da FCTUC, in preparation (subject: Complementarity and variational models).
- P. Teixeira, (supervisors: A. Faustino and J. J. Judice) Univ. Porto, concluded in 1996 (subject: A study of linear complementarity problems using nonlinear optimization).

Publications

Books and Book Chapters

J. E. Dennis and L. N. Vicente, Trust-region interior-point algorithms for minimization problems with simple bounds, Applied Mathematics and Parallel Computing, Festschrift for Klaus Ritter, pp. 97-107, edited by H. Fisher, B. Riedmuller and S. Schaffler, Physica-Verlag, Springer-Verlag, 1996.

L. M. Fernandes, A. P. Lima, and J. J. Judice, On the solution of the monotone and nonmonotone linear complementarity problem, Nonlinear Optimization and Applications, pp. 213-227, edited by G. Di Pillo and F. Giannessi, Plenum Press, 1996.

Papers in Journals

J. E. Dennis and L. N. Vicente, On the convergence theory of trust-region-based algorithms for equality constrained optimization, to appear in *SIAM Journal on Optimization*.

D. J. Evans, M. M. Martins, and M. E. Trigo, On the preconditioned MSOR iterations, *Inter. Jour. of Comp. Math.*, vol. 59, pp. 251-257, 1996.

F. Facchinei, J. J. Judice, and J. Soares, Generating box-constrained optimization problems, to appear in *ACM Trans. Math. Software*.

F. Facchinei, J. J. Judice, and J. Soares, Software for generating box-constrained optimization problems, to appear in *ACM Trans. Math. Software*.

F. Facchinei, J. J. Judice, and J. Soares, An active set Newton's algorithm for large-scale nonlinear programs with box constraints, to appear in *SIAM Journal on Optimization*.

L. Fernandes, A. Fischer, J. J. Judice, C. Requejo, and J. Soares, A block active set algorithm for large-scale quadratic programming with box constraints, to appear in *Annals of Operations Research*.

L. M. Fernandes, J. J. Judice, and J. Patricio, An investigation of interior-point and block-pivoting algorithms for large-scale symmetric monotone linear complementarity problems, *Computational Optimization and Applications*, vol. 5, pp. 49-77, 1996.

E. Gonçalves and N. M. Lopes, Stationarity of GTARCH processes, *Statistics*, vol. 70, pp. 1-8, 1996.

E. Gonçalves, P. Jacob, and N. M. Lopes, A new test for ARMA models with a general white noise process, *Test*, vol. 5, pp. 187-202, 1996.

M. M. Martins, M. E. Trigo, and M. M. Santos, An Error Bound for the SSOR and USSOR methods, *Linear Algebra and its Applications*, vol. 232, pp 131-147, 1996.

M. M. Martins and D. J. Evans, The block successive relaxation - additive iterative method for least square problems, *Inter. Jour. of Comp. Math.*, vol. 62, pp. 89-99, 1996.

K. Murty and J. J. Judice, On the complexity of finding stationary points of nonconvex quadratic programs, *Opsearch*, vol. 33, pp. 162-166, 1996.

P. Oliveira and C. Suquet, An $L_2[0,1]$ invariance principle for LPQD random variables, *Portugaliae Mathematica*, vol. 53, pp. 367-379, 1996.

L. Portugal, F. Bastos, J. J. Judice, J. Paixao, and T. Terlaky, An Investigation of interior-point algorithms for the linear transportation problem, *SIAM Journal on Scientific Computing*, vol. 17, pp. 1202-1223, 1996.

L. Portugal and J. J. Judice, A hybrid algorithm for the solution of a large-scale single commodity equilibrium model, *Computers and Operations Research*, vol. 23, pp. 623-639, 1996.

L. N. Vicente, G. Savard, and J. J. Judice, Discrete linear bilevel programming problem, *Journal of Optimization Theory and Applications*, vol. 89, pp. 597-614, 1996.

L. N. Vicente, A comparison between line searches and trust regions for nonlinear optimization, *Investigação Operacional*, vol. 16, pp. 173-179, 1996.

Papers in Conference Proceedings

E. Gonçalves and N. M. Lopes, Time series with conditionally heteroscedastic errors, Actas do III Congresso Anual da SPM, Col. Novas Tecnologias/Estatísticas, pp. 517-562, 1996.

P. Oliveira and C. Suquet, Le processus empirique uniforme sous de'pendance dans $L_p[0,1]$, Recueil des Communications des XXVIII^{es} Journées de Statistique, Quebec, pp. 568-571, May 1996.

L. Portugal, L. Fernandes, and J. J. Judice, A truncated Newton interior-point algorithm for the solution of a multicommodity spatial equilibrium problem, Proceedings of the International Conference on Complementarity Problems, SIAM Publications, 1996.

Miscellaneous

Technical Reports and Papers Submitted to Publication:

- D. Andrews and L. N. Vicente, Characterization of the smoothness and curvature of a marginal function for a trust-region problem, submitted for publication.

- S. Ceria and J. Soares, Disjunctive cut generation: duality and lifting, submitted for publication.

- S. Ceria and J. Soares, Convex programming for disjunctive optimization, submitted for publication.

- E. Gonçalves and N. M. Lopes, A consistent test for bilinear time series, Departamento de Matematica da FCTUC, Preprint 96-11, 1996.

- M. C. Gouveia, Some results on generalized inverses of Toeplitz matrices, submitted for publication.

- L. N. Vicente, On interior-point Newton algorithms for discretized optimal control problems with state constraints, Departamento de Matematica da FCTUC, Preprint 96-18, 1996.

Presentations in Conferences:

J. J. Corado and J. J. Judice, Portfolio selection models, IO96 APDIO, Aveiro, Portugal, April 1996.

A. M. Faustino, J. J. Judice, and I. Ribeiro, Enumerative and global optimization algorithms for linear complementarity problems, IO96 APDIO, Aveiro, Portugal, April 1996.

L. M. Fernandes, M. C. Guedes, J. J. Judice, and A. P. Teixeira, Solution of linear complementarity problem as a system of nonlinear equations, IO96 APDIO, Aveiro, Portugal, April 1996.

E. Goncalves and N. M. Lopes, A consistent test for bilinear time series, 4th World Congress of the Bernoulli Society, Vienna, Austria, August 1996.

M. C. Gouveia, Regular Hankel matrices over integral domains, 2nd European Congress of Mathematics, Budapeste, Hungary, July 1997.

L. Gouveia and C. Requejo, Redefinition techniques of variables for formulations of the minimal spanning tree problem with hop constraints. A computational experiment, IO96 APDIO, Aveiro, Portugal, April 1996.

J. J. Judice, Merit functions and algorithms for the linear complementarity problem, 5 International Colloquium on Numerical Analysis, Plovdiv, Bulgaria, August 1996.

J. J. Judice, Nonlinear optimization algorithms for the linear complementarity problem 6
Sexto Encontro Nacional da SPM, Lisboa, Portugal, February 1996.

M. C. Martins, On the third-order moment structure of a bilinear model with a non-independent white noise, 4th World Congress of the Bernoulli Society, Vienna, Austria, August 1996.

P. Oliveira e C. Suquet, Le processus empirique uniforme sous de'pendance dans $L_p[0,1]$,
XXVIII^{emes} Journe'es de Statistique, Quebec, Canada, May 1996.

M. C. Pinto, SP-Classes of Kripke Structures and Vopenka Principle Workshop do Projecto
ESCOLA (Projecto Jnict-PBIC/P/MAT/1629/93), Portugal, February 1996.

L. N. Vicente, Trust-region interior-point SQP algorithms with applications to optimal
control, Fifth SIAM Conference on Optimization, Victoria, Canada, May 1996.

9.2.4 Power Systems Research Line

Human Resources

Collaborators

- António João Marques Cardoso Ph.D. Assistant Professor, FCTUC
- André Manuel dos Santos Mendes M.Sc. Student Assistant, FCTUC
- Sérgio Manuel Ângelo da Cruz M.Sc. Student Assistant, FCTUC
- Eduardo de Sousa Saraiva Ph.D. Full Professor, FCTUC

Other Collaborators

- Maria Teresa Barroca Delgado M.Sc, Student
- António Jorge de Sousa Mendes Lic. Student Final Year Project

Projects

- SET-1(Electromagnetic Compatibility) The study of the effects of the electromagnetic field over the human health was continued. As a result a paper was prepared by Eduardo de Sousa Saraiva (to be published in 1997) dealing with the effects over the human body, of electromagnetic fields from 300 Hz to 300 GHz.. The studies related to a M.Sc. thesis in Electromagnetic Compatibility in Industrial Environment were also continued (Maria Teresa Barroca Delgado). Work on the use of C++ for the simulation of electric energy systems was done by a final year student (António Jorge Sousa Mendes).
- PBIC/C/CEG/2441/95 (“Fault Analysis and Diagnostics in Electrical Variable Speed Drives”) - Funded by JNICT (1996/1998), this project is 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 the first year of the project a data acquisition and processing system was developed, concerning voltage and current signals,

which was used during the laboratory tests conducted on power electronics equipment fault diagnosis (rectifiers, semi.converters and fully controlled converters), allowing for the validation of the simulation results also obtained in this domain. Regarding rotor cage fault diagnosis in the three-phase induction motors, methods based on the analysis of rotor speed oscillations as well as on the analysis of axial magnetic flux were explored. The instantaneous electrical power and the electromagnetic torque were also considered. Both simulation and experimental research are being conducted concerning these two quantities,

M.Sc. Theses

- André Manuel dos Santos Mendes (supervisors: António João Marques Cardoso e Eduardo de Sousa Saraiva), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Power Electronics Fault Diagnosis).
- Sérgio Manuel Ângelo da Cruz (supervisor: António João Marques Cardoso), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Rotor Cage Fault Diagnosis in Three-Phase Induction Machines).
- Maria Teresa Barroca Delgado (supervisor Eduardo de Sousa Saraiva), Faculdade de Ciências e Tecnologia da Universidade de Coimbra, in preparation (subject: Manutenção e Compatibilidade Electromagnética em Ambiente Industrial, (some delay due to illness)).

Publications

Papers in Journals

S.M.A. Cruz, A.J.M. Cardoso, “Diagnóstico da Ocorrência de Fraturas na Gaiola Rotórica de Motores de Indução Trifásicos”, Anais da Engenharia e Tecnologia Electrotécnica, N.º.2, pp. 9-12, November 1996.

Papers in Conference Proceedings

A.J.M. Cardoso, A.M.S. Mendes, “On-Line Diagnostics of Three-Phase Diode Rectifiers, by Park’s Vector Approach”, Proceedings of the International Conference on Electrical Machines, Vigo, Spain, Vol. 3, pp. 433-438, September 10-12, 1996.

A.J.M. Cardoso, A.M.S. Mendes, “Semi-Converter Fault Diagnosis in DC Motor Drives, by Park’s Vector Approach”, IEE Sixth International Conference on Power Electronics and Variable Speed Drives, Nittingham, UK, IEE Conference Publications N° 429, pp. 93-98, September 23-25, 1996.

S.M.A. Cruz, A.J.M. Cardoso, “Diagnóstico de Avarias no Rotor de Motores de Indução Trifásicos”, 5º Congresso Nacional de Manutenção Industrial, Figueira da Foz, Portugal, Tema G, Comunicação N° 19, October 23-25, 1996.

A.M.S. Mendes, A.J.M. Cardoso, “ Manutenção de Equipamentos Trifásicos de Electrónica de Potência”, 5º Congresso Nacional de Manutenção Industrial, Figueira da Foz, Portugal, Tema G, Comunicação N° 20, October 23-25, 1996.

Miscellaneous

- António João Marques Cardoso served as reviewer of papers for the IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS and for the IEEE TRANSACTIONS ON POWER ELECTRONICS for 1996.

- António João Marques Cardoso was actively involved, as an expert, in the field of standardisation on condition monitoring and diagnostics, both as a national and international level, where he has been acting as a convener of ISSO/TC108/SC5 Advisory Group C (Condition monitoring of electrical motors and generators, for the purposes of diagnostics) and member of several Working Groups of ISO, IEC and CEN.

- António João Marques Cardoso served as member of the Overseas Advisor Panel of Condition Monitoring and Diagnostic Technology, a former journal published by the British Institute of Non-Destructive Testing, now incorporated into INSIGHT.

- António João Marques Cardoso served as founder member of the European Consortium for Research on Condition Monitoring of Electrical Systems and Drives.

- Eduardo de Sousa Saraiva was member of the Editorial Board of ANAIS DA ENGENHARIA E TECNOLOGIA ELECTROTÉCNICA, a periodical of ORDEM DOS ENGENHEIROS, the Portuguese engineering professional organization.

- Eduardo de Sousa Saraiva was the Coordinator of Electromechanics, in ORDEM DOS ENGENHEIROS, and a member of the Access Examination Board, for the same area of Electrical Engineering.

- António Jorge Sousa Mendes developed a program for the detailed simulation of electric energy systems, using C++ and modular structures (student final year project) “Detailed Simulation of Electrical Energy Systems with a Modular Structure”.

9.3 Aveiro Pole

9.3.1 Radio, Microwaves and Millimetre waves Research Line

Human Resources

Collaborators

- | | | |
|--------------------------|--------|---------------------------|
| • José Carlos Neves | Ph. D. | Associate Professor, U.A. |
| • José Rocha Pereira | Ph. D. | Associate Professor, U.A. |
| • José Carlos Pedro | Ph. D. | Assistant Professor, U.A. |
| • João Nuno Matos | Ph. D. | Assistant Professor, U.A. |
| • Armando Domingos Rocha | Ph. D. | Assistant Professor, U.A. |
| • José Joaquim Fernandes | Lic. | Assistant, U.A. |
| • Manuel Jesus Dinis | Lic. | Senior Engineer, P.T. |
| • Luis Travassos | Lic. | Senior Engineer, P.T. |

Other Collaborators

- | | | |
|--------------------------|----------------|-------------------|
| • Nuno Borges Carvalho | Ph. D. Student | Grant, PRAXIS XXI |
| • Luis Ramos Gomes | M.Sc. Student | Grant, JNICT |
| • Carla Raquel Madureira | M.Sc. Student | Grant, I.T. |
| • Arlindo Marques | M.Sc. Student | Grant, PRAXIS XXI |
| • Paulo Marques | M.Sc. Student | Grant, PRAXIS XXI |
| • Victor Santos | M.Sc. Student | Grant, PRAXIS XXI |
| • Francisco Costa | M.Sc. Student | Grant, IT |
| • António Costa | M.Sc. Student | Grant, PRAXIS XXI |

• Ilidio Chaves	Research Student	Grant, I.T.
• Mário Santos	Research Student	Grant, I.T.
• Abel Joaquim Gomes da Costa	Lic. Student	Final Year Project
• Domingos Jorge Ferreira Lemos	Lic. Student	Final Year Project
• Paulo Manuel Azevedo Matos	Lic. Student	Final Year Project
• Paulo José Henriques Jesus	Lic. Student	Final Year Project
• Miguel Macedo	Lic. Student	Final Year Project
• Ana Paula Reis	Lic. Student	Final Year Project
• José Ferreira	Lic. Student	Final Year Project
• Pedro Tavares	Lic. Student	Final Year Project
• Pedro Alexandre	Lic.. Student	Final Year Project
• António Gabriel Augusto	Lic.. Student	Final Year Project

Projects

- ITCOM - *“Integration of Technologies in Mobile Communications”* Design and implementation of a high efficiency MMIC power amplifier for the demonstrator’s mobile handset using the GEC Marconi F20 GaAs Process. Preliminary studies for the design of a fast switching frequency synthesiser. Preliminary MIC design of an high dynamic range optical return link to be inserted between the base-station and the central station. Study of the diffraction and transmission phenomena to include in a propagation simulation tool and development of an user interface for the tool.
- DISERT - *“Television Services Distribution System”*. Design and implementation of the Tuner and Re-allocation modules. Design and implementation of a first coaxial distribution prototype version.
- CORAL - *“Radio Communications for a Wide Band Local Access”*. Characterisation of the radio propagation channel at 1.5 GHz. Definition of the demonstrator’s specifications.

- COLORS - *"Spread Spectrum System for ISDN Local Loop"*. Preliminary work on the system's identification. Adaptation of the RF modules developed under a previous project: RALIS.
- LIRA - *"Linearity and Efficiency in Power Amplifiers"*. Design, implementation and test of an MMIC highly efficient power amplifier module. Since this circuit was intended for mobile handset applications, it was designed for low voltage battery supplies. GaAs MESFET physical modelling for studying the dependence of linearity on the channel doping profile. This studies assumed, on one hand, the simultaneous numerical solution of the unidimensional semiconductor drift-diffusion model equations. And on the other hand, the analytical solution of the same equations using the depletion region approximation. Development of a in-house non-linear circuit simulator using the Spectral-Balance engine. This simulator is mainly driven by the necessity of simulating the steady-state response of an RF or microwave circuit excited by a complex signal composed of a large number of tones.
- ACTS 204 - SAMBA *"System for Advanced Mobile Broadband Communications"*. Generation of Power Delay Profiles (PDP) for the system Trial Platform definition. Study of antenna diversity and signal combining techniques in outdoor environments. Definition of the signals for testing and trial evaluation.
- ISAC - *"Implementation Aspects of a Mobile Telecommunications Satellite System Payload with Dynamic Channel Allocation"*. Project ISAC has just started. It was approved exactly at the end of the year.
- COST 252 *"Evolution of Satellite Personal Communications from Second to Future Generations Systems"*. Participation in the kick-off meeting and definition of the project activities and IT contributions.
- COST 245 *"Active Phased Arrays and Array Feed Antennas"*. Modelling and implementations of a patch antenna.

- COST 255 “*Radiowave Propagation Modelling for New SatCom Services at Ku-Band and Above*”. Participation in the kick-off and first meetings. Definition of the project activities and IT contributions.

Ph.D. Theses

- Armando Domingos da Rocha, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro.
Concluded in 1996 (subject: Propagations Studies in the Atmosphere at 12, 20 and 30GHz).
- Paulo Grilo Domingues, (supervisor: Dr. José Carlos Pedro and Dr. Aníbal Oliveira Duarte), Universidade de Aveiro.
Concluded in 1996 (subject: Design of Highly Linear Optical Receivers).
- José Joaquim Fernandes, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro
Concluded in 1996 (subject: Indoor Mobile Communication Systems in Millimetre Wave Band).
- Manuel Jesus Dinis, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro
In preparation (subject: Mobility and Resource Management in Mobile Satellite Systems for Global Communications).
- Borges de Carvalho, (supervisor: Dr. José Carlos Pedro), Universidade de Aveiro
In preparation (subject: Nonlinear Distortion Studies of RF Power Amplifiers Driven by a Large Number of Tones).

M.Sc. Theses

- Luís Miguel Gomes, (supervisor: Dr. José Carlos Pedro), Universidade de Aveiro
In preparation, (subject: High Efficiency RF Power Amplifiers for Mobile Communications Handsets).
- Carla Raquel Madureira, (supervisor: Dr. José Carlos Pedro), Universidade de Aveiro
In preparation, (subject: Nonlinear Modelling and Linearisation of Analogue LASER Diodes).
- Arlindo Marques, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro
In preparation, (subject: Characterisation of Diffuse Reflection in Rough Surfaces).
- Francisco Costa, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro
In preparation, (subject: Mobility Management in Mobile Satellite Networks).
- António Arsénio Costa, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro
In preparation, (subject: Inter-satellite Handover Implications in Mobile Satellite Networks).
- Paulo Marques, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro
In preparation, (subject: Wideband Propagation Channel Modelling for the Millimetrewave Band).
- Victor Santos, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro
In preparation, (subject: Resource Management in Mobile Satellite Constellations).
- Ilidio Chaves, (supervisor: Dr. José Carlos Neves), Universidade de Aveiro.
In preparation, (subject: Mobility Management in Mobile Satellite Constellations)

Publications

Papers in Journals

J. Fernandes and J. Neves, "Modelo de Propagação de Banda Larga para a Faixa das Ondas Milimétricas", Submitted to Revista do DETUA, Universidade de Aveiro.

N. Borges and J. Pedro, "Alternativa ao SPICE para Simulação do Estado Estacionário de Circuitos Não-lineares", Submitted to Revista do DETUA, Universidade de Aveiro.

Papers in Conference Proceedings

N. Carvalho, R. Madureira and J. Pedro, "Prediction of PLL Frequency Discriminator Nonlinear Distortion Using the Volterra Series Approach", Proceedings of the 1996 Intern. Symp. on Circuits and Systems, Vol. 3, p.229-232, Atlanta 1996.

M. Dinis, I. Chaves, F. Costa and J. Neves, "Location and Paging Area Definition and its Impact on Mobile Satellite Networks Mobility Management Signalling", VTC '96, Vol. 1, p. 91-95, Atlanta, April 1996.

A. Rocha and J. Neves, "Propagation Channel Characterisation by using Satellite Multifrequency Beacon Measurements", Progress in Electromagnetics Research Symposium '96 Proc., p. 434-434, Innsbruck, 1996.

A. Rocha and J. Neves, "Propagation Channel Characterisation by XPD Frequency Scaling", XXVth General Assembly of The International Union of Radio Science, p. 319-319, Lille, August 1996.

A. Rocha and J. Neves, "Scintillation Results for a Medium Elevation Earth-Satellite Link" 1996 IEEE Antennas and Propagation International Symposium and URSI Radio Science Meeting - URSI-Comission F - URSI Digest,, USA National Committee e International Union of Radio Science, p. 140-140, Batimore, 1996.

G. Brussard , J. Neves, et al., "A New Techynique for Crosspolarizatrion Frequency - Scaling Based on the Separation of Rain - and Ice-Effects: Theory and Experimental

Results” (invited paper) XXVth General Assembly of The International Union of Radio Science, Lille, August, 1996.

A. Arsénio, M. Dinis and J. Neves, "Gestão de “handovers” inter-satélite em Sistemas de Comunicações Móveis por Satélite não geoestacionários" Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

N. Carvalho and J. Pedro, "Simulação da Resposta Estacionária de Circuitos Não-Lineares de Rádio-Frequência - Estado da Arte 1996 - ", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

N. Carvalho and J. Pedro, "Simulação de Circuitos Não-Lineares para Aplicação em Comunicações Móveis", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

C. Caseiro, P. Torres, J. Fernandes, R. Dinis, and A. Gusmão, "Avaliação de uma Técnica de Controlo de Erros para o MBS", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

F. Costa, M. Dinis and J. Neves, "Gestão de Mobilidade em Sistemas de Comunicações Móveis Usando Redes de Satélites", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

M. Dinis, J. Fernandes, L. Travassos, J. Neves and V. Lagarto, "Sistema de Comunicações Móveis para Aplicações de Banda Larga", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

J. Fernandes and J. Neves, "Avaliação do Impacto do Cenário e das Antenas no Desempenho de Transmissão", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

J. Fernandes and J. Neves, "New Wide-band Propagation Channel Model for the mm-Wave Band", Submitted to 2nd MATHMOD VIENNA, Feb. 1997.

J. Ferreira, P. Tavares, V. Santos, M. Dinis and J. Neves, "Estudo e Modelos de Tráfego para Redes de Satélites que Usem Constelações do Tipo LEO e ICO", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

A. Marques, J. Fernandes, Rocha and J. Neves, "Caracterização das Reflexões em Superfícies Rugosas", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

P. Marques, J. Fernandes and J. Neves, "Diversidade Espacial em Sistemas de Comunicação Móveis de Banda Larga", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

J. Pedro, N. Carvalho and R. Madureira, "Nonlinear Distortion Study of FM Transmission Systems Composed By a VCO-PLL Association", Submitted to 1997 International Symposium on Circuits and Systems, Hong-Kong, 1997.

J. Pedro, "Análise de Cascatas de Quadripolos Fracamente Não-Lineares", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

J. Pedro and P. Domingues, "Distorção Não-Linear em Amplificadores Multioitava a GaAs MESFET", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

V. Santos, M. Dinis and J. Neves, "Gestão de Recursos em Sistemas de Comunicação Moveis via Satélite", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

R. Silva, M. Dinis and A. Gameiro, "Dimensionamento de Sistemas Baseados em Spread Spectrum para RDIS", Submitted to I Conferência Nacional de Telecomunicações, Aveiro, IT, 1997.

Project Deliverables

J. Fernandes, "Contribution for the Budget Link and Antenna Configuration Definition", SAMBA Internal Report, SAMBA/IT211011, August, 1996.

J. Fernandes, "Signals for Testing and Trial Evaluation", SAMBA Internal Report, SAMBA/IT325021, October, 1996.

M. Dinis, M. Proegler, "Interproject Relationships", SAMBA Deliverable DE00, September, 1996

9.3.2 Networks Research Line

Human resources

Collaborators from CET

- Artur Calado Lic. Director, Network and Services Management
- Henrique Sousa Lic. Director, Systems and Infrastructure Development
- Luís Silva Lic. HoG, Network and Services Management Systems
- Marcelino Pousa Lic. HoG, Access Network Systems
- Pedro Carvalho Lic. HoG, Multimedia Laboratory
- António Vidal Lic. HoG, ATM Systems
- Nuno Silva Lic.
- Telma Mota Lic.
- Laura Paiva Lic.
- José Fernandes Lic.
- Jorge Gonçalves Lic.
- José Maio Lic.
- Ricardo Afonso Lic.

HoG-Head of Group

Other collaborators

- Augusta Manuela M.Sc. student
- António Carvalho Researcher
- Bernardete Tavares M.Sc. student
- Helder Biscaia M.Sc. student
- Maria Areias Researcher
- Lisa Silva Researcher
- António Lopes Researcher
- José Cunha Researcher

- Manuel Aguiar Researcher
- Vitor Oliveira Researcher
- Gustavo P. Basto Researcher
- Alfredo França Researcher
- Frederico Costa Researcher
- António Rocha Researcher
- José Santos Researcher
- Paulo Rocha Researcher
- Alexandre Almeida Researcher
- Jorge Carvalho Researcher

Projects

- TESTE - DSP algorithm for copper pairs testing Project sponsored by Portugal Telecom. The project started with the study of the techniques applicable for the identification and localisation of problems in twisted pair copper cables. TDR was found to be the most feasible and thus the effort has been directed towards a system based on this technique. The hardware for the DSP platform was specified, as well as the associated algorithm. The following modules were specified: Signal reception (echos plus test signal). Test signal emission. Communication with the PC.
- PLANRI - Intelligent Networks Planning Project sponsored by Portugal Telecom, jointly executed with CET. The following results were achieved: Project feasibility study, which produced a detailed project plan Configuration and testing of the involved equipment and tools, including ORACLE 7 RDBMS, Developer 2000, SQLnet Specification and development of the database. Development of the database GUI. Specification of the module for the dimensioning of the SS#7 network. Specification of the PSTN algorithms (“Public Stwicked Telephone Network”): Development of a class of sockets supporting the client server communication.

- MUXATM- ATM services multiplexer. Project sponsored by Portugal Telecom, jointly executed with CET The following results were achieved: Implementation of the VME communications drivers for Windows NT. Implementation of the driver for IP transport over ATM. Implementation of the MUXATM SNMP agent and MIBs. First version of the MUXATM manager. MEGABIT -Management of a 2 Mbits cross-connect Project sponsored by Portugal Telecom, jointly executed with CET The following results were achieved: Implementation of the management system database. Implementation of the MEGABIT SNMP agent and MIBs. Development of the network management application “MEGABIT BASE”. Development of the service management application “MEGABIT CIRCUITS”
- GISA - Management of Integrated SDH and ATM networks. Related with MISA ACTS project, IT acting as CET subcontractor. Coordination of the activity responsible for the definition of the QSDH interface (between the SDH OS and MISA OS), for the areas of Configuration Management (path provisioning) and Fault Management (alarm surveillance) Final edition of the path provisioning Ensemble for the QSDH interface. Contribution for the definition of QATM interfaces (between the ATM OS and MISA OS) and XCOOP (between different MISA Oss). Description of testing scenarios for the QSDH interface. Description of the RIA ATM trial infrastructure. Execution of interoperability tests with other project partners (concerning the OSI application layer). Implementation and demonstration of the QSDH interface path provisioning agent
- SUGESTÃO - Support for the development of the RIA ATM OS. Sponsored by Portugal Telecom, in collaboration with CET. The following results were achieved: Specification of the interface between the Network Element OS and the RIA ATM cross-connect Element Adaptor. Specification and development of the SNMP agent for the Element Adaptor. Design and implementation of a JAVA based GUI for path provisioning and alarm surveillance in the XCOOP system.
- VITAL/LATIV - Development of a prototype for the validation of the TINA architecture. Related with ACTS VITAL project. IT is a project partner, involved in the development of support applications that will exercise the platform; it also provides collaborative effort with CET (LATIV) for the specification and development of some modules of the TINA

architecture. Main results:. Specification and development of a first version of the Whiteboard application. Contribution for the specification and implementation of a Connection Coordinator (computational object of the TINA Communications Architecture).

M.Sc. Theses

- Jorge Gonçalves (supervisor: Prof. José Craveirinha, Eng Paulo Nordeste), Universidade de Aveiro
In preparation (subject: Performance evaluation of an ATM Multiplexer).
- Laura Paiva (supervisor: Prof. Joaquim Arnaldo Martins), Universidade de Aveiro
In preparation (subject: Application of CORBA in TMN).
- Telma Mota (supervisor: Prof. Carlos Ruela), FEUP
Concluded in 1996 (subject: TINA Architecture).

Publications

Papers in Conference Proceedings

Telma Mota, TINA'96 Conference :“Migration scenarios for evolving to TINA”.

Miscellaneous

-IT has sent to Red Bank (USA), headquarters of the TINA Consortium, a representative to give a presentation and discuss the work carried out in the area of Connection Management Architecture.

9.3.3 Optical Communications Research Line

Human resources

Collaborators from associated institutions

• José Ferreira da Rocha	PhD	Full Professor, UA
• Mário Rui Ferreira	Lic.	PT-CET Senior Engineer
• Atílio da Silva Gameiro	PhD	Assistant Professor, UA
• Paulo Pereira Monteiro	Lic.	Assistant, UA
• Rui F. Gomes Ribeiro	PhD	Assistant Professor, UA
• Rui Valadas	PhD	Assistant Professor, UA
• Ana Geração	Lic.	PT-CET Engineer
• Teresa Almeida	Lic.	PT-CET Researcher

Other Collaborators

• António Manuel Tavares	PhD Student	Grant Praxis XXI
• António Domingos Reis	PhD Student	Assistant, U.B.I.
• António Teixeira	PhD Student	Grant, Praxis XXI
• Artur Sousa	PhD Student	
• Adriano Moreira	PhD Student	Assistant, Univ. Minho
• Cipriano Lomba	PhD Student	Grant, Praxis XXI
• Paula Couto	PhD Student	
• Carlos A. de Oliveira	M.Sc Student	
• Jorge Barriga	M.Sc Student	Engineer, Radiomóvel
• António Oliveira	M.Sc Student	Engineer, Portugal Telecom
• Pedro Antunes	Research Student	Grant, IT
• João Miguel Figueiredo	Researcher Student	Grant, IT
• Pedro Tavares	Researcher Student	Grant, IT
• Mário Lima	M.Sc Student	

- Pedro Ribau M.Sc Student Grant, IT
- Albano Loureiro Research Student Grant, PRAXIS XXI

Projects

- *UPGRADE Funding: European Union Objectives:* Project AC045/UPGRADE is a 3 year project whose main objective is to expand in capacity and distance the presently existing transport networks based on standard optical fibers, through the practical implementation of 10Gbit/s STM-64 hierarchy. The project will have a demonstrator that will consist of an international link between Madrid and Lisbon, operating with real traffic at 10Gbit/s using 1300nm soliton transmission. IT Aveiro namely the Optical Communication Research Line participates in the two following activities: WP330-Optical RZ Front-Ends and WP 410-Components for All-Optical Functionality. *Activities during 1996:* WP 330: Characterization of the photodiodes to be used in the transimpedance configurations were characterized. Single input and differential amplifiers were considered. Some optical heads prototypes were mounted using double-PAD photodiodes. The electrical characterization of these circuits has given good results. The use of post-detection filters in the receiver has proven to be adequate for soliton transmission giving a significant improvement. WP 410: Analytical and simulation work was carried out to study new soliton generation techniques along with their technological requirements and complexity. Among the techniques considered the use of double cavity high Q filters did not fulfill the system requirement, and then self-pulsating devices electrically controlled though an injection current were considered. This turned out to be a promising solution in terms of the project requirements and will be the object of further development during 1997. This will allow to pursue the clock recovery tests with 40GHz signals in order to obtain an all-optical clock recovery circuit.
- *EMITON Funding: Portugal Telecom Objectives:* The project EMITON has for objective the development of a transmitting prototype for high speed transmission systems based on soliton technology. Besides the development of the soliton transmitter prototype studies on very high bit rate (10Gbit/s) optical modulation techniques adequate to operation in real systems will be carried out. *Activities during 1996.* Project EMITON started in

October 1996. During the first trimester only two activities have been carried. The main work has been on one side in the preparation of the laboratory to create a working bench to carry out the development of the project, and on the other side related to a reviewing of the literature to select the technological options for the development of the optical short pulses generator. A three phase development has been defined: direct modulation of the laser, external modulation with a Mach-Zender modulator and then use of a MZ modulator with dispersion compensation through fiber. Some of these components have been selected and purchased. Some experiments on direct modulation of a 1300nm (because the 1550nm device was not available) laser were carried out. With the existing RF equipment difficulties arose to generate short pulses. Work is planned to perform the adaptation of a 10GHz generator to produce shape controlled short optical pulses. A lack of knowledge on this topic was recognized and further literature reviewing is intended. Also it is planned to rely on some experience and results obtained within the UPGRADE project in spite of some different technological options because of the 1300nm operation for this latter project. A deliverable with the first results on the analysis of the different techniques used to generate solitons and with the results of the experiments carried so far was produced.

- **ITCOM:** *Funding:* JNICT. *Objectives:* This project aims at the integration of different enabling technologies for the development of third generation wireless systems (indoor and outdoor). The contributions of the optical communications research line for the project lie in the construction of optical links to transport the RF signals between remote antennas and central station, and the development of an infrared WLAN. *Activities during 1996:* As concerns the task related to the development of optical transport links, there has been a close collaboration between ITCOM and a project going on at the DETUA. The main achievements were the design of the receiver and a first version of the transmitter. The components to be used in the two modules were selected. Relatively to the development of the IRWLAN, studies were performed to obtain an adequate characterization of the indoor optical channel, namely: propagation characterization, development of techniques to optimize the spatial power distribution, characterization of noise and interference produced by lamps. The specification of the medium access protocol was carried out, and the development of the optical infrared transceivers, medium access controller, and Ethernet access point was started.

- CORAL: *Funding:* Portugal Telecom *Objectives:* This project is carried out by researchers from the Optical Communication and Radio research lines. The main objective of the project is the development of an asymmetric capacity and complexity link to distribute through fading channels wideband signals to subscribers equipped with low cost transceivers. *Activities during 1996:* The project started in November 1996, and the activities carried on were on the identification and characterization of scenarios where the system to be developed could be used.
- COMUNICAÇÕES RÁDIO PARA ACESSO LOCAL DE BANDA LARGA. *Funding:* JNICT. *Objectives:* This project has as main objective research on advanced signal processing techniques adequate to be used on asymmetrical systems like the one proposed to be developed by CORAL project. Among the techniques to be considered we point: precoding at the transmitter to compensate the fading, channel estimation techniques and modulation techniques with superior performance with non-coherent detection. *Activities during 1996:* The main research activities during 1996 focused the use of modulation techniques suitable to differentially coherent demodulation. Results were obtained in terms of the specification of pulses that allow a performance identical to DBPSK along with superior spectral characteristics, namely much sharper out of band roll off.
- COLORS *Funding:* Portugal Telecom. *Objectives:* This project is carried out by researchers from the Optical Communication and Radio research lines. The project lies in the area of wireless local loops and the main objective of the is the development of a direct sequence spread spectrum radio connection for distribution of basic ISDN signals. *Activities during 1996:* The project started in July 1996, and since then the activities have been mainly the system definition and start of the design of some of the system modules. The main achievements were the following: - Specification of the system's architecture and performance. - Specification of the IF-RF module for the subscriber's transmitter.- Specification of the interface ISDN (2B1Q) spreading module. - Selection and purchase of components for the above referred modules.
- DISERT *Funding:* TEKA Portuguesa. *Activities during 1996:* The structure of the high capacity fiber based distribution system was defined.

Ph. D. Theses

- Rui Jorge Morais Tomaz Valadas (Supervisor: A. Manuel de Oliveira Duarte)
Universidade de Aveiro. Concluded 1995 approved 1996, Thesis subject: Infrared Wireless Local Area Networks.
- Rui F. G. S. Ribeiro (Supervisor: Prof. J. Ferreira da Rocha) Universidade de Aveiro
Concluded and approved 1996 Thesis subject: Simulation, Analysis and Optimization of Optical FSK Systems.
- Adriano Jorge Cardoso Moreira (Supervisor: A. Manuel de Oliveira Duarte e Rui Jorge Morais Tomaz Valadas) Universidade de Aveiro. Ongoing Thesis subject: Free Space Optical Transmission Systems for Indoor .
- Cipriano Rogério Alves Tavares Lomba (Supervisor: A. Manuel de Oliveira Duarte e Rui Jorge M. Tomaz Valadas) Universidade de Aveiro. Ongoing. Thesis subject: Infrared Communication Systems: Characterization, modeling, simulation and optimization.
- António Manuel Rodrigues Tavares (Supervisor: A. Manuel de Oliveira Duarte e Rui Jorge Morais Tomaz Valadas) Universidade de Aveiro. Ongoing. Thesis subject: Free Space Optical Transmission Systems for Indoor: Angle Diversity Use.
- Paulo Miguel Nepomuceno Pereira Monteiro (Supervisor: J. Ferreira da Rocha) Universidade de Aveiro. Ongoing . Thesis subject: Multigigabit Optimum Optical Receivers.
- António Domingos Reis (Supervisor: J. Ferreira da Rocha e Atílio Gameiro) Universidade de Aveiro. Ongoing Thesis subject: Synchronization and Line Coding for High Bit Rate Systems.

- António Teixeira (Supervisor: J. Ferreira da Rocha) Universidade de Aveiro. Ongoing. Thesis subject: Optical Equalization for WDM Systems.

M.Sc. Theses

- Paula Cristina da Silva Couto (upervisor: Rui Jorge Morais Tomaz Valadas) Universidade de Aveiro Concluded and approved 1996 Thesis subject: Wireless Local Area Networks: Study and development of sublayer MAC IEEE 802.11.
- Artur Neves de Sousa (Supervisor: J. Ferreira da Rocha) Universidade de Aveiro. Concluded and approved 1996 Thesis subject: Line Codes for Optical FSK Systems with Direct Laser Modulation.
- Jorge Barriga (Supervisor: J. Ferreira da Rocha) Universidade de Aveiro. Concluded and approved 1996 Thesis subject: Evolutionary Optical Network for Subscriber's.
- António Francisco Pinto de Oliveira (Supervisor: J. Ferreira da Rocha) Universidade de Aveiro. Ongoing Thesis subject: Optical Technology Impact on Wireless Networks.
- Mário Lima (Supervisor: J. Ferreira da Rocha) Universidade de Aveiro. Ongoing Thesis subject: Clock Recovery Systems for Multigigabit Communications.

Publications

Papers in Journals

Adriano J. C. Moreira, Rui T. Valadas, A. M. de Oliveira Duarte, "Optical Interference Produced by Artificial Light", ACM Wireless Networks Journal, Baltzer Science Publishers, Accepted for publication.

Adriano J. C. Moreira, Rui T. Valadas, A. M. de Oliveira Duarte, "Performance of Infrared Transmission Systems Under Ambient Light Interference", IEE Proceedings J - Optoelectronics, vol. 143, no 6, December 1996, pp. 339-346.

Rui T. Valadas, António R. Tavares, A. M. de Oliveira Duarte, "Angle Diversity to Combat the Ambient Noise in Indoor Optical Wireless Communication Systems", International Journal of Wireless Information Networks, Plenum Press, Accepted for publication.

J. Figueiredo, A. Perpétua, R. Aguiar, A. Gameiro, "Extractor de relógio versátil", Revista do DETUA, nº6, Set.. 1996, pp.589-594.

A.Teixeira, G.P.Agrawal, J.F. da Rocha, "Increasing soliton transmission distance of soliton communication systems", Electronics Letters, 1996.

A.Teixeira, M. Lima, N. Matos, P.Monteiro, J.da Rocha,"Realização em tecnologia monolítica de Arsieneto de Gálio (GaAs MMIC) de amplificadores sintonizados para recuperadores de relógio a 10 e 20 Gbps", Revista do DETUA, Vol.1, N' 6, Setembro de 1996.

Rui Valadas, Adriano Moreira, Cipriano Lomba, António Tavares, Luís Moreira, Carlos Oliveira, Rui Aguiar, Amaro de Sousa, A. M. de Oliveira Duarte, "Contribuições da Universidade de Aveiro para a Especificação da Rede de Área Local não-cablada IEEE 802.11", Revista do Departamento de Electrónica e Telecomunicações da Universidade de Aveiro. Accepted for publication.

Papers in conference proceedings

A. Gameiro, "Differentially Coherent Detection for SFSK Signals", International Conference on Telecommunications, ICT'96, Istanbul, Turkey, 14-17 April 1996, pp. 379-384.

L. F. Ribeiro, A. N. Pinto, J. F. Da Rocha and J. L. Pinto, "Tecnologia fotónica para sistemas de comunicação de alto débito", Física'96, Faro, Portugal.

A. N. Pinto and J. F. Da Rocha, "Timing jitter statistics due to soliton interaction and Gordon-Haus effect", NOC'96, Heidelberg, Germany.

A. N. Pinto, G. P. Agrawal and J. F. Da Rocha, "Analytical and numerical study of timing jitter in soliton communications", OSA'96, Rochester, USA.

Adriano Cardoso Moreira, Rui Tomaz Valadas, A. M. de Oliveira Duarte, "Reducing the Effects of Artificial Light Interference in Wireless Infrared Transmission Systems", Proceedings of the IEE Colloquim on Optical Free Space Communication Links, Savoy Place, London, UK, February 19, 1996, pp. 5/1-5/9.

Rui T. Valadas, "Interference Modelling for the Simulation of IEEE 802.11 Infrared Local Area Networks", Proceedings of the Seventh IEEE International Symposium on Personal, Indoor and Mobile Communications, PIMRC'96, Taipei, Taiwan, October 15-18, 1996, pp. 257-261.

Rui Valadas, Adriano Moreira, Carlos Oliveira, Luís Moreira, Cipriano Lomba, António Tavares, A. M. de Oliveira Duarte, "Experimental Results of a Pulse Position Modulation Infrared Transceiver", Proceedings of the Seventh IEEE International Symposium on Personal, Indoor and Mobile Communications, PIMRC'96, Taipei, Taiwan, October 15-18, 1996, pp. 252-256.

A. Gameiro, "Performance Evaluation of an improved ARQ Technique to Control Errors in Integrated Service Packet Networks", Proceedings of MELECON'96, Bari, Italy, May 1996.

A. Gameiro, "Differential detection of precoded MSK-type modulated signals in Rician channels", International Conference on Millimeter and Submillimeter Waves and Applications, Denver, USA, Ag. 1996.

A. Gameiro, "Optimum Phase Tracking of Sinewaves Corrupted by Cyclostationary Disturbances", Proceedings of ISITA'96, pp. 258-261, Victoria, Canada, Sept. 96.

A.Teixeira, G.P.Agrawal, J.Ferreira da Rocha, "A novel scheme for increasing soliton transmission distance of soliton communication systems", CThF2, CLEO, Hamburgo, 9-13 de Setembro 1996.

A.Teixeira, J.F.da Rocha, "Two soliton behaviour in presence of a frequency shift", SPIE, Boston, 18-22 November 1996.

MONTEIRO, Paulo; BORJAK, Assaad; ROCHA, José da; O'REILLY, John; DARWAZEH, Izzat; Pulse shaping distributed based transversal filter for optical soliton system, Conference proceedings 26th European Microwave Conference, Setembro 1996, pp. 409-412.

MONTEIRO, Paulo; BORJAK, Assaad; ROCHA, José da; O'REILLY, John; DARWAZEH, Izzat; Microwave Pulse Shaping Filters for Multigigabit Optical Systems; NOC'96 - Conference proceedings of European Conference on Networks & Optical Communications, Junho de 1996, na Alemanha, pp. 232-239.

Deliverables

CORREIA, João; GOULART, Paulo; CARTAXO, Adolfo; MONTEIRO, Paulo; ROCHA, José; Partial Response Techniques for Dispersive Optical Transmission, Deliverable n.º 08 of ACTS project n.º AC049 - Superhighway by Photonically and Electronically Enhanced Digital Transmission (SPEED), Sept. 96.

BAUMHEIRICH, T.; LANGMAN, U.; CEBULLA, U.; GEUPEL, H.; POHLMANN, W.; WEDDING, B.; CORREIA, J.; CARTAXO, A.; LIMA, M.; TEIXEIRA, A.; MONTEIRO, P., RIBEIRO, ROCHA, Jose F. da; Monolithic circuit concepts for 40 Gbit/s ETDM/DST transmission including and analytical comparison of m-valued circuit concepts (m=2,3,4), Deliverable n.º 05 of ACTS project n.º AC049 - Superhighway by Photonically and Electronically Enhanced Digital Transmission (SPEED), June 96.

J. Pires, W. Idler, A.Teixeira, R. Ribeiro, F. da Rocha, "D09: Report on TDM Vs WDM systems", Deliverable of SPEED, November of 1996.

Paper Review

International Journal of Wireless Information Networks, Plenum Press, special series on Infrared Communications (Rui Valadas).

9.3.4 Electronic and Opto-electronic Components Research Line

Human Resources

Collaborators

- João Lemos Pinto PhD Associate Professor, UA
- José Marcelino Pousa Lic. Researcher, CET
- Luis Filipe Botelho Ribeiro PhD Invited Assistant Professor, UA

Other Collaborators

- Armando Nolasco Pinto PhD Student Grant, Praxis XXI
- Paulo Sérgio de Brito André Research Grant, IT
- Luís Manuel Caldas Sobral Lic. Student Final Year Project

Projects

- EMITON: Project IT_018: Development of an optical transmitter for optical fibre soliton transmission systems at 10 Gbps The main research activities during 1996 can be summarized as follows:- Definition of the emitter. - Bibliographic survey - Definition of technological options related to source - A comparative study of different modulation techniques - An analytical study and simulation of optical pulse propagation in 10 Gbps systems - Acquisition of equipment: -10 GHz 1550 nm DFB laser, Model 1741A Ortel; - Polarization independent tunable Bandpass filter, Model TB4500, JDS Fitel; -Electro-optic Mach-Zehnder modulator, Model M2123C, AT&T; -Fiber Fabry-Perot tunable filter, Model FFP-TF+FFP-C, Micron Optics.

Ph. D. Thesis

Armando Nolasco Pinto, (Supervisor: J. Ferreira da Rocha) Universidade de Aveiro.
Ongoing. Thesis subject: Optimization of Optical Soliton Systems.

Publications

F. Ribeiro, A. N. Pinto, J. F. Rocha, J. L. Pinto, “Tecnologia fotónica para sistemas de alto débito”, 10^a Conf. Nac. Física, Livro de resumos, p. 583, Setembro de 1996.

A. Nolasco Pinto, Govind P. Agrawal, J. Ferreira da Rocha “Analytical and numerical study of timing jitter in soliton communication systems” OSA’96, Rochester, EUA.

A. Nolasco Pinto, J. Ferreira da Rocha “Timing jitter statistics due to soliton interaction and Gordon-Haus effect” NOC’96, Heidelberg, Germany.

9.3.5 Integrated Circuits and Systems Research Line

Human Resources

Collaborators

- | | | |
|--------------------------|------------|--------------------|
| • Dinis Magalhães Santos | Ph.D. | Full Professor, UA |
| • Pedro Falcão Fonseca | Researcher | CET (PT) |
| • José L. Cura | M. Sc. | Assistant, UA |
| • Rui L. Aguiar | M. Sc. | Assistant, UA |

Other Collaborators

- | | | |
|---------------------------|------------------|--------------------|
| • Eduardo M. V. Cardoso | Research Student | Grant, IT |
| • António M. S. Rodrigues | Research Student | Grant, IT |
| • Miguel A. Osório | Research Student | Grant, IT |
| • António Deus | Research Student | Grant, IT |
| • Armindo Carreiró | Research Student | Grant, PRAXIS |
| • Jorge S. C. Mota | Lic. Student | Final year project |
| • Filipe M. Patrício | Lic. Student | Final year project |
| • Jorge M. F. Teixeira | Lic. Student | Final year project |
| • Eliseu A. Macedo | Lic. Student | Final year project |
| • Joaquim M. Bastos | Lic. Student | Final year project |

Projects

- GENCLOCK — Architectures for High-Speed Clock generation and Synchronization (PRAXIS). This work started nominally on October 1, 1996, but so far no financing is forthcoming. Some bibliographical preliminary research has been started. Participants: Dinis Magalhães Santos; António M. S. Rodrigues; José L. Cura and Rui L. Aguiar.

- IRWLAN — This research group participates in the project (described elsewhere in this report) through the intervention of Dinis Magalhães Santos; Armindo Carreiró and Rui L. Aguiar. Development of low-noise, high-speed front ends for optical communications is under way.
- NTBL — SDH Network Termination SDH low cost STM-1 Terminal Multiplexer development. This equipment allows the SDH 155 optical or electrical section termination at the SDH client's premises taking the Operator Management network. As an option this equipment can have two PDH tributary interfaces: 3x34Mb/s or 1 x 140Mb/s.
- ALTIMETRO FPGA project and development for a 140Mb/s G751 PDH quality analysis board.

Ph.D. Theses

- José L. Cura, (supervisor: Dinis M. Santos) Universidade de Aveiro. In preparation (subject: High-Speed Analog-Digital Conversion Techniques).
- Rui L. Aguiar (supervisor: Dinis M. Santos) Universidade de Aveiro. In preparation (subject: Clock Synchronization and Generation).

Publications

Papers in Journals

“ A CMOS Delay Locked Loop and Sub-Nanosecond Time-to-Digital Converter Chip”.
Dinis M. Santos, Scott F. Dow, Michael E. Levi. IEEE Tran. on Nuclear Science, 43, N° 3
June 1996, 1717-1720.

“A Multi-Channel Time-to-Digital Converter Chip for Drift Chamber Readout”. Alan Chau,
Derek DeBusschere, Scott Dow, Jeremy Flasck, Michael E. Levi, Frederick Kirsten, D. M.
Santos, Edwin Su. IEEE Tran. on Nuclear Science, 43, N° 3 June 1996 1720-1724.

“Extractor de Relógio Versátil”. João Figueiredo, António Perpétua, Rui Aguiar, Atílio Gameiro *Electrónica e Telecomunicações*, Setembro 1996, pp. 589-594.

Project Deliverables

“ES2 1.0µm/0.7µm — Propriedades para Desenho e Simulação”, Eduardo V. Cardoso, Instituto de Telecomunicações, Janeiro de 1996.

“Introdução à Geração/Recuperação de Relógio”, António Maria S. Rodrigues, Eduardo V. Cardoso, Instituto de Telecomunicações, Outubro de 1996.

Miscellaneous

Deliverables and Standards contributions in 96

ETSI TM3-Viena Mar 96

DTR/TM-03041 “Network Protection Schemes-Interworking”

“Switching time influence in Tandem Dual Node Interconnection using Drop and Continue”

Pedro Falcão Fonseca

Eurescom P513

Enhancements of SDH Networks

Contributions (Pedro Falcão Fonseca):

Subtask 1.2 “Restoration in SDH networks”

“Restoration criteria in Distributed restoration”

“Description of distributed restoration schemes”

“Sender-Chooser restoration techniques”

“SDH interworking of restoration and automatic protection”

“Description of a new Dual node interconnection Sender-Chooser distributed restoration algorithm”

“Return-to-Normal considerations in Distributed restoration schemes.”

Subtask 1.3 (Sub-Task leader) “Interworking between SDH networks protection\restoration and its client layers protection\restoration

“Description of SDH client layers PDH layer (Architecture aspects)”

“Description of SDH client layers protection restoration. *PDH layer*”

“Scenarios of survivability techniques in a layered network: Case of PDH over SDH”

Research topics not directly related to IT:

- Front-End and data readout for radiation detector electronics (project **PET**, in collaboration with LIP and FCTUC and FMUC. Involvement: : Dinis Magalhães Santos and José L. Cura.
- Flash ADC’s for Telecommunications and scientific applications. Involvement: DMS, JT (last year project)
Smart Power Integrated Circuits (in collaboration with IT/IST). Involvement: Dinis Magalhães Santos and Rui L. Aguiar Financing: PRAXIS.

9.3.6 Integrated Communications and Multimedia

Human Resources

Collaborators

A. Manuel de Oliveira Duarte	Ph.D.	Associate Professor, DET-UA
Vasco Lagarto	M.Sc.	Director, CET-PT
Manuel Violas	M.Sc.	Assistant, DET-UA
Jorge Ferraz de Abreu	M.Sc.	Assistant, SACA-UA
Lídia Silva	M.Sc.	Assistant, SACA-UA

Other Collaborators

António Nogueira	Ph.D. Student	Grant, JNICT
Victor Marques	M.Sc. Student	Grant, JNICT
Nuno Delgado	M.Sc. Student	Grant, UA
Pedro Roldão	Research Student	Grant, UA
Manuel Batista	M.Sc. Student	Grant, UA
Henrique Vale	M.Sc. Student	Grant, UA
Paulo Loureiro	Lic. Student	Final Year Student
Nelson Pita	Lic. Student	Final Year Student
Miguel Monteiro	Lic. Student	Final Year Student
Mario Rui Santos	Lic. Student	Final Year Student
Jorge Carvalho	Lic. Student	Final Year Student
Paulo Oliveira	Lic. Student	Final Year Student
Rui Manuel Rodrigues	Lic. Student	Final Year Student
António Veiga da Silva	Lic. Student	Final Year Student

Projects

NEAR VIDEO-ON-DEMAND (2 Final Year Projects)

Project sponsored by UA, jointly executed with Dep. of Electronics and Telecommunications.

The aim of this project was the implementation and test of a NVOD system. One of the important achievements was the familiarisation, by the students, with the specification and requirements of these kind of systems

INTERNET ACCESS THROUGH CATV NETWORKS (Final Year Project)

Project sponsored by UA, jointly executed with Dep. of Electronics and Telecommunications.

The aim of this project was to study a Internet Access service system through CATV networks. One of the important achievements was the study of Cable Modems utilisation enabling the coexistence of Broadcast TV and Interactive Services in the same infrastructure. By this way, it is possible CATV costumers be provided with Internet Access services. Another advantage of Cable Modems is the higher throughput compared with standard Modems.

MULTIMEDIA INFORMATION PRODUCTION INTEGRATED SYSTEM (Final Year Project).

Project sponsored by UA, jointly executed with Dep. of Electronics and Telecommunications.

The aim of this project was to produce a software tool for edition of MPEG Digital Information. The tool was produced with the following capabilities:

- Separate Video and Audio Streams from an MPEG Film
- Join Video and Audio Streams with user defined starting points
- Concatenate Video Streams.

ABC'96 - IV INTERNATIONAL SUMMER SCHOOL ON ADVANCED BROADBAND COMMUNICATIONS

Project sponsored by European Commission, jointly executed with UA and CET

This summer school was a distributed event through more than a dozen different places and has used international ATM connections. The aim of this event was to deliver advanced formation in broadband services and systems, using a distance learning CSCW tool. IT has supported the event through:

- organisational aspects
- supporting communications infrastructure
- hosting an Watch Point in its premises for remote participation.

ACQUISITION OF KNOW-HOW IN PLANNING AND MANAGEMENT OF ATM NETWORKS

Internal activity, jointly executed with DETUA.

This activity aimed to plan the acquisition and implementation of an ATM LAN at the Aveiro University Campus. This was done taking into account the requirements of all potential users of the network within the Campus. A survey of the relevant ATM equipment available on the main ATM vendors was done as a way to anticipate possible implementation scenarios.

Ph.D. Theses

- Manuel Alberto O. R. Violas (Supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: Optical Receivers for Several GigaHertz of Bandwidth)
- Lúcia de Jesus O. L. Silva (Supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: Cognitive and Social Impact of the Communication Networks Globalization).
- Amaro Fernandes de Sousa (supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: Transport Protocols for Multimedia Communications in Broadband Networks).

M.Sc. Theses

- Jorge T. Ferraz de Abreu (Supervisor: Oliveira Duarte), University of Aveiro, concluded in 1996, (subject: CATV Networks: Actual Situation and Future Perspectives).

- António Manuel Duarte Nogueira (Supervisor: Oliveira Duarte), University of Aveiro, concluded in 1996, (subject: Development of Tools for the Performance Evaluation of ATM Systems).

- Victor Manuel Letra Macedo Marques (Supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: Services in ATM Networks).

- Nuno Miguel Bravo Lima Nunes Delgado(Supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: Digital Video Transmission over Broadband Networks).

- Manuel António Esteves Batista (Supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: New Telematics and Home Automation Technologies for the Support of Disabled People).

- Henrique Manuel Fadigas do Vale (Supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: CATV based Multimedia Services - Home Automation Applications).

- Ângelo J. S. Almeida (Supervisor: Oliveira Duarte), University of Aveiro, in preparation, (subject: Access Networks).

Publications

Books and book chapters

A. M. Oliveira Duarte (Co-autor), "Introduction Strategies and Techno-Economic Evaluation of The Access Network", edited by Artech House, London, in printing, expect date to appear for sale: Sep. 97.

A. J. Ferrer Correia, A. M. Oliveira Duarte, Lúcia J. O. L. Silva, "Comunicação, Redes e o Processo Educacional", Manuais Universitários do Plano de Edições de Educação, Fundação Calouste Gulbenkian, in printing, expect date to appear for sale: Nov. 97.

Papers in Journals

A.J.C. Moreira, R.T. Valadas, A.M. de Oliveira Duarte," Performance of infrared transmission systems under ambient light interference ", IEE Proceedings -Optoelectronics, Vol. 143, No. 6, December 1996.

Paula Loureiro, Manuel A. Esteves Batista, A. M. de Oliveira Duarte, M^a. J. Loureiro, R. Cadanho, F. Castro, I. Baptista, "Espaço Multimédia EMA-Aplicação de Sistemas Multimédia na Educação e Reabilitação de Deficientes Mentais Profundos", Rev. da Fenacerci, p45, Mai 96.

Papers in Conference Proceedings

Moreira A.C., Valadas R.T., Duarte A.M.O., "Reducing the Effects of Artificial Light Interference in Wireless Infrared Transmission Systems",In Proceedings of the IEE Colloquim on Optical Free Space Cpmmunication Links, Savoy Place, London, UK, p.5/1-5/9, Feb.96.

Valadas R, Moreira A, Oliveira C, Moreira L, Lomba C, Tavares A, Duarte A, "Experimental Results on a Pulse Position Modulation Infrared Transceiver", 7th IEEE Intern. Symposium on Personal, Indoor and Mobile Radio Communic. PIMRC'96, Taipei, Taiwan, p.252-256, Oct.96.

Manuel de Oliveira Duarte, Manuel Batista, Carlos Barreto, Clara Cidade, "Plataformas Telemáticas para Apoio a Pessoas com Necessidades Especiais", Comunicação apresentada na I Jornadas: Tecnologias de Apoio e Reabilitação, AJUTEC 96, Exponor, Porto, 27 Set. 96.

Carlos José Rodrigues, Eduardo Anselmo de Castro, Raquel Pina Carvalho, Daniel Polónia, Manuel de Oliveira Duarte, Daniel Trigo, "Serviços Avançados de Telecomunicações nas Regiões Menos Favorecidas-O Projecto Mosaicc", IV Enc. Nacional APDC, Covilhã, Nov 96.

Miscellaneous

This Research Line has promoted the submission of an application to the Research Institute of 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 Center) and it was successful. As a result, the equipment was acquired and it is being installed.