Research Report 2006

Department of Mathematics
Instituto Superior Técnico
Portugal

Contents

Preface

The Department of Mathematics regards the annual publication of this research report as an important instrument of scientific policy. On the sixteenth year of its publication we reassert the original goals. The report fulfills simultaneously two complementary purposes. Internally, it highlights the research publications by department members and their involvement in international scientific exchange as a public statement of the importance we attach to them.

Externally, it provides information to interested people outside the department about our current research work. Reflecting the scientific activity developed by its members, the research report is a helpful way of assessing the level of achievement of the objectives embraced by the department. These include the pursuit of internationalization as a way to achieve recognition as a mathematics research department. The Department of Mathematics has at present 106 members holding Ph.D. degrees and is the largest mathematics department in the country. All information regarding the department and its own graduate and undergraduate programs is available through the Internet (http://www.math.ist.utl.pt).

The department experienced a fast development since it embraced the goal of becoming a research department about 20 years ago. Its members obtained Ph.D. degrees from a diversified group of leading universities in mathematics while their relative youth accounts for an energetic environment and provides a good opportunity for innovative and challenging research projects. New challenges and opportunities arose with the collaboration agreements between the Portuguese Government and the Carnegie Mellon University and University of Texas at Austin, of which the Mathematics Department is a partner. We believe that these agreements will increase the internationalization of research and post-graduate programs. The research centers that involve the department members are regularly subjected to external international reviews within the overall Research Units Assessment scheme established, at internal level, by the Science and Technology Foundation, the public agency responsible for promoting, funding and evaluating research in Portugal. The research centers related to our department are highly rated, acknowledging the high international value of the research performed. The organization of this report reflects the activities of the centers associated to our department, and, therefore, we have decided to include in this Report, without any change, the annual reports of the research centers associated to the department, suplemented with a report describing the activities of members of the department not currently members of research centers associated with the Department of Mathematics.

We would like to thank everyone who was involved in the organization of this issue, especially Prof. Ana Bela Cruzeiro, who coordinated the production of the report. We are also grateful to Margarida Silva Carvalho for her work in the compilation of information and LATEX processing of this issue.

1 Organizations and activities

The research activity mentioned above is developed in the following main areas:

Dynamical Systems and Differential Equations

The dominant research in this area falls within the general field of mathematical analysis with an emphasis on nonlinear problems whose interest in applications is well known. The activities cover the following subjects: dynamical systems and ergodic theory, ordinary, partial and functional differential equations, calculus of variations and optimization, geometric, topological and algebraic methods in nonlinear analysis, control theory and mechanics of continuous media. The research follows five lines of work: qualitative theory of dynamical systems; geometric mechanics and Hamiltonian systems; methods of nonlinear analysis in mechanics of continuous media; methods of nonlinear systems analysis in control theory; ergodic theory and dynamical systems.

Geometry and Topology

The work in these areas addresses several topics which can be divided into five main fields as follows: i) symplectic geometry, including the study of topological invariants of groups of symplectomorphisms, presymplectic invariants, Poisson manifolds and Hamiltonian circle actions; ii) algebraic geometry, covering the theory of algebraic curves and surfaces, moduli of instantons and vector bundles, spaces of algebraic cycles and pluricanonical maps to projective space; iii) algebraic topology, including elliptic cohomology, algebraic K-theory, equivariant homotopy theory and homological algebra; iv) differential geometry, involving Lie groupoids and algebroids, Kähler geometry, geometric quantization, gerbes, noncommutative geometry and infinite dimensional differential geometry; v) discrete geometry, with emphasis on oriented matroids and arrangements of hyperplanes. The research in geometry and topology also addresses applications to problems motivated from areas of mathematical-physics such as general relativity, symmetries of dynamical systems, Yang-Mills and Chern-Simons theory, string theory and quantum topology.

Operator Theory and Integral Equations

The work in this area is focused on classes of linear operators like Toeplitz, Carleman-Shift singular integral operators and pseudo-differential operators. Current problems under investigation include factorization of (semi)-almost periodic matrix-valued symbols, diffraction problems with approximate boundary conditions of arbitrary order, normalizations problems, symbol calculi, index theory and methods for classes of convolution type operators. C^* algebras of operators on Hardy and Bergman spaces and invertibility theory for non local C^* algebras are other research topics. Applications of the above topics to elliptic boundary-value problems, in particular, problems in diffraction theory are being studied. Applications to other problems in Mathematical Physics such as integrable systems are also of interest to members of the research group.

Probability, Statistics and Applications

The research in this general area has focused on queuing theory and quality control, multivariate analysis, stochastic optimization, categorical data analysis and statistical inference. In queuing theory and quality control interest is concentrated on order relations, transient behavior, threshold problems, and on control charts. In the area of multivariate analysis, topics of interest are factor analysis and related models, multidimensional scaling and discriminant analysis. Particular attention is given to the study of the robustness of these methods. In categorical data analysis and statistical inference, emphasis has been given to incomplete data and statistical theory advanced topics relying on measure and integration.

Numerical Analysis and Applications in Continuum Mechanics

Research in this area has been focused on mathematical and numerical problems in differential and integral equations with applications in continuum mechanics. More precisely:
(i) mathematical and numerical analysis of models in haemodynamics, analysis of the motion of rigid bodies in viscous fluids, analysis of thin flows in lubrification and oceanography;
(ii) singular boundary value problems for second order nonlinear ordinary differential equations, mathematical analysis and numerical methods for Volterra integral equations with singular kernels;
(iii) mathematical and numerical analysis for direct and inverse problems in acoustic and elastic scattering, meshless methods for partial differential equations.

Logic and Computation

Research in this area is concentrated on four main topics: (i) abstract deductive systems, with emphasis on analysis and synthesis of logic systems, including modal logic, hybrid logic, paraconsistent logic, observational logic, probabilistic logic, algebraic logic, higher-order logic and categorical logic, with applications in knowledge representation, software engineering and security; (ii) probabilistic and quantum computation and information, including probabilistic models of computation, quantum computation and quantum cryptography, with applications in security; (iii) dynamical systems and computational complexity, including digital and analog computation, physical realizability of analog computational classes, recursive functions over the reals, analog characterization of low time complexity classes, links between computational complexity and dynamical systems, neural networks, brain modeling with dynamical systems, and applications in classification of spatial data; (iv) type theory, constructive mathematics and mobile computation, including higher-order logics and type systems applied to constructive mathematics and to provably correct concurrent and distributed mobile systems.

Other Areas

There are also some members of the department working in other areas, including stochastic analysis, operations research or the theory of distributions.

1.1 Research centers

Most of the research activities in the Department are organized in research centers approved and regularly assessed by international evaluation panels (cf. appendices) within a scheme of national scope established by the Science and Technology Foundation, the public agency responsible for promoting, funding and evaluating research in Portugal.

The majority of the Department staff belongs to one of the following Centers:

- Center for Logic and Computation, coordinated by C. Sernadas, with 15 Ph.D. members.
  URL: *http://www.math.ist.utl.pt/clc/*
- Center for Mathematical Analysis, Geometry, and Dynamical Systems, coordinated by C. Rocha, with 48 Ph.D. members.
  URL: *http://www.math.ist.utl.pt/cam/*
- Center for Mathematics and its Applications, coordinated by A. Sequeira, with 48 Ph.D. members and research groups in Operator Theory, Banach Algebras and Applications; Numerical Analysis

and Applications in Continuum Mechanics; Statistics and Stochastic Processes; Harmonic Analysis, Operator Theory and Applications.
URL: *http://www.math.ist.utl.pt/cma/*

Other Centers, mainly based on researchers of other departments, count with one or two members of the Department of Mathematics, namely:

- Center for Mathematics and Fundamental Applications, CMAF (Lisbon University), coordinated by L. Sanchez.
  URL: *http://cmaf.lmc.fc.ul.pt/*

- Center for Plasma Physics, coordinated by J. T. Mendonça.
  URL: *http://cfp.ist.utl.pt/*

- Laboratory of Modeling of Agents, coordinated by Luís Correia
  URL: *http://labmag.di.fc.ul.pt/*

- Mathematical Physics Group, Lisbon University, coordinated by J.-C. Zambrini.
  URL: *http://gfm.cii.fc.ul.pt/*

1.2 Research seminars

During 2006 the Department of Mathematics at Instituto Superior Técnico ran regular sessions of the following seminars:

- Seminar on Algebra (16 sessions).
  Organizers: Pedro Resende.
- Seminar on Analysis, Geometry, and Dynamical Systems (28 sessions).
  Organizer: Luís Barreira.
- Seminar on Applied Mathematics and Numerical Analysis (27 sessions).
  Organizer: Adélia Sequeira.
- Seminar on Functional Analysis and Applications (21 sessions).
  Organizer: Frank-Olme Speck.
- Seminar Geometria em Lisboa, (14 sessions).
  Organizer: Sílvia Anjos.
- Seminar on Logic and Computation (26 sessions).
  Organizer: C. Caleiro
- Seminar on Mathematics, Systems and Robotics, in collaboration with ISR (16 sessions).
  Organizers: Diogo Gomes and João Xavier (ISR).
- Seminar on Partial Differential Equations (11 sessions).
  Organizers: Diogo Gomes.
- Seminar on Probability and Statistics (10 sessions).
  Organizer: Ana Maria Pires.

- Seminar on Quantum Computation and Information (27 sessions), in collaboration with the Department of Physics.
  Organizer: Ana Maria Martins (Department of Physics), Jorge Buescu and Paulo Mateus.
- Seminar on Topological Quantum Field Theory Club (10 sessions).
  Organizers: José Mourão and Roger Picken.

Colloquium: the department also runs a Colloquium, jointly sponsored by the Center for Logic and Computation, the Center for Mathematical Analysis, Geometry, and Dynamical Systems, and the Center for Mathematics and its Applications, with 2 sessions in 2006. The organizer was A.B. Cruzeiro.

1.3 Academic Degrees Awarded in 2006

Doutoramentos/Ph.D.'s

- Sofia Marta Lima Naique, Doutoramento em Matemát¡ca, Instituto Superior Técnico, Universidade Técnica de Lisboa, 22.12.2006. Thesis: On a class of oscillatory Riemann-Hilbert problems with triangular symbols. Supervisor: António Ferreira dos Santos, DM, I.S.T.
- Luis Ricardo Cardoso Gomes da Costa Borges, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 22.12.2006. Thesis: Domain Decomposition Methods for Non-Newtonian Fluids. Supervisor: Adélia Sequeira, DM, I.S.T.
- Carlos Correia Ramos, Doutoramento em Matemá¡tica, Instituto Superior Técnico, Universidade Técnica de Lisboa, 12.12.2006. Thesis: Representações, C*-algebras e transformações do intervalo. Supervisor: Nuno Martins, DM, I.S.T.
- Pedro Miguel dos Santos Alves Madeira Adão, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 5.12.2006. Thesis: Formal methods for the analysis of security protocols. Supervisor: Paulo Mateus, DM, I.S.T.
- Cláudio António Rainha Aires Fernandes, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 13.9.2006. Thesis: Álgebras C* de Operadores com deslocamentos e coeficientes oscilantes, Supervisor: Amélia Bastos, DM, I.S.T.
- Rui Pedro da Silva Cabrita Carpentier, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 9.6.2006. Thesis: Representations of tangles by operators. Supervisor: Roger Picken, DM, I.S.T.
- Nuno Filipe de Jesus Cirilo António, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 20.4.2006. Thesis: Quantum Integrable Systems with Jordanian Twist. Supervisor: Nenad Manojlovic, Universidade do Algarve.
- Marko Stosic, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 31.3.2006. Thesis: Khovanov homology of links and graphs. Supervisor: Roger Picken, DM, I.S.T.
- Maria do Carmo Carvalho Sousa da Cunha Martins, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 17.2.2006. Thesis: Factorização generalizada de uma classe de símbolos triangulares quase-periódicos. Supervisor: Cristina Câmara, DM, I.S.T.
- Pedro Miguel Montes Martins Matias, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 2.2.2006. Thesis: Geometric Quantization and the Coherent State Transform. Supervisor: José Mourão, DM, I.S.T.

- António Carlos dos Santos Paixão, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 26.1.2006. Thesis: On the algebraic, differential, integral and spectral properties of Mercer-like kernels. Supervisor: Jorge Buescu, DM, I.S.T.
- Luis Filipe Serrazes Ventura de Barros Pessoa, Doutoramento em Matemática, Instituto Superior Técnico, Universidade Técnica de Lisboa, 10.1.2006. Thesis: Algebras of Bergman type operators with piecewise continuous coefficients. Supervisor: Yuri Karlovich, Univ. Autonoma de Morelos (Mexico).

Mestrados/M.A's/M.S.c.'s

- Patrícia Alexandra de Azevedo Carvalho Ferreira, Mestrado em Estatística, Instituto Superior Técnico, Universidade Técnica de Lisboa, 21.12.2006. Thesis: Análise de Correspondências: uma perspectiva em torno do método e das aplicações. Supervisor: João António Branco, DM, I.S.T.
- Delfina Rosa Moura Barbosa, Mestrado em Estatística, Instituto Superior Técnico, Universidade Técnica de Lisboa, 28.7.2006. Thesis: Metodologias de Amostragem em Populações Finitas. Supervisor: Conceição Amado, DM, I.S.T.
- Catarina da Cunha Santiago Soares, Mestrado em Estatística, Instituto Superior Técnico, Universidade Técnica de Lisboa, 25.5.2006. Thesis: Análise de Dados de Microarrays. Supervisor: Ana Pires Parente, DM, I.S.T.
- Maria João Costa Almeida Quintão Pereira Braga, Mestrado em Matemática e Aplicações, Instituto Superior Técnico, Universidade Técnica de Lisboa, 12.1.2006. Thesis: Teorema da Coroa e Invertibilidade de Operadores tipo Convolução. Supervisor: Amélia Bastos, DM, I.S.T.

New Positions

- Luis Pessoa, Professor Auxiliar
- Nuno Cirilo António, Professor Auxiliar
- Rui Pedro Carpentier, Professor Auxiliar
- Sofia Naíque, Professor Auxiliar

2 Appendices

- CAMGSD Research Report, see in http://camgsd.math.ist.utl.pt/report2006.pdf `http://camgsd.math.ist.utl.pt/report2006.pdf`
- CLC Research Report,
- CEMAT Research Report
- Other Units

Center for Mathematical Analysis,
Geometry, and Dynamical Systems

Report 2006

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Contents

1 Visitors

The following researchers visited the Center in 2006:

R. Abgrall, Univ. Bordeaux 1, France, 23–29.07.06.

P. Aguiar, Instituto Superior Técnico, Portugal, 5.05.06.

K. Ammar, Freie Univ. Berlin, Germany, 23–29.07.06.

P. del Angel, Centro de Investigación en Matemáticas, Mexico, 28.11–1.12.06.

J. Babadjian, Scuola Internazionale Superiore di Studi Avanzati, Italy, 4–9.09.06.

F. Balibrea, Univ. Murcia, Spain, 27–30.11.06.

M. Barchiesi, Scuola Internazionale Superiore di Studi Avanzati, Italy, 4–9.09.06.

M. Bardi, Univ. Padova, Italy, 24–28.07.06.

R. Barros, Univ. Aix-Marseille III, France, 29.11.06.

A. Barroso, Univ. Lisboa, Portugal, 4–9.09.06.

A. Bas, Univ. Murcia, Spain, 27–30.11.2006.

A. Bernardino, Instituto Superior Técnico, Portugal, 7.12.06.

J. Bioucas, Instituto Superior Técnico, Portugal, 14.07.06.

A. Braides, Univ. Studi di Roma Tor Vergata, Italy, 1–9.09.06.

F. Boca, Univ. Illinois, Urbana-Champaign, USA, 31.08–5-09.06.

F. Cagnetti, Scuola Internazionale Superiore di Studi Avanzati, Italy, 1–2.09.06.

F. Camilli, Univ. l'Aquila, Italy, 28.01–4.02.06.

P. Cannarsa, Univ. Studi di Roma Tor Vergata, Italy, 24–28.07.06.

P. Cardaliaguet, Univ. Bretagne Occidentale, Brest, France, 24–28.07.06.

A. Carvalho, Univ. São Paulo, São Carlos, Brazil, 27–29.11.06.

C. Carvalho, Instituto Superior Técnico, Portugal, 12.01.06, 15.03.06.

F. Chalub, Univ. Nova de Lisboa, Portugal, 5.05.06.

C. Ciliberto, Univ. Studi di Roma Tor Vergata, Italy, 31.01–2.02.06.

S. Conti, Univ. Duisburg-Essen, Germany, 31.08–01.09.06.

M. Crainic, Utrecht Univ., The Netherlands, 28.08–8.09.06.

I. Cruz, Univ. Porto, Portugal, 8–12.05.06.

B. Dacorogna, École Polytechnique Fédérale de Lausanne, Switzerland, 3–10.09.06.

C. Dafermos, Brown Univ., USA, 14–21.01.06.

F. Da Lio, Univ. Torino, Italy, 23–28.07.06.

P. Damianou, Univ. Cyprus, Cyprus, 11–19.02.06.

J. Darbon, École Nationale Supérieure de Télécommunications, France, 27.1.06.

S. Darmatti, Univ. Paul Sabatier, Toulouse, France, 23–29.07.06.

A. Davini, Univ. Padova, Italy, 23–29.07.06.

A. Demianov, Scuola Internazionale Superiore di Studi Avanzati, Italy, 4–9.09.06.

C. Dolcetta, Univ. Roma La Sapienza, Italy, 23–29.07.06.

I. Dolgachev, Univ. Michigan, USA, 15–19.05.06.

F. Dragoni, Univ. Roma La Sapienza, Italy, 22–28.07.06.

S. Dwivedi, Darmstadt Univ. Technology, Germany, 23–29.07.06, 3–10.09.06.

M. Edmundo, Univ. Aberta, Portugal, 7.12.06.

M. Efendiev, Technische Univ. München, Germany, 10–15.09.06.

S. Elaydi, Trinity University, San Antonio, USA, 11–17.06.06.

D. Evans, Univ. Wales, Cardiff, UK, 31.08–2.09.06.

R. Exel, Univ. Federal de Santa Catarina, Brazil, 15.11.06.

M. Falcone, Univ. Roma La Sapienza, Italy, 24–28.07.06.

A. Fathi, École Normale Supérieure de Lyon, France, 24–28.07.06.

R. Ferreira, Instituto de Sistemas e Robótica, Portugal, 3.03.06.

I. Fonseca, Carnegie Mellon Univ., USA, 2–9.09.06.

N. Forcadel, Centre d'Enseignement et de Recherche en Mathématiques et Calcul Scientifique, France, 23–29.07.06.

D. Forge, Univ. Paris Sud, France, 23–29.03.06.

N. Fusco, Univ. Studi di Napoli Federico II, Italy, 2–10.09.06.

A. Garroni, Univ. Roma La Sapienza, Italy, 30.08–10.09.06.

J. Gaspar, Instituto Superior Técnico, Portugal, 7.12.06.

G. Gomes, Instituto Gulbenkian de Ciência, Portugal, 21.02.06.

J. Gomes, Centro de Matemática e Aplicações Fundamentais, Portugal, 17.10.06.

M. Gotay, Univ. Hawai, Manoa, USA, 9–13.10.06.

S. Hollander, Hebrew Univ. Jerusalem, Israel, 7–25.04.06, 26–30.06.06.

J. Hausmann, Univ. Geneva, Switzerland, 17–21.09.06.

J. Harper, Univ. Rochester, USA, 21–24.06.06.

A. Helemskii, Moscow State Univ., Russia, 16–31.10.06.

R. Hric, Univ. Paris XIII, France, 12–29.10.06.

H. Ishii, Waseda Univ., Japan, 24–28.07.06.

D. Jefferson, IPA Energy Institute, Edinburgh, UK, 20–26.11.06.

L. Kauffman, Univ. Illinois, Chicago, USA, 31.05–10.06.06.

M. Khovanov, Columbia Univ., New York, USA, 30.03–2.04.06.

N. Kitchloo, Univ. California, San Diego, USA, 16.06–5.07.06.

J. Kristensen, Univ. Oxford, UK, 31.08–2.09.06.

S. Lawton, Univ. Maryland, USA, 4–13.06.06.

O. Ley, Univ. Tours, France, 24–28.07.06.

F. Linares, Instituto Nacional de Matemática Pura e Aplicada, Brazil, 24–28.07.06.

A. Linero, Univ. Murcia, Spain, 27–30.11.06.

J. Llibre, Univ. Autònoma de Barcelona, Spain, 13–24.11.06.

P. Loreti, Univ. Roma La Sapienza, Italy, 23–28.07.06.

A. Lopes, Univ. Federal do Rio Grande do Sul, Brazil, 3–31.01.06.

F. Macia, Univ. Complutense de Madrid, Spain, 23–29.07.06.

F. Maggi, Univ. Studi di Firenze, Italy, 3–10.09.06.

S. Maroso, Institut National de Recherche en Informatique Automatique, France, 23–28.07.06.

A. Martins, Instituto Superior Técnico, Portugal, 9.06.06.

G. Maso, Scuola Internazionale Superiore di Studi Avanzati, Italy, 31.08–2.09.06.

D. Matsnev, Penn State Univ., USA, 17–28.07.06.

D. McDuff, State Univ. New York, Stony Brook, USA, 15–18.03.06.

W. McEneaney, Univ. California, San Diego, USA, 24–28.07.06.

R. Monneau, École Nationale des Ponts et Chaussées, France, 24–28.07.06.

A. Montanari, Univ. Bologna, Italy, 24–28.07.06.

M. Mora, Scuola Internazionale Superiore di Studi Avanzati, Italy, 3–10.09.06.

F. Morgan, Williams College, Williamstown, USA, 11.09.06.

M. Morini, Scuola Internazionale Superiore di Studi Avanzati, Italy, 31.08–10.09.06.

P. Mossay, Univ. Alicante, Spain, 3–10.09.06.

C. Mulvey, Univ. Sussex and Cambridge Univ., UK, 5–17.11.06.

M. Nadia, École Nationale Supérieure de Techniques Avancées, France, 23–28.07.06.

J. Nascimento, Instituto de Sistemas e Robótica, Portugal, 10.11.06.

J. Neisendorfer, Univ. Rochester, USA, 10–13.10.06.

J. Nelson, Univ. Torino, Italy, 25–29.09.06.

F. Neumann, Univ. Leicester, UK, 26–30.06.06.

A. Nogueira, Institut de Mathématiques de Luminy, France, 31.10–1.11.06.

B. Noohi, Max Planck Institute, Bonn, Germany, 24–29.06.06.

P. Norbury, Univ. Melbourne, Australia, and Brandeis Univ., USA, 19–21.06.06.

M. Oliveira, Univ. Aberta, Portugal, 7.02.06.

J. Ortega, Centre National de la Recherche Scientifique, France, 31.10–6.11.06.

R. Pardini, Univ. Pisa, Italy, 19–26.03.06.

B. Perthame, École Normale Supérieure, France, 23–28.07.06.

M. Pinsonnault, The Fields Institute, Canada, 02–11.07.06.

G. Pisante, Seconda Univ. Studi di Napoli, Italy, 31.08–10.10.06.

A. Porretta, Univ. Studi di Roma Tor Vergata, Italy, 24–28.07.06.

A. Pratelli, Univ. Pavia, Italy, 3–10.09.06.

V. Quitalo, Instituto Politécnico de Setúbal, Portugal, 3–10.09.06.

P. Raith, Univ. Wien, Austria, 3–9.12.06.

T. Ratiu, École Polytechnique Fédérale de Lausanne, Switzerland, 31.10–6.11.06.

A. Ribeiro, Univ. Nova de Lisboa, Portugal, 3–10.09.06.

J.-L. Rodriguez, Univ. Almería, Spain, 25–29.06.06

J.-M. Roquejoffre, Univ. Toulouse, France, 24–28.07.06.

M. Rorro, Univ. Roma La Sapienza, Italy, 23–28.07.06.

L. Rossi, Univ. Roma La Sapienza, Italy, 23–28.07.06.

F. Russo, Univ. Federal de Pernambuco, Brazil, 21–25.10.06.

M. Sandberg, Royal Institute of Technology (KTH), Sweden, 23–28.07.06.

L. Scardia, Scuola Internazionale Superiore di Studi Avanzati, Italy, 4–9.09.06.

S. Shamir, Univ. Aberdeen, UK, 25.11–1.12.06.

A. Sharkovsky, National Academy of Sciences of Ukraine, Ukraine, 21.08–10.09.06.

A. Siconolfi, Univ. Roma La Sapienza, Italy, 23–28.07.06.

T. Sougadinis, Univ. Texas, Austin, USA, 24–28.07.06.

B. Sousa, Carnegie-Mellon Univ., USA, 2–13.09.06.

B. Stroffolini, Univ. Napoli, Italy, 24–28.07.06.

I. Stubbe, Centro de Matemática da Univ. Coimbra, Portugal, 21–24.06.06.

I. Sushko, National Academy of Sciences of Ukraine, Ukraine, 26.11–1.12.06.

I. Struchiner, Univ. Estadual de Campinas, Brazil, 10.1–30.06.06.

P. Supino, Univ. Roma Tre, Italy, 28.01–4.02.06.

G. Tabuada, Univ. Denis Diderot, Paris VII, France, 25–27.09.06.

G. Terrone, Univ. Padova, Italy, 23–29.07.06.

J. Tiago, Univ. Castilla-La Mancha, Spain, 4–9.09.06.

P. Turner, Heriot-Watt University, UK, 30.03–2.04.06.

J. Urbano, Univ. Coimbra, Portugal, 23–28.07.06.

E. Valdinoci, Univ. Studi di Roma Tor Vergata, Italy, 1–9.03.06, 16–29.07.06.

P. Vaz, Univ. Algarve, Portugal, 30.03–1.04.06.

S. Verra, Univ. Roma Tre, Italy, 14–19.05.06.

A. Vitolo, Univ. Salerno, Italy, 23–29.07.06.

J. Weitsman, Univ. California, Santa Cruz, USA, 22.06–2.07.06.

N. Winter, Aachen Univ., Germany, 22–29.07.06.

M. Wolfrum, Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany, 25.03–5.04.06.

J. Xavier, Instituto Superior Técnico, Portugal, 13.10.06.

E. Zappale, Univ. Salerno, Italy, 15–20.09.06.

2 Seminars

Analysis, Geometry, and Dynamical Systems Seminar. This is the main seminar of the Center. It included the following talks in 2006:

- Peter Raith (Univ. Wien), Continuity properties of pressure and entropy for piecewise monotone interval maps, 7/12/06.
- Andrey Biryuk (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Analysis of a pressureless dynamical system and an open geometrical problem, 5/12/06.
- Francisco Balibrea (Univ. Murcia), Geometric unfolding of some difference equations, 29/11/06.

- Antonio Linero (Univ. Murcia), Some results on omega-limit sets of two-dimensional permuted direct product maps, 29/11/06.
- Irina Sushko (National Academy of Sciences of Ukraine), Bifurcation structure of parameter plane for a family of unimodal piecewise smooth maps: border-collision bifurcation curves, 29/11/06.
- Alexandre Carvalho (Univ. São Paulo, São Carlos), Strongly damped wave equations: continuity of attractors, 28/11/06.
- Jaume Llibre (Univ. Autònoma de Barcelona), The set of periods for the Morse–Smale diffeomorphisms on $\mathbb{T}^2$, 21/11/06.
- Ruy Exel (Univ. Federal de Santa Catarina), Algebras associated to irreversible dynamical systems, 15/11/06.
- Arnaldo Nogueira (Institut de Mathématiques de Luminy), Ergodic properties of triangular partitions, 31/10/06.
- Godofredo Iommi (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Phase transitions and multifractal analysis for horseshoes, 24/10/06.
- José Maria Gomes (Centro de Matemática e Aplicações Fundamentais), $2^n - 1$ positive solutions to a superlinear elliptic problem with sign changing weight, 17/10/06.
- Dmitry Matsnev (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), The Baum–Connes conjecture and linear group actions on spaces of finite asymptotic dimension, 3/10/06.
- Nuno Luzia (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Measure of full dimension for nonconformal dynamics, 19/9/06.
- Messoud Efendiev (Technische Univ. München), On some class of nonautonomous equations and their attractors, 12/9/06.
- Frank Morgan (Williams College, Williamstown), The double bubble theorem, 11/9/06.
- Saber Elaydi (Trinity Univ., San Antonio), From periodic to almost periodic dynamical systems, 16/6/06.
- Saber Elaydi (Trinity Univ., San Antonio), Topological properties of global atractors, 14/6/06.
- Nuno Luzia (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Hausdorff dimension for an open class of repellers in $\mathbb{R}^2$, 16/5/06.

- Matthias Wolfrum (Weierstrass Institute for Applied Analysis and Stochastics, Berlin), Systems of delay differential equations with large delay, 28/3/06.
- Godofredo Iommi (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Suspension flows over countable Markov shifts, 7/3/06.
- Gabriela Gomes (Instituto Gulbenkian de Ciência), Fundamental assumptions in models of reinfection, 21/2/06.
- Pantelis Damianou (Univ. Cyprus), The modular class and integrable systems, 14/2/06.
- Maria João Oliveira (Univ. Aberta), Bogoliubov functionals: from measure theory to functional analysis, 7/2/06.
- Constantine Dafermos (Brown Univ.), Hyperbolic conservation laws with contingent entropies and involutions, 18/1/06.

Algebra Seminar. This included the following talks in 2006:

- Pedro Ferreira dos Santos (Instituto Superior Técnico), Bigraded equivariant cohomology of real quadrics, 15/12/06.
- Joana Ventura (Instituto Superior Técnico), Extension of linking systems III, 12/12/06.
- Mário Edmundo (Univ. Aberta), Cohomology in o-minimal and real algebraic geometry, 7/12/06.
- Shoham Shamir (Univ. Aberdeen), Cellular approximations and the Eilenberg–Moore spectral sequence, 30/11/06.
- Pedro del Angel (Centro de Investigación en Matemáticas, Mexico), On the motive of certain subvarieties of fixed flags, 29/11/06.
- Joana Ventura (Instituto Superior Técnico), Extensions of linking systems II, 29/11/06.
- Joana Ventura (Instituto Superior Técnico), Extensions of linking systems, 23/11/06.
- Joe Neisendorfer (Univ. Rochester), Application of Dror–Farjoun localization in algebraic topology, 12/10/06.
- Stavros Papadakis (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Introduction to unprojection III, 21/7/06.

- Stavros Papadakis (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Introduction to unprojection II, 20/7/06.
- Stavros Papadakis (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Introduction to unprojection I, 19/7/06.
- Frank Neumann (Univ. Leicester), Frobenius actions on the cohomology of moduli stacks of vector bundles on curves, 28/6/06.
- John Harper (Univ. Rochester), Finite H-spaces with retractile generating complex, 23/6/06.
- Isar Stubbe (Centro de Matemática da Univ. Coimbra), Q-orders and Q-modules, 21/6/06.
- João Faria Martins (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), On the homotopy type and the fundamental crossed complex of the skeletal filtration of a CW-complex, 12/4/06.
- Paola Supino (Univ. Roma Tre), Injective endomorphisms of algebraic varieties, 1/2/06.
- Gustavo Granja (Instituto Superior Técnico), Realizing modules over the homology of a DGA, 18/1/06.

Discrete Dynamical Systems Seminar. This included the following talks in 2006:

- Alexander Sharkovsky (National Academy of Sciences of Ukraine), About common periodical orbits of several maps, 6/9/06.
- Alexander Sharkovsky (National Academy of Sciences of Ukraine), On some mathematical models of storing (and processing?) information, 4/9/06.

"Geometria em Lisboa" Seminar. This included the following talks in 2006:

- Rosa Sena-Dias (Instituto Superior Técnico), Estimated transversality and rational maps, 20/12/06.
- Tudor Ratiu (École Polytechnique Fédérale de Lausanne), Convexity for symplectic actions, 2/11/06.
- Francesco Russo (Univ. Federal de Pernambuco), Homaloidal hypersurfaces and hypersurfaces with vanishing Hessian, 24/10/06.

- Jean-Claude Hausmann (Univ. Geneva), Polygon spaces and Hamiltonian geometry, 19/9/06.
- Nitu Kitchloo (Univ. California, San Diego), K-theory and representations of loop groups, 4/7/06.
- Paul Norbury (Univ. Melbourne and Brandeis Univ.), Volumes of moduli spaces of hyperbolic surfaces, 20/6/06.
- Sean Lawton (Univ. Maryland), Poisson structure of flat SL(3)-bundles over a thrice punctured sphere, 7/6/06.
- Inês Cruz (Univ. Porto), Exact (or unimodular) Poisson structures on a 4-dimensional manifold, 9/5/06.
- José Natário (Instituto Superior Técnico), Relativity and singularities — A short introduction for mathematicians, 26/4/06.
- Carlos Florentino (Instituto Superior Técnico), Invariants of 2 by 2 matrices and $\mathrm{SL}(2,\mathbb{C})$ character varieties, 4/4/06.
- Rita Pardini (Univ. Pisa), The fundamental group of surfaces with small K^2, 21/3/06.
- Dusa McDuff (State Univ. New York, Stony Brook), Homotopy properties of groups of symplectomorphisms, 15/3/06.
- Emily Dryden (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Using heat invariants to hear the geometry of orbifolds, 7/3/06.
- André Neves (Princeton Univ. and Instituto Superior Técnico), Singularities of Lagrangian mean curvature flow, 10/1/06.

Mathematics, Systems and Robotics Seminar. In collaboration with Instituto de Sistemas e Robótica. It included the following talks in 2006:

- (December 7)
  - Pedro Resende (Instituto Superior Técnico), What is a good semigroup of binary relations?
  - Alexandre Bernardino, José Gaspar (Instituto Superior Técnico), Biologically Inspired Visual Geometries.
- (November 10)
  - Margarida Baía (Instituto Superior Técnico), An example of 2D discrete-continuum reduction argument by Γ-convergence.

  - Jacinto Nascimento (Instituto de Sistemas e Robótica), Probabilistic data association techniques for target/contour tracking in clutter.

- (October 13)

  - João Xavier (Instituto Superior Técnico), Time-series models on manifolds: the AR case.
  - Henrique Oliveira (Instituto Superior Técnico), Synchronization of pendulum clocks — the Huygens phenomena.

- (July 14)

  - Mahendra Panthee (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Recent Techniques for Solutions to Nonlinear Dispersive Equations.
  - José Bioucas (Instituto Superior Técnico), Two-step iterative shrinkage/thresholding algorithms for total variation and wavelet-based image restoration.

- (June 9)

  - Pedro Santos (Instituto Superior Técnico), Gamma-convergence.
  - André Martins (Instituto Superior Técnico), String kernels and similarity measures for information retrieval.

- (May 5)

  - Pedro Aguiar (Instituto Superior Técnico), Minimum-energy and H-infinity state estimation.
  - Fabio Chalub (Univ. Nova de Lisboa), O processo de Moran contínuo.

- (March 3)

  - Ricardo Ferreira (Instituto de Sistemas e Robótica), Hessian of the Riemannian distance function on connected locally symmetric spaces: centroid computation with a Newton method.
  - Enrico Valdinoci (Univ. Roma II), Entropy penalization methods for Hamilton-Jacobi equations.

- (January 27)

  - Pedro Girão (Instituto Superior Técnico), Some remarks on extremal functions for Poincaré–Sobolev-type inequalities.

– Jerome Darbon (École Nationale Supérieure de Télécommunications, France), Fast and exact algorithms for energy minimization.

Partial Differential Equations Seminar. This included the following talks in 2006:

- Diogo Gomes (Instituto Superior Técnico), Another short course on Aubry–Mather theory IV, 6/12/06.
- Ricardo Barros (Univ. Aix-Marseille III), Gravity waves in two-layer flows with free surface, 29/11/06.
- Daniel Jefferson (IPA Energy Institute, Edinburgh), The small dissipation limit for CGL equations, 22/11/06.
- Diogo Gomes (Instituto Superior Técnico), Another short course on Aubry–Mather theory III, 15/11/06.
- Diogo Gomes (Instituto Superior Técnico), Another short course on Aubry–Mather theory II, 8/11/06.
- Diogo Gomes (Instituto Superior Técnico), Another short course on Aubry–Mather theory I, 25/10/06.
- Elvira Zappale (Univ. Salerno), A lower semicontinuity result in SBD, 18/9/06.
- Diogo Gomes (Instituto Superior Técnico), Wigner and semiclassical defect measures and dissipative wave equation, 24/2/06.
- Mahendra Panthee (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos) Well posedness issues for some nonlinear dispersive equations, 17/2/06.
- Mahendra Panthee (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Unique Continuation for some nonlinear dispersive equations, 10/2/06.
- Fabio Camilli (Univ. l'Aquila), Large deviations and Aubry–Mather theory, 3/2/06.

Topological Quantum Field Theory Club. This included the following talks in 2006:

- Louis Kauffman (Univ. Illinois, Chicago), Virtual knot theory I, 2/06/-2006.

- Louis Kauffman (Univ. Illinois, Chicago), Virtual knot theory II, 6/06/-2006.
- Louis Kauffman (Univ. Illinois, Chicago), Virtual knot theory III, 7/06/2006.
- Mark Gotay (Univ. Hawai, Manoa), Experimental star-product quantization, 13/10/2006.
- Mark Gotay (Univ. Hawai, Manoa), Obstructions to quantization, 12/10/2006.
- Mark Gotay (Univ. Hawai, Manoa), Stress-energy-momentum tensors, 9/10/2006.

Working Seminar on Groupoids and Noncommutative Geometry. This included the following talks in 2006:

- Dmitry Matsnev (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Introduction to coarse geometry, 28/9/06.
- Ivan Struchiner (Univ. Estadual de Campinas), The equivalence problem for G-structures, 21/6/06.
- Rui Loja Fernandes (Instituto Superior Técnico), Proper groupoids, 17/5/06.
- Radu Popescu (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Morita equivalence for groupoids and C*-algebras III, 26/4/06.
- Radu Popescu (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Morita equivalence for groupoids and C*-algebras II, 19/-4/06.
- Radu Popescu (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Morita equivalence for groupoids and C*-algebras I, 29/-3/06.
- Catarina Carvalho (Instituto Superior Técnico), Index theory and groupoids II, 15/3/06.
- Rui Loja Fernandes (Instituto Superior Técnico), Symplectic groupoids, 8/3/06.
- Rui Loja Fernandes (Instituto Superior Técnico), Integrability of Lie algebroids II, 22/2/06.

- Pedro Resende (Instituto Superior Técnico), Étale groupoids and quantales II, 22/2/06.
- Rui Loja Fernandes (Instituto Superior Técnico), Integrability of Lie algebroids I, 16/2/06.
- Pedro Resende (Instituto Superior Técnico), Étale groupoids and quantales I, 16/2/06.
- Radu Popescu (Centro de Análise Matemática, Geometria e Sistemas Dinâmicos), Locally compact groupoids and C*-algebras, 12/1/06.
- Catarina Carvalho (Instituto Superior Técnico), Index theory and groupoids I, 12/1/06.

Other seminars. The Center has also contributed to activities of the Department of Mathematics of Instituto Superior Técnico and of other research centers, in particular providing partial support to the Colloquium of the Department of Mathematics and to the Quantum Information and Computation Seminar of the Center for Logic and Computation.

3 Conferences and short courses

The following Conferences and Short Courses were organized or co-organized by members of the Center in 2006:

CAMGSD Thematic Semester on Partial Differential Equations

July 1 to December 31, 2006

Events (see details further down):

- Conference: *New Trends in Viscosity Solutions and Nonlinear PDEs*, Lisboa, July 24–28, 2006,
- *Workshop in Calculus of Variations and Applications*, Lisboa, September 1–2, 2006,
- *Summer School on Calculus of Variations and Applications* (Satellite meeting of the International Congress of Mathematicians 2006), Ponta Delgada, September 4–9.

http://www.math.ist.utl.pt/∼dgomes/pdesem/

IST Courses on Algebraic Geometry III—Introduction to classical Cremona transformations

Instituto Superior Técnico, May 15–19, 2006

Lecturers:

- Igor Dolgachev (Univ. Michigan),
- Sandro Verra (Univ. Roma Tre).

http://www.math.ist.utl.pt/∼mmlopes/CourseAGIII.html

VII Lisbon Summer Lectures in Geometry

Instituto Superior Técnico, June 26–28, 2006

Lecturer: Jonathan Weitsman (Univ. California, Santa Cruz).

http://www.math.ist.utl.pt/SummerLect06/

Introduction to Topological Stacks

Instituto Superior Técnico, June 26–29, 2006

Main lecturer: Behrang Noohi (Max Planck Institute, Bonn).

Additional lectures by:

- Gustavo Granja (Instituto Superior Técnico),
- Sharon Hollander (Hebrew Univ. Jerusalem).

http://www.math.ist.utl.pt/∼ggranja/TopStacks/

XV$^{\text{th}}$ Oporto Meeting on Geometry, Topology and Physics — Mathematical Aspects of Supersymmetry

Faculdade de Ciências, Univ. Porto, July 20–23, 2006

Main speakers:

- Frank Ferrari (Univ. Libre de Bruxelles),
- Dan Freed (Univ. Texas, Austin),
- Nicholas Manton (Cambridge Univ.),
- Veeravalli Varadarajan (Univ. California, Los Angeles),
- Albert Schwarz (Univ. California, Davis).

http://www.fc.up.pt/oldcfp/omgtp2006/

New Trends in Viscosity Solutions and Nonlinear PDEs

Instituto Superior Técnico, July 24–28, 2006

Main speakers:

- Martino Bardi (Univ. Padova),
- Piermarco Cannarsa (Univ. Studi di Roma Tor Vergata),
- Pierre Cardaliaguet (Univ. Brest),
- Albert Fathi (École Normale Supérieure de Lyon),
- Hitoshi Ishii (Waseda Univ.),
- Régis Monneau (École Nationale des Ponts et Chaussées),
- Benoit Perthame (École Normale Supérieure),
- José Rodrigues (Univ. Lisboa),
- Jean-Michel Roquejoffre (Univ. Toulouse),
- Antonio Siconolfi (Univ. Roma La Sapienza),
- Takis Souganidis (Univ. Texas, Austin),
- José Urbano (Univ. Coimbra).

http://www.math.ist.utl.pt/∼dgomes/newtrends/

Brazilian Operator Algebras Conference (Satellite Meeting of the XV International Congress on Mathematical Physics)

Florianópolis, Brazil, July 24–28, 2006

Invited speakers:

- Ola Bratteli (Univ. Oslo),
- Joachim Cuntz (Univ. Münster),
- David Evans (Univ. Wales, Cardiff),
- Vaughan Jones (Univ. California, Berkeley),
- Karl-Henning Rehren (Univ. Goettingen),
- Mikael Rordam (Univ. Southern Denmark),
- Yasuo Watatani (Kyushu Univ.).

http://www.mtm.ufsc.br/∼exel/oa/

Workshop in Calculus of Variations and Applications

Instituto Superior Técnico, September 1–2, 2006

Invited speakers:

- Ana Barroso (Univ. Lisboa),
- Andrea Braides (Univ. Studi di Roma Tor Vergata),
- Sergio Conti (Univ. Duisburg-Essen),
- Gianni Dal Maso (Scuola Internazionale Superiore di Studi Avanzati),
- Antonia di Napoli (Univ. Studi di Napoli Federico II),
- Adriana Garroni (Univ. Roma La Sapienza),
- Diogo Gomes (Instituto Superior Técnico),
- Jan Kristensen (Univ. Oxford),
- Felipe Linares (Instituto Nacional de Matemática Pura e Aplicada).

http://www.math.ist.utl.pt/∼dgomes/wcva/

Knot Theory and Related Areas (Symposium of the International Conference on Interdisciplinary Mathematical & Statistical Techniques 2006)

Instituto Politécnico de Tomar, September 1–4, 2006

Invited speakers:

- Rui Carpentier (Instituto Superior Técnico),
- J. Scott Carter (Univ. South Alabama),
- J. Faria Martins (Instituto Superior Técnico),
- Pedro Lopes (Instituto Superior Técnico),
- Roger Picken (Instituto Superior Técnico).

http://scra2006.southalabama.edu/

Summer school and workshop on Operator Algebras, Operator Theory and Applications (Satellite meeting of the International Congress of Mathematicians 2006)

Instituto Superior Técnico, September 1–5, 2006

Invited short courses by:

- Stephen Power (Lancaster Univ.),
- Konrad Schmüdgen (Leipzig Univ.),
- Bernd Silbermann (Chemmitz Univ.),
- Harald Upmeier (Marburg Univ.).

Invited lectures by:

- Mikhail Agranovich (Moscow Institute of Electronics and Mathematics),
- Florin Boca (Univ. Illinois, Urbana-Champaign),
- Lewis Coburn (State Univ. New York, Bufallo),
- David Evans (Univ. Wales, Cardiff),
- Israel Gohberg (Tel Aviv Univ.),
- Yuri Karlovich (Univ. Autonoma del Estado de Morelos),
- Naum Krupnik (Univ. Toronto),
- Vladimir Manuilov (Moscow State Univ.),
- Nikolai Nikolski (Univ. Bordeaux and Steklov Mathematical Institute),
- Vladimir Rabinovich (Instituto Politecnico Nacional, Mexico),
- Steffen Roch (Technical Univ. Darmstadt),
- Stefan Samko (Univ. Algarve),
- Ilya Spitkovsky (William and Mary College, Williamsburg).

http://woat2006.ist.utl.pt/

Summer School on Calculus of Variations and Applications (Satellite meeting of the International Congress of Mathematicians 2006)

Ponta Delgada, Açores, September 4–9, 2006

Lecturers:

- Andrea Braides (Univ. Studi di Roma Tor Vergata),
- Bernard Dacorogna (École Polytechnique Fédérale de Lausanne),
- Irene Fonseca (Carnegie Mellon Univ.),
- Nicola Fusco (Univ. Studi di Napoli Federico II).

Invited speakers:

- Roberto Alicandro (Univ. Studi di Cassino),
- Jean-François Babadjian (Scuola Internazionale Superiore di Studi Avanzati),
- Mikil Foss (Univ. Lincoln, Nebraska),
- Francesco Maggi (Univ. Studi di Firenze),
- Maria Mora (Scuola Internazionale Superiore di Studi Avanzati),
- Massimiliano Morini (Scuola Internazionale Superiore di Studi Avanzati),
- Giovanni Pisante (Seconda Univ. Studi di Napoli),
- Ana Ribeiro (Univ. Nova de Lisboa).

http://www.math.ist.utl.pt/∼dgomes/sscva/

Introduction to Differential Graded Categories

Instituto Superior Técnico, September 25–27, 2006

Lecturer: Gonçalo Tabuada (Univ. Denis Diderot, Paris VII).

http://www.math.ist.utl.pt/∼ggranja/DGCats/

Quantum Functional Analysis in the Non-coordinate Presentation

Instituto Superior Técnico, October 17–30, 2006

Lecturer: Alexander Ya. Helemskii (Moscow State Univ.).

http://www.math.ist.utl.pt/∼jmourao/MC/AYH/

II Workshop de Estatística, Matemática e Computação

Univ. Aberta, November 8–9, 2006

Main speakers:

- Gael Dias (Univ. Beira Interior),
- Fernando Ferreira (Univ. Lisboa),
- João Mexia (Univ. Nova de Lisboa),
- João Pequito (PSE - Produtos e Serviços de Estatística, Lda.),
- Manuela Neves (Instituto Superior de Agronomia),
- Margarida Cardoso (Instituto Superior de Ciências do Trabalho e da Empresa),
- Pedro Resende (Instituto Superior Técnico),
- Roman Zmyslony (Univ. Zielona Góra).

http://www.moodle.univ-ab.pt/moodle/course/view.php?id=66

4 Postdoctoral program

The Center started a postdoctoral program in the academic year 1998/99. Positions are for one year, with the possibility of extension for a second year upon mutual agreement. Applicants must have earned a Ph.D. in mathematics preferably within a 2-year period before the opening date of the position. To be selected an applicant must show very strong research promise in one of the areas in which the members of the Center are currently active. There are no teaching duties associated with these positions. They are announced internationally including in the Notices and in the Data Base of the American Mathematical Society. In addition, the Center hosts postdoctoral fellows supported directly by the FCT or by other research projects.

The following fellows have stayed in the Center during the whole or part of 2006:

- J. Agapito, PhD in Mathematics, Univ. California, Santa Cruz, USA, 2004. Research areas: symplectic geometry, discrete mathematics. Supported by an FCT postdoctoral grant (Jan. 2005–present).

- A. Biryuk, PhD in Mathematics, Heriot-Watt Univ., Edinburgh, 2002. Research areas: nonlinear partial differential equations, stochastic partial differential equations, differential geometry, harmonic analysis, numerical methods. Supported by the CAMGSD plurianual funding (Sep. 1, 2006–Aug. 31, 2007).

- J.O. Brahic, PhD in Mathematics, Univ. Montpellier II, France, 2004. Research areas: Poisson geometry, Lie groupoids and algebroids, representation theory. Supported by an FCT postdoctoral grant (Jan. 2006–present).

- R. Czaja, PhD in Mathematics, Univ. Silesia, Poland, 2004. Research areas: semilinear abstract parabolic equations. Supported by the CAMGSD plurianual funding (Sep. 1, 2005–Aug. 31, 2007).

- R. Dawe Martins, PhD in Mathematical Physics, Nottingham Univ., 2006. Research areas: Noncommutative geometry, spectral triples, standard model of particle physics, K-theory. Supported by an FCT postdoctoral grant (Oct. 2006–present).

- E. Dryden, PhD in Mathematics, Dartmouth College, USA, 2004. Research areas: spectral theory, geometry of orbifolds and Riemann surfaces. Supported by the CAMGSD plurianual funding (Oct. 1, 2005–Jul. 31, 2006).

- J. Faria Martins, PhD in Mathematics, Nottingham Univ., UK, 2004. Research areas: quantum topology, quantum groups, knot theory, applications of categorical groups to low dimensional topology. Supported by an FCT postdoctoral grant (Jan. 2005–present).

- J.M. Gomes, Doutoramento em Matemática, Faculdade de Ciências, Univ. Lisboa, Portugal, 2005. Research areas: partial differential equations, variational methods. Supported by an FCT postdoctoral grant (Dec. 2006–present).

- S. Hollander, PhD in Mathematics, Massachussets Institute of Technology, 2001. Research areas: algebraic topology and algebraic geometry. Supported by the CAMGSD plurianual funding (Nov. 1, 2006–Oct. 31, 2007).

- G. Iommi, PhD in Mathematics, Univ. Warwick, UK, 2004. Research areas: dynamical systems. Supported by an FCT postdoctoral grant (Jan. 2006–present).

- S.S. Kim, PhD in Mathematics, Stanford Univ., USA, 2001. Research areas: symplectic and contact geometry. Supported by an FCT postdoctoral grant (Jul. 2005–present).

- H. Li, PhD in Mathematics, Univ. Illinois, Urbana-Champaign, USA, 2003. Research area: symplectic geometry. Supported by an FCT postdoctoral grant (May 2006–present).

- N. Luzia, Doutorado em Matemática, Instituto Nacional de Matemática Pura e Aplicada, Brazil, 2004. Research areas: dynamical systems. Supported by an FCT postdoctoral grant (May 2005–present).

- D. Matsnev, PhD in Mathematics, Penn State Univ., 2005. Research areas: operator algebra K-theory, noncommutative geometry, coarse geometry, Baum-Connes conjecture. Supported by the CAMGSD plurianual funding (Sep. 1, 2006–Aug. 31, 2007).

- P. McNamara, PhD in Mathematics, Massachussets Institute of Technology, USA, 2003. Research areas: algebraic combinatorics, matrix theory. Supported by the CAMGSD plurianual funding (Aug. 1, 2005–Jul. 31, 2006).

- M. Panthee, Doutorado em Matemática, Instituto Nacional de Matemática Pura e Aplicada, Brazil, 2004. Research areas: partial differential equations, harmonic analysis. Supported by the CAMGSD plurianual funding (Dec. 15, 2004–Jan. 14, 2006) and an FCT postdoctoral grant (Jan. 15, 2006–present).

- S. Papadakis, PhD in Mathematics, Warwick Univ., UK, 2002. Research areas: birational geometry, commutative algebra, computer algebra methods in algebraic geometry, algebraic surfaces, unprojection. Supported by an FCT postdoctoral grant (Jul. 2006–present).

- R. Popescu, Doctorat de Mathématiques, Univ. Claude Bernard, Lyon 1, France, 2000. Research areas: C*-algebras, bivariant K-theory, groupoids, foliations, quantales. Supported by an FCT postdoctoral grant (Apr. 2005–present).

- N. Sousa, PhD in Physics, Katholieke Univ. Nijmegen (now Radbaud Univ.), The Netherlands, 2003. Research areas: string theory, conformal field theory, topological string theory, geometric quantization, matrix models. Supported by an FCT postdoctoral grant (Mar. 2006–present).

- C. Valls, Doctor in Matematics, Univ. Barcelona, Spain, 1999. Research areas: dynamical systems. Supported by two FCT postdoctoral grants (Oct. 2003–present).

- B. Van Steirteghem, PhD in Mathematics, Columbia Univ., USA, 2004. Research areas: algebraic groups, symplectic geometry. Supported by the CAMGSD plurianual funding (Nov. 1, 2004–Jan. 31, 2006) and an FCT postdoctoral grant (Feb. 1, 2006–present).

5 Publications in 2006

Publications which appeared in 2006

Books

F. da Costa, M. Grinfeld, W. Lamb and J. Wattis (editors). *Coagulation-Fragmentation Processes*. Phys. D, 222, Nos. 1–2. Elsevier, 2006.

A. Corso, P. Gimenez, M. Vaz Pinto and S. Zarzuela (editors). *Commutative Algebra. Geometric, Homological, Combinatorial and Computational Aspects*. Lect. Notes Pure Appl. Math., 244. Proc. First Joint Meeting of the Amer. Math. Soc. and the Real Sociedad Matemática Española and the Lisbon Conference of Commutative Algebra, Seville and Lisbon 2003. Chapman & Hall/CRC, 2006.

Chapters in books

L. Barreira and Ya. Pesin. Smooth ergodic theory and nonuniformly hyperbolic dynamics, with appendix by O. Sarig. In Handbook of Dynamical Systems 1B, edited by B. Hasselblatt and A. Katok. Elsevier, 2006, pp. 57–263.

A. Cannas da Silva. Symplectic geometry. Handbook of Differential Geometry II, edited by F. Dillen and L. Verstraelen. Elsevier, 2006, pp. 79–188.

Articles in international journals with referees

M. Abreu, G. Granja and N. Kitchloo. Moment maps, symplectomorphism groups and compatible complex structures. Special issue: Conference on Symplectic Topology (Stare Jablonki, Poland, 2004). *J. Symplectic Geom.*, 3 (2005), 655–670 (published in April 2006).

M. Aganagic, R. Dijkgraff, A. Klemm, M. Mariño and C. Vafa. Topological strings and integrable hierarchies. *Comm. Math. Phys.*, 261 (2006), 451–516.

J. Agapito. Weighted Brianchon–Gram decomposition. *Canad. Math. Bull.*, 49 (2006), 161–169.

L. Alvarez-Gaumé, P. Basu, M. Mariño and S. Wadia. Blackhole/string transition for the small Schwarzschild blackhole of $AdS_5 \times S^5$ and critical unitary matrix models. *Eur. Phys. J. C Part. Fields*, 48 (2006), 647–665.

J. Alves, J. Fachada and J. Sousa Ramos. Dynamical zeta functions and kneading determinants: a linear algebra point of view. *Linear Algebra Appl.*, 418 (2006), 913–924.

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6 Partnership protocols

In October 2004 the Center submitted to the Minister of Science, Innovation and Higher Education a request for the Statute of Associate Laboratory, with a strategic project entitled Internationalization of the Research and Promotion of Mathematics in Portugal. Besides pursuing the strategy of further development and internationalization of the research activities, in particular through the Postdoctoral Program and a Program for career development and employment of new researchers, the Center signed partnership protocols with the Institute for Systems and Robotics - Lisbon (Instituto de Sistemas e Robótica-Lisbon) and with the Institute of Telecommunications (IT) regarding interdisciplinary research cooperation, and also signed partnership protocols with 44 secondary and primary schools, which together enroll more than 38000 students, aiming at the promotion of Mathematics at these education levels through a set of activities oriented towards students and teachers.

While the evaluation of the request for the Statute of Associate Laboratory is still in progress, the Center has nevertheless started to develop various activities in collaboration with the secondary schools, and it has also pursued its past collaboration with the Ciência Viva Program. Some of these activities are listed below.

Summer school. "A Ciência do Não Linear", Instituto Superior Técnico, June 28 to July 1, 2006, http://www.math.ist.utl.pt/∼sramos/nao_linear .html (José Sousa Ramos).

Activities for secondary school teachers. The following working sessions took place in 2006:

- "Linear Programming" (Margarida Mendes Lopes and Diogo Gomes), Instituto Superior Técnico, April 22, 2006. (Seventeen teachers participated.)
- "Mathematics in the exploitation of natural resources" (José Fachada), and "The names of numbers" (Pedro Martins Rodrigues), Instituto Superior Técnico, December 16, 2006. (Ten teachers participated.)

CEMAT Research Report 2006

Department of Mathematics
Instituto Superior Técnico
Portugal

Contents

1 Introduction

CEMAT is a research center in mathematics and applications, integrating 38 members and 24 post-graduate students in 2006, that is organized in four main research groups:

- Operator Theory, Banach Algebras and Applications
- Harmonic Analysis, Operator Theory and Applications
- Applied and Numerical Analysis
- Statistics and Stochastic Processes

The Operator Theory, Banach Algebras and Applications's group, coordinated by Prof. Frank-Olme Speck, carries out research mainly on: symbol factorization; C*algebras; Toeplitz operators with oscillatory symbols; and boundary value problems.

The Harmonic Analysis, Operator Theory and Applications's group, coordinated by Prof. Stefan Samko, carries out research mainly on: operator theory in function spaces with non-standard growth and fractional type operators; singular integral operators and factorization; and factorization and integrable systems.

The Applied and Numerical Analysis's group, coordinated by Prof. Carlos Alves, carries out research mainly on: mathematical and numerical modeling of Newtonian and non-Newtonian flows with applications to haemodynamics; singular initial and boundary value problems for nonlinear ordinary second order differential equations; inverse problems; and the method of fundamental solutions for solving direct problems.

The Statistics and Stochastic Processes's group, coordinated by Prof. Ana Pires, carries out research mainly on: robust methods in multivariate analysis and applications to data analysis; statistical modelling and applications in categorical and survival data; and stochastic processes and applications.

The list of members of CEMAT in 2006 is the following:

PhD members:

Adélia Sequeira
Amarino Lebre
Ana Leonor Silvestre
Ana Moura Santos
Ana Pires Parente
António Bravo
António Pacheco Pires
Carla Pereira
Carlos Alves
Carlos Daniel Paulino
Catarina Carvalho
Cláudia Nunes Philippart
Francisco Teixeira
Frank-Olme Speck
Giovani Silva
Helena Mascarenhas
Isabel Rodrigues
João Amaral
João Branco
Juan Rodriguez

Juha Videman
Lina Oliveira
Manuel Cabral Morais
Margarida Baía
Maria Amélia Bastos
Maria Cristina Câmara
Maria da Conceição Amado
Maria do Rosário de Oliveira
Maria Teresa Diogo
Natasha Samko
Nelson Antunes
Paulo Lopes
Paulo Soares
Pedro Lima
Pedro Simões dos Santos
Rafael Santos
Stefan Samko
Viktor Kravchenko

Post-graduate students:

Alexandra Moura
Ana Isabel Guerra
Cláudio Fernandes
Cristina Diogo
Euclides Luís
Isabel Oliveira
João Janela
José Alberto Rodrigues
Luís Borges
Luís Pessoa
Magda Rebelo
Maria de Fatima Ferreira
Maria Helena Ribeiro
Maria Luísa Morgado
Nuno Cirilo António
Nuno Santos
Pedro Antunes
Pedro Serranho
Sofia Naique
Vanda Lourenço
Maria do Carmo Martins
Maria João Braga
Rui Marreiros
Svilen Valtchev

2 Publications in 2006

2.1 Books or Special Journal Issues (authored or edited)

- C.J.S. Alves, *Computers*, Materials & Continua, Tech Science Press (USA), since 2004.
- T. Diogo, P. Lima and T. Tang (Eds.), Journal: *Communications on Pure and Applied Analysis*, Volume 5, Number 2 (2006).
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- A.M. Robertson and A. Sequeira, M. Kameneva, *Hemorheology, in: Hemodynamical Flows: Modeling, Analysis and Simulation*, Birkhauser, to appear.
- N.C. Roberty and C.J.S. Alves, *On the identification of star shape sources from boundary measurements using a reciprocity functional*, submitted.
- N. Samko, *Upper and lower indices of a certain class of monotonic functions in connection with Fredholmness of singular integral operators*, Proceed. of 5th Congress of ISAAC, Catania, July 2005, World Scientific Press. (to appear)
- N. Samko, *Solutions of Singular Integral Equations in Function Spaces of Continuous Functions with Weights at End Points*, Proc. Workshop ICNPAA 2006: Math. Problems in Engineering and Aerospace Sciences. (to appear)
- N. Samko and B. Vakulov, *Spherical potentials of complex order in weighted generalized Holder spaces with radial oscillating weights*, Operators and Matrices. (to appear)
- S. Samko, B. Vakulov, *Weighted Sobolev theorem in Lebesgue spaces with variable exponent* , J. Math. Anal. and Applic. (to appear)
- E. Sellountos and A. Sequeira, *An advanced meshless LBIE/RBF method for solving two dimensional incompressible fluid flows*, Computational Mechanics, submitted.
- V. Todorov and A. M. Pires, *Comparative performance of several robust linear discriminant analysis methods*, REVSTAT, Statistical Journal. 2006, in press.
- V. L. D. Tomazella, F. Louzada-Neto and G. L. Silva, *Bayesian modelling for multivariate lifetime data with homogeneous Poisson process and additive frailty*, Journal of Applied Statistical Science, 2006, in press.

4 Research Lectures

A. M. Artoli,

- and A. Sequeira, *Mesoscopic simulations of unsteady shear-thinning flows*, Computational Science - ICCS 2006, Springer Lecture Notes in Computer Science, vol. 3992: 78-85, 2006.

A. Conceição,

- *Factorization algorithm for some classes of non-rational matrix functions*, Workshop "Operator Algebras, Operator Theory and Applications" (WOAT-2006), Satellite Conference to ICM (Madrid), 2006, September, 1-5, Lisbon, Portugal.

R.C. Marreiros,

- *On the kernel of singular integral operators with non-Carleman shift*, Workshop "Operator Algebras, Operator Theory and Applications" (WOAT-2006), Satellite Conference to ICM (Madrid), 2006, September, 1-5, Lisbon, Portugal.
- *On the kernel of some singular integral operators with non-Carleman shift* - 9th European Workshop on Applications and Generalizations of Complex Analysis, Coimbra, July 1, 2006, CIM.

H. Rafeiro,

- *On a class of integral equations of the first kind with weak singularity in variable exponent spaces*, Workshop "Operator Algebras, Operator Theory and Applications" (WOAT-2006), Satellite Conference to ICM (Madrid), 2006, September, 1-5, Lisbon, Portugal.

J. Rodrigues,

- *The kernel of singular integral operators with a Carleman shift and conjugation in the real line*, Workshop "Operator Algebras, Operator Theory and Applications" (WOAT-2006), Satellite Conference to ICM (Madrid), 2006, September, 1-5, Lisbon, Portugal.

N. Samko,

- *Properties of almost monotonic functions in application to Fredholm theory of singular integral operators*, Seminar "Operator Theory and Applications", Rostov State University, Russia, February 13, 2006.
- *Solutions of singular integral equations in spaces of continuous functions with weights oscillating at end points*, Workshop ICNPAA 2006: Math. Problems in Engineering and Aerospace Sciences, Budapest, 2006, June 21-23.
- *Weighted theorems on potential operators in the generalized Holder spaces via indices* ∞ *and* ∞*,* Workshop "Operator Algebras, Operator Theory and Applications," Satellite Conference to ICM (Madrid), 2006, September, 1-5, Lisbon, Portugal.
- Weighted theorems for spherical convolutions in the generalized Holder spaces in terms of index numbers of the weight and characteristic of the space, Seminar "Operator Theory and Applications", Rostov State University, Russia, November 13, 2006.

S. Samko,

- *Modern trends in the variable exponent spaces*, 4th Intern. Symposium "*Fourier Series and Applicatons*", Novorossiisk, Russia, 2006, May 29 - June 5.
- *On solvability of singular integral equations in spaces with variable order of integrability*, Sixth Intern. Conf. ICNPAA-2006 on Math. Problems in Engineering and Aerospace Sciences, Budapest Univ. Techn. and Economics, Budapest, Hungary, June 21-23, 2006.
- *Periodization of fractional Integrals*, 2nd IFAC Workshop on Fractional Differentiation and its Applications, Porto, Portugal, 19 - 21 July, 2006.
- *Classical Operators of Analysis - Maximal, Singular and Potential Operators - in Variable Exponent Spaces.* WOAT 2006, Instituto Superior Técnico, Lisbon, Portugal, September 1-5.

5 Seminar Series

5.1 Applied Mathematics and Numerical Analysis

- Jean-François Babadjian (SISSA - Trieste, Italy), A *multiscale approach to the Neumann Sieve problem in dimensional reduction,* January 11.
- K. R. Rajagopal (Texas A&M University, College Station, USA), *New perspectives in Fluid Mechanics*, January 27.
- Neville J. Ford (University of Chester, UK), *Super-exponential solutions: their numerical modelling and detection*, February 8.
- Marcelo Colaço (Instituto Militar de Engenharia, Rio de Janeiro, Brasil) Técnicas Híbridas de Otimização Aplicadas a Problemas de Eletro-Magneto-Hidrodinâmica com Mudança de Fase, February 23.
- Luigi C. Berselli (Department of Applied Mathematics, University of Pisa, Italy), *An introduction to Large Eddy Simulation (LES) of Turbulent Flows* (Part I), March 22.
- Luigi C. Berselli (Department of Applied Mathematics, University of Pisa, Italy), *An introduction to Large Eddy Simulation (LES) of Turbulent Flows* (Part II), March 29.
- Luigi C. Berselli (Department of Applied Mathematics, University of Pisa, Italy), *An introduction to Large Eddy Simulation (LES) of Turbulent Flows* (Part III), April 6.
- Fabien Borocin (University of Edinburgh, U.K.), D*issipation of energy in fluid-filled poroelastic materials,* April 6.
- Felix Sadyrbaev (University of Lavia and Daugavpils University), *Two-point nonlinear boundary value problems for ordinary differential equations: existence, multiple solutions, properties*, April 19.
- Euripides Sellountos, (CEMAT - IST, Lisbon, Portugal), Meshless Local Boundary Integral Equation method for solving two dimensional fluid flow problems, May 24.
- Iliya Brayanov (CEMAT - IST, Lisbon, Portugal), *Uniformly Convergent Finite Volume Schemes for a Convection-Dominated Equation with Discontinuous Coefficients. Application to Blood Flow Problems*, June 7.
- Sharath S. Girimaji (Aerospace Engineering Dept.,Texas A&M University, USA), *Toward turbulence description using Boltzmann: Theory and Computations,* July 5.
- Abdallah Bradji (Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany), *An approach to improve Convergence Order in Finite Volume Methods and its Application in Finite Element Methods,* July 14.
- Ana Santos Silva (Instituto de Biopatologia Química - FML), *Biophysical properties in an experimental animal model of inflamation by intravial microscopy,* July 19.
- Abdel Monim Artoli (Departamento de Matemática and CEMAT - IST), *Which force triggers and dominates rolling of leukocytes?,* July 19.
- Iliya Brayanov (Departamento de Matemática and CEMAT - IST), *On the application of a fractional step finite volume method for solving a blood flow problem in a channel,* July 19.
- Euripides Sellountos (Departamento de Matemática and CEMAT - IST), *A meshless multiregion - BEM approach for the solution of the Navier-Stokes equations,* July 19.
- João Paulo Janela (ISEG/UTL and CEMAT/IST), *Benchmarking of 2D and 3D numerical solvers for generalized Newtonian flows using semi-analytical solutions,* July 19.

- Tomás Bodnar (Dept. of Tech. Mathematics, Czech Tech. University of Prague and CEMAT/IST), *On an advanced mathematical model for blood coagulation*, July 21.
- Nilson Costa Roberty (Universidade Federal do Rio de Janeiro, Brasil), *Direct and inverse problems in the one-speed transport theory* , (Part I), October 12.
- Nilson Costa Roberty (Universidade Federal do Rio de Janeiro, Brasil), *Direct and inverse problems in the one-speed transport theory* , (Part II), October 16.
- Nilson Costa Roberty (Universidade Federal do Rio de Janeiro, Brasil), *Direct and inverse problems in the one-speed transport theory* , (Part III), October 19.
- Nilson Costa Roberty (Universidade Federal do Rio de Janeiro, Brasil), *Direct and inverse problems in the one-speed transport theory* , (Part IV), October 23.
- Alexandra Moura (MOX - Modeling and Scientific Computing, Department of Mathematics, Politecnico di Milano, Italy and CEMAT/IST), *Coupling between 3D and 1D fluid-structure interaction models for blood flow,* October 25.
- Serguei A. Nazarov (University of St. Petersburg, Russia), *On smooth images of oscillating surfaces of solids*, October 30.
- Hedia Chaker (ENIT-LAMSIN, Tunísia), L*imite asymptotique des equations de Boltzman a champ fort: solution entropique?,* November 10.
- Didier Bresch (LAMA/UMR5127 - Université de Savoie, France), G*lobal existence of viscous heat conducting fluids,* November 22.

5.2 Functional Analysis and Applications

- Alexei Karlovich (Universidade do Minho, Braga), *Asymptotics of block Toeplitz determinants generated by factorable matrix functions with equal partial indices* , January 13.
- Vladimir Mityushev (Pedagogical Academy, Krakow, Poland), *Constructive solution to the C-linear problem with piece-wise constant matrices*, February 3.
- Alexei Karlovich (Universidade do Minho, Braga), *Asymptotic formulas for traces of Toeplitz matrices with symbols in Hölder-Zygmund spaces*, March 10.
- Roland Duduchava (A. Razmadze Mathematical Institute, Academy of Sciences, Tbilisi, Georgia, presently: Universität Saarbrücken, Alemanha), *Differential operators and boundary value problems on hypersurfaces*, March 31.
- Sergej Rjasanow (Universität Saarbrücken, Alemanha), *The Boltzmann equation. Theory and numerics*, April 7.
- Cristina Câmara (Instituto Superior Técnico, U.T. Lisboa), *Fredholmness and corona problems*, April 21.
- Anthippi Poulkou (University of Athens Panepistimioupolis, Grécia), *Sampling and interpolation theories associated with boundary value problems*, May 12.
- Ana Moura Santos (Instituto Superior Técnico, U.T. Lisboa), *Difracção de ondas por cunhas e estruturas periódicas no âmbito da Feira de Conhecimento e da Inovação*, May 19.
- Cristina Diogo (Instituto Superior Técnico, U.T. Lisboa), *Generalized factorization for a class of triangular symbols with a gap around zero*, June 16.
- Sergei V. Rogosin (Belarusian State University, Minsk, Belarus), *Hele-Shaw model for melting with several dendrits*, July 7.

- Marina Dubatovskaya (Belarusian State University, Minsk, Belarus), *Heat conduction in 2D-domains with symmetric inclusions: a model and reduction to a vector-matrix problem*, July 7.
- Messoud Efendiev (GSF/TUM Munich, Germany), *Nonlinear Riemann-Hilbert problem: theory and application*, September 8.
- Lina Oliveira (Instituto Superior Técnico, U.T. Lisboa), *A non-commutative notion of topology*, October 20.
- Andreas Hartmann (Université Bordeaux I, France), *Extremal functions of kernels of Toeplitz operators*, October 27.
- Sofia Naique (Instituto Superior Técnico, U.T. Lisboa), *Polynomial almost periodic solutions for a class of Riemann-Hilbert problems*, November 3.
- Frank-Olme Speck (Instituto Superior Técnico, U.T. Lisboa), *On the analytical solution of the linear-fractional Riemann problem*, November 10.
- António Ferreira dos Santos (Instituto Superior Técnico, U.T. Lisboa), *Lax equations, factorization and Riemann-Hilbert problems*, November 24.
- Alexey N. Karapetyants (Rostov State University, Russia), *Toeplitz operators with special symbols in weighted Bergman spaces*, November 24.
- Vakhtang Kokilashvili (A. Razmadze Mathematical Institute, Tbilisi, Georgia), *Singular integrals in weighted Lebesgue spaces with variable exponent and applications,* In collaboration with the Seminar on Applied Mathematics and Numerical Analysis, November 30.
- Ernst Stephan (Leibniz Universität Hannover, Alemanha), *Corner singularities and Mellin symbols*, December 14.
- Yuri Karlovich (Universidad Autónoma del Estado de Morelos, México), *Algebras of singular integral operators with shifts*, December 15.

5.3 Harmonic Analysis, Operator Theory and Applications

- Alexandre Koshelev (University of St Petersbourg), *On regular solutions of elliptic systems,* May 25.
- Serguey Rogosin (University of Belarus), *Complex-analytic methods for the study of the effective conductivity of composite materials*, July 12.
- Virginia Stoyneva Kiryakova (Institute of Mathematics and Informatics, Bulgarian Academy of Sciences), *The role of some special functions in developing generalized fractional calculus and new integral transforms,* July 17.
- Alexey Karapetyants (Rostov State University), *Compactness of Toeplitz operators with BMO-symbols on weighted Bergman spaces and the Beresin transform,* November 28.
- Vakhtang Kokilashvili (A.Razmadze Mathematical Institute, Tbilisi), *On two-weighted inequalities for some integral operators in variable Lebesgue spaces,* December 5.

5.4 Probability and Statistics

- Jorge Alberto Achcar (Universidade Federal de São Carlos), *Estimators of Sensitivity and Specificity in the Presence of Verification Bias: A Bayesian Approach*, January 24.
- Graciela Boente (Universidad de Buenos Aires), *Regiões de Tolerância Multivariadas Robustas*, February 15.

- Isabel Rodrigues (DMIST), *Testes Robustos para o Modelo das Componentes Principais Comuns*, June 1.
- Conceição Amado (DMIST), *Bootstrap Robusto com base na Função de Influência*, June 8.
- Wolfgang Schmid (Europe University, Frankfurt (Oder), *Comparison of Different Estimation Techniques for Portfolio Selection*, June 21.
- Guy Latouche (Université Libre de Bruxelles), *Structured Markov Chains in Applied Probability and Numerical Analysis*, June 21.
- Ana M. Bianco (IC/FCEN - Universidade de Buenos Aires), *Tests Robustos en el Modelo de Regresión Logística*, October 11.
- Thelma Safadi (DCE, Universidade Federal de Lavras), *Uma Abordagem Bayesiana do Modelo ARCH com Potência Assimétrica*, October 27.
- Robert Weiss (DB/UCLA, University of California), *Hierarchical Models for Combining Phylogenetic Analyses Using an Iterative Re-weighting Algorithm*, November 2.
- Márcia D'Elia Branco (DE/IME, Universidade de São Paulo), *A Skew-Normal Item Response Theory Family*, November 8.

6 Participation in research projects

- *Inverse Problems and Meshless Methods in PDEs*, Project POCTI/MAT/60863/2004, [2005-2007]. Coordinator: C. Alves.
- *Problemas inversos de identificação de obstáculos, inclusões, falhas e não-homogeneidades em materiais*, Project CAPES-GRICES, with H. Orlande (UFRJ, Brazil [2004 – 2006]. Local Coordinator: C. Alves.
- *Three-dimensional Wave Propagation in Layered Media Containing Cracks or Thin Inclusions - Computational Modelling and Experimental Detection.* Project FCT - POCTI/ECM/58940/2004, 2005-07 (participants: C.J.S. Alves, S. Valtchev, P. Antunes).
- *Computational Methods for Singular Problems*, project POCTI/MAT/45700/2002, [01.09.2003-31.08.2006]. Coordinator: P. Lima.
- EURO-FGI, *Design and Engineering of the Future Generation Internet, Towards Convergent Multi-Service Networks*, 2006/12/01-2009/11/30. Participants: A. Pacheco, C. Nunes, R. Oliveira, N. Antunes, F. Ferreira, H. Ribeiro.
- EURO-NGI, *Design and Engineering of the Next Generation Internet, Towards Convergent Multi-Service Networks*, 2003/12/01-2006/11/30. Participants: A. Pacheco, C. Nunes, R. Oliveira, N. Antunes, F. Ferreira, H. Ribeiro.
- *Internet Traffic Measurements, Modelling and Statistical Analysis*, POSI/EIA/60061/2004, 2005/01/01-2006/12/31. Participants: A. Pacheco, C. Nunes, R. Oliveira, N. Antunes, F. Ferreira, H. Ribeiro.
- *QuantLog: Logic in Quantum Computation and Information*, POCI/MAT/55796/2004, 2005/01/01-2007/12/31. Participants: A. Pacheco, C. Nunes.
- *Métodos Estatísticos Robustos para a Análise de Dados Multivariados*, GRICES. Proc. 4.1.7/Argentina, 2005/01/01-2006/12/31. Leader: A. Pires. Participant: I. Rodrigues.

- *Modelação do Tráfego do Aeroporto de Lisboa*, Research and consultancy project for ANA, Aeroportos de Portugal, SA, 2005/10/01-2008/03/01. Coordinators: A. Pires, C. Nunes, A. Pacheco, R. Oliveira.
- ESF Network: *Statistical Analysis of Complex Data with Robust and Related Statistical Models (SACD)* Ref.: Network 117, 2004/01/01-2006/12/31. Member of steering Committee: A. Pires. Participants: C. Amado, R. Oliveira, I. Rodrigues.
- INTAS grant (Brussels) was awarded to the project *Variable Exponent Analysis*, coordinated by Stefan Samko, which includes 4 international teams (Portugal, Finland, Georgia, Azerbaijan), ref. Nr.06-1000017-8792. Coordinator: S. Samko.
- *Mathematical and Numerical Modelling of the Human Cardiovascular System*, POCTI/MAT/41898/2001, [15.1.2002-30.04.2006]. Coordinator: A. Sequeira.
- HaeMOdel: *Mathematical and Numerical Modelling in Haemodynamics, Research Training Network*, HPRN-CT-2002-00270, [01.10.2002-30.9.2006]. Coordinator: A. Quarteroni (EPFL, Switzerland and Politecnico di Milano, Italy). Local Coordinator: A. Sequeira.
- *Blood Flow Modelling in the Vascular System*, Bilateral Project Portugal/Tunisia, with H. Chaker (LAMSIN/ENIT) [2004-2007]. Local Coordinator: A. Sequeira.
- *Analysis of Mathematical Models for the Motion of Rigid Bodies in Incompressible Fluids*, POCTI/MAT/61792/2004, [2005-2007]. Coordinator: A. L. Silvestre.

7 Organizations of scientific events

- *Follow-up Workshop on Mathematics and the Environment*, January 27-28, 2006, CIM, Coimbra, Portugal (J. Videman, Chairman of the Organizing Committee).
- *III European Conference on Computational Mechanics*, LNEC, Lisbon, Portugal, June 5-9, 2006 (C.J.S. Alves: Organizer of the Meshless Methods Session and Member of the Scientific Committee).
- *International Conference on Robust Statistics, ICORS 2006*, Instituto Superior Técnico, Lisboa, 16-21 July 2006.
- *Second International Workshop on Analysis and Numerical Approximation of Singular Problems* (IWANASP2006), September 6-8, 2006, Samos, Greece (T. Diogo and P. Lima, Co-organizers).
- *Third International Symposium on Modelling of Physiological Flows – MPF2006*, Bergamo, Italy, September 25-27, 2006 (A. Sequeira: Member of the Scientific Committee).
- *Workshop on Shallow-Water Equations*, IST, Lisbon, Portugal, November 20, 2006, (J. Videman, Member of the Organizing Committee).

8 Academic degrees awarded in 2006

8.1 Doutoramentos/Ph.D.'s

- Luis Borges, *Domain Decomposition Methods for Viscoelastic Fluids*, IST/UTL, December 2006, Supervisor: A. Sequeira.
- Rogério Cardoso, *Integral equations of the first kind of Sonine type*" (Univ. of Algarve), September 2006, Supervisor: S. Samko.
- G. Couto, *Opções reais e decisão sob incerteza no processo de relocalização (Real options and decision under uncertainty in the rellocation process)*, ISEG, Technical University of Lisbon, 2006, Supervised by J.A. Pereira, co-supervised by C. Nunes.
- Rui Carlos Marreiros, *Sobre o núcleo de operadores integrais singulares com deslocamento não Carlemaneano*, (Univ. of Algarve), October 2006, Supervisor: V. Kravchenko.
- Humberto Rafeiro, *Hypersingular integrals and potential type operators in Lebesgue spaces with variable exponent*, (Univ. of Algarve), September 2006, Supervisor: S. Samko.

8.2 Mestrados/M.A's/M.S.c.'s

- D. Barbosa, *Metodologias de amostragem em populações finitas (Finite population sampling methods)*. Master's thesis, IST, Technical University of Lisbon, 2006. Supervisor: C. Amado.
- Ana Sofia Mendonça, *Simulação Numérica de Fluidos Newtonianos Generalizados do Sistema Circulatório*, IST/UTL, Lisbon, December 2006, Supervisor: A. Sequeira.
- F. Poleto, *Análise de Dados Categorizados com Omissão (Analysis of Missing Categorical Data)*, Instituto de Matemática e Estatística, Universidade de São Paulo, 2006, Co-supervisor: C. D. Paulino.
- C. S. S. Soares, *Análise de dados de microarrays (Microarray data analysis)*, IST, Technical University of Lisbon, 2006, Supervisor: A. M. Pires.

CLC Research Report 2006

14 de Março de 2007

1 Overview

During 2006, the shift towards topics in the quantum and security fronts was consolidated. Two projects were submitted to FCT, one of which was already approved in the topic of kleistic logic.

The work on quantum logic went on following the idea of adopting superpositions of classical models as quantum models (exogenous approach). The logic is a conservative extension of classical logic including also primitives for reasoning about amplitudes and probabilities of quantum states. A complete axiomatization was proposed by relaxing the semantics to real closed fields. Decidability and complexity results were also obtained. With the same approach, research was also targeted towards dynamic quantum and probabilistic logics for reasoning about quantum programs and quantum systems. One of the most important contributions was to prove the completeness of the Hoare probabilistic logic for reasoning about probabilistic imperative algorithms (that include quantum algorithms). Preliminary steps were taken towards model-checking of quantum systems using the logics above as well as some of their temporal extensions. An institution-theoretical account of the exogenous approach to enriching logics was also proposed.

Research was also targeted at information security with an emphasis on logics for classical security and computational issues in quantum security. Attacks to classical protocols using quantum systems were developed, namely exploring decoherence and entanglement (this work was awarded the Portuguese IBM Scientific Prize 2005). A new quantum protocol for message authentication was proposed and its security was analyzed. An extension of first-order logic with a almost-everywhere quantifier was proposed envisaging the future development of a kleistic logic. The completeness of the axiomatization against the measure-theoretic semantics was proved. Both a denotational semantics and an operational semantics were developed for specification of security protocols. A labeled calculus for distributed temporal logic and its application to security protocol analysis was further developed. Security properties were also studied using trace properties and observational equivalences. A cryptographic implementation was developed and proved to preserve all the properties of safe programs. A quantitative extension of the usual Dolev-Yao intruder model was

presented and proved not to increase the computational complexity of the protocol insecurity problem in the case of a finite number of interleaved protocol sessions.

Work went on in the broad area of combination of logics. Cryptofibring was further developed. The collapsing problem was identified as a special case of the failure of conservativeness. Sufficient conditions were established for cryptofibring to yield a conservative extension of the combined logics. A survey monograph on Analysis and Synthesis of Logics was submitted to Springer - Applied Logic Series. Research on algebraization of logics was also pursued, namely for many-sorted logics as well as the exogenous approach to enriching logics, capitalizing on the theory of many-sorted equational logic.

In the area of computability over the reals, work was focused on computability with dynamical systems, where the computational universality of polynomial differential equations was established, and the equivalence with recursive analysis, under a given framework, was proved. Work was also focused on recursion theory on the reals, where new inductive techniques to establish links among function algebras on the integers, the rationals, and the reals was also developed. Research on continuous-time neural nets started shifting towards the Reservoir Computing framework, which is one of the novel scientific contexts where complex dynamical input-output relations can be used for the benefit of computation.

On the type system front, work was centered on the static verification of liveness properties of distributed systems, like receptiveness, responsiveness, determinism and deadlock-freedom. Work was also done on the development of a service-centered calculus featuring notions of service definition and invocation as well as session handling.

During 2006 the center supported an intensive guest program including visits of 26 foreign scientists who gave talks in the two running seminars: Logic and Computation Seminar and Quantum, Computation and Information Seminar.

2 Guest program

The following scientists visited the Center in 2006:

1. Nick Papanikolaou, U Warwick, UK, 12-18.11.06.
   Lecture: Towards a model-checker for quantum stabilizer protocols, 17.11.06.

2. Paulo Nogueira, CFIF-IST, 10.11.06.
   Lecture: Some combinatorics from Quantum Field Theory.

3. Marcelo Terra Cunha, U Federal de Minas Gerais, Brasil / U Leeds, UK, 21-28.10.06.
   Lecture: Entanglement: estimation, extraction, and transfer, 27.10.06.

4. Michael Ben-Or, Hebrew University, Israel, 5-12.9.06.
   Lecture: Secure multiparty quantum computation with (only) a strict honest majority, 8.9.06.

5. Marcelo Coniglio, IFCH, UniCamp, Brazil, 8-25.7.06.
   Lecture: Fibring in the Leibniz hierarchy, 21.7.06.

6. Jerry den Hartog, U Twente, Netherlands, 17-22.7.06.
   Lecture: A probabilistic Hoare-style logic for game-based cryptographic proofs, 20.7.06.

7. Luca Viganò, ETH, Switzerland, 16-23.7.06.

8. Peter Selinger, Dalhousie University, 14.7.06.
   Lecture: Idempotents in dagger categories.

9. Pedro Castelo Ferreira, CENTRA - IST, 14.7.06.
   Lecture: Topological quantum computation (conclusion).

10. Josep Batle Vallespir, U Balearic Islands, 5-12.7.06.
    Lecture: Entanglement, speed of quantum evolution and entropic inequalities, 11.7.06.

11. Ojas Parekh, Emory U, USA, 6-10.7.06.
    Lecture: Compacting cuts: a new linear formulation for minimum cut, 7.7.06.

12. Pedro Castelo Ferreira, CENTRA - IST, 7.7.06.
    Lecture: Topological quantum computation.

13. Mário Figueiredo, IT, Instituto Superior Técnico, 30.6.06.
    Lecture: Network inference from co-occurences.

14. Francisco Marcos de Assis, U Federal de Campina Grande, Brasil, 18.6-1.7.06.
    Lecture: Quantum zero-error capacity, 29.6.06.

15. Ana Matos, U Nijmegen, Netherlands, 20.6.06.
    Lecture: Typing secure information flow: declassification and mobility.

16. Jean-Yves Béziau,SNSF, U Neuchâtel, Switzerland, 16.6.06.
    Lecture: Absolute maximality.

17. Carlos Russo, Institut für Experimentalphysik, U Innsbruck, Germany, 2.6.06.
    Lecture: Quantum information processing with trapped ions.

18. Luís Antunes, LIACC, U Porto, Portugal, 26.5.06.
    Lecture: Worst-case running times for average-case algorithms.

19. Ignacio Cirac, Max-Planck-Institut für Quantenoptik, Germany, 16.5.06.
    Lecture: Quantum simulations in many-body systems.

20. Alexandre Costa-Leite, U Neuchâtel, Switzerland, 26.4-17.6.06.
    Lecture: The Church-Fitch paradox and combining logics, 12.5.06.

21. Jorge Orestes Cerdeira, Instituto Superior de Agronomia, Portugal, 5.5.06.
    Lecture: Connectivity in the design of protected area networks.

22. Daniel Gottesman, Perimeter Institute, Canada, 2-7.5.06.
    Lecture: The threshold for fault-tolerance, 5.5.06.

23. Armando Perez, U Valencia, Espanha, 27-28.4.06.
    Lecture: Non-linear quantum walks, 27.4.06.

24. Diamantino Caseiro, INESC, Portugal, 21.4.06.
    Lecture: Spoken language processing using weighted finite-state transducers.

25. Simone Severini, U York, UK, 6-9..4.06.
    Lecture: Unitarity as a finer sieve in distinguishing combinatorial objects, 7.4.06.

26. Mingsheng Ying, Tsinghua University, China, 20.3.06-5.6.06.
    Lecture: Quantum Entanglement Transformation, 7.4.06.

27. Christopher Fuchs, Bell Laboratories, USA, 28.3-2.4.06.
    Lecture: Maximally sensitive quantum states and a measure of quantumness, 31.3.06.

28. Luca Viganò, ETH, Switzerland, 15-24.3.06.
    Lecture: Symbolic and cryptographic analysis of the secure WS-ReliableMessaging scenario, 17.3.06.

29. Olivier Bournez, LORIA, France, 10.3.06.
    Lecture: Syntactic characterizations of some complexity classes in the Blum/Shub/Smale model.

30. Diana Santos, SINTEF, Norway, 24.2.06.
    Lecture: HAREM: the first evaluation contest for named entity recognition in Portuguese.

31. Marcelo Coniglio, CLE, UniCamp, Brazil, 5.2-2.3.06.
    Lecture: Plain fibring of matrix semantics, 24.2.06.

32. Ashwin Nayak, U Waterloo & Perimeter Institute, Canada, 4-8.2.06.
    Lecture: Approximate encryption of quantum states, 7.2.06.

33. Rahul Jain, U Berkeley, USA, 21.1-3.2.06.
    Lecture: Resource requirements of private quantum channels, 27.1.06.

34. Virgil D. Gligor, U Maryland, USA, 10-15.1.06.
    Lecture: Emergent properties in ad-hoc networks: a security perspective, 13.1.06.

35. Scott Aaronson, U Waterloo, Canada, 10-14.1.06.
    Lecture: Quantum versus classical proofs and advice, 13.1.06.

3 Seminars

The Center organizes the Logic and Computation and the Quantum Computation and Information Seminars with the following talks in 2006:

3.1 Logic and Computation Seminar

1. João Rasga (Instituto Superior Técnico)
   Almost-everywhere quantification revisited, 15/12/06.

2. Nick Papanikolaou (U Warwick, UK)
   Towards a model-checker for quantum stabilizer protocols, 17/11/06.

3. Luís Cruz-Filipe (Instituto Superior Técnico)
   Reasoning about probabilistic sequential programs, 3/11/06.

4. Jaime Ramos (Instituto Superior Técnico)
   Towards exogenous quantum first-order logic (Part 2), 20/10/06.

5. Amílcar Sernadas (Instituto Superior Técnico)
   Towards exogenous quantum first-order logic, 13/10/06.

6. Amílcar Sernadas (Instituto Superior Técnico)
   Towards a universal theory of fibring, 29/9/06.

7. Marcelo Coniglio (IFCH, UniCamp, Brazil)
   Fibring in the Leibniz hierarchy, 21/7/06.

8. Jerry den Hartog (U Twente, Netherlands)
   A probabilistic Hoare-style logic for game-based cryptographic proofs, 20/7/06.

9. Ojas Parekh (Emory U, USA)
   Compacting cuts: a new linear formulation for minimum cut, 7/7/06.

10. Mário Figueiredo (IT, Instituto Superior Técnico)
    Network inference from co-occurences, 30/6/06.

11. Ana Matos (U Nijmegen, Netherlands)
    Typing secure information flow: declassification and mobility, 20/6/06.

12. Jean-Yves Béziau (SNSF, U Neuchâtel, Switzerland)
    Absolute maximality, 16/6/06.

13. Kerry Ojakian (Instituto Superior Técnico)
    The method of approximation in real computation, 9/6/06.

14. Luís Antunes (LIACC, U Porto)
    Worst-case running times for average-case algorithms, 26/5/06.

15. Alexandre Costa-Leite (U Neuchâtel, Switzerland)
    The Church-Fitch paradox and combining logics, 12/5/06.

16. Jorge Orestes Cerdeira (Instituto Superior de Agronomia)
    Connectivity in the design of protected area networks, 5/5/06.

17. Diamantino Caseiro (INESC)
    Spoken language processing using weighted finite-state transducers, 21/4/06.

18. Ricardo Gonçalves (Instituto Superior Técnico)
    On the algebraization of global logic, 31/3/06.

19. Luca Viganò (ETH, Switzerland)
    Symbolic and cryptographic analysis of the Secure WS-ReliableMessaging Scenario, 17/3/06.

20. Olivier Bournez (LORIA, France)
    Syntactic characterizations of some complexity classes in the Blum/Shub/Smale model, 10/3/06.

21. Diana Santos (SINTEF, Norway)
    HAREM: the first evaluation contest for named entity recognition in Portuguese, 24/2/06.

22. Marcelo Coniglio (CLE, UniCamp, Brazil)
    Plain fibring of matrix semantics, 24/2/06.

23. Carlos Caleiro (Instituto Superior Técnico)
    Combining classical and intuitionistic logics, 10/2/06.

24. Pedro Lopes (Instituto Superior Técnico)
    r,m-colorings of knots, 3/2/06.

25. Pedro Adão (Instituto Superior Técnico)
    Cryptographically sound implementations for communicating processes, 20/1/06.

26. Virgil D. Gligor (U Maryland, USA)
    Emergent properties in ad-hoc networks: a security perspective, 13/1/06.

3.2 Quantum Computation and Information Seminar

1. Marcelo Terra Cunha (U Federal de Minas Gerais - U Leeds)
   Entanglement: Estimation, Extraction, and Transfer - Part 2, 15/12/06.

2. Nick Papanikolaou (University of Warwick)
   Towards a model-checker for quantum stabilizer protocols, 17/11/06. Joint session with Logic and Computation Seminar.

3. Paulo Nogueira (Instituto Superior Técnico)
   Some combinatorics from Quantum Field Theory (conclusion), 17/11/06.

4. Paulo Nogueira (Instituto Superior Técnico)
   Some combinatorics from Quantum Field Theory, 10/11/06.

5. Marcelo Terra Cunha (U Federal de Minas Gerais / U Leeds)
   Entanglement: Estimation, Extraction, and Transfer, 27/10/06.

6. Jaime Ramos (Instituto Superior Técnico)
   Towards exogenous quantum first-order logic (conclusion), 20/10/06.

7. Amílcar Sernadas (Instituto Superior Técnico)
   Towards exogenous quantum first-order logic, 13/10/06.

8. Michael Ben-Or (Hebrew University)
   Secure Multiparty Quantum Computation with (Only) a Strict Honest Majority, 8/9/06.

9. Peter Selinger (Dalhousie University)
   Idempotents in dagger categories, 14/7/06.

10. Pedro Castelo Ferreira (CENTRA - IST)
    Topological quantum computation (conclusion), 14/7/06.

11. Josep Batle Vallespir (U Balearic Islands)
    Entanglement, speed of quantum evolution and entropic inequalities, 11/7/06. Joint seminar with CFIF.

12. Pedro Castelo Ferreira (CENTRA - IST)
    Topological quantum computation, 7/7/06.

13. Francisco Marcos de Assis (U Federal de Campina Grande)
    Quantum Zero-Error Capacity, 29/6/06.

14. Nikola Paunkovic (Instituto Superior Técnico)
    Ground state overlap, quantum phase transitions and the orthogonality catastrophe, 20/6/06.

15. Carlos Russo (Institut für Experimentalphysik, U Innsbruck)
    Quantum Information Processing with Trapped Ions, 2/6/06.

16. Vítor Rocha Vieira (Instituto Superior Técnico)
    Transport, relaxation and entropy in physical systems, 30/5/06.

17. Ignacio Cirac (Max-Planck-Institut für Quantenoptik)
    Quantum Simulations in Many-Body Systems, 16/5/06. Joint seminar with CFIF.

18. Pedro Ribeiro (Université Pierre et Marie Curie)
    Adiabatic Quantum Computation, 12/5/06.

19. Daniel Gottesman (Perimeter Institute)
    The Threshold for Fault-tolerance, 5/5/06.

20. Armando Perez (U Valencia)
    Non-linear Quantum Walks, 27/4/06.

21. Simone Severini (U York, UK)
    Unitarity as a finer sieve in distinguishing combinatorial objects, 7/4/06.

22. Mingsheng Ying (Tsinghua University)
    Quantum Entanglement Transformation, 7/4/06.

23. Christopher Fuchs (Bell Laboratories)
    Maximally Sensitive Quantum States and a Measure of Quantumness, 31/3/06.

24. Nikola Paunkovic (Instituto Superior Técnico)
    Entanglement-assisted Orientation in Space, 24/3/06.

25. Ashwin Nayak (U Waterloo & Perimeter Institute)
    Approximate Encryption of Quantum States, 7/2/06.

26. Rahul Jain (U Berkeley)
    Resource requirements of private quantum channels, 27/1/06.

27. Scott Aaronson (U Waterloo)
    Quantum Versus Classical Proofs And Advice, 13/1/06.

4 Organization of scientific meetings

Encontro Nacional de Matemática'06 da Sociedade Portuguesa de Matemática, ISEL, Lisboa, June 20-23, 2006.
A. Sernadas: Program chair of the Logic and Computation Session.

5 Postdoctoral program

During 2006, the following researchers started, continued or concluded their postdocs at the Center:

- Rohit Chadha (PhD in Mathematics, U Penn, USA), from September 2005 to August 2006. Supervisors: Amílcar Sernadas and Paulo Mateus.
- Kerry Ojakian (PhD in Mathematics, CMU, USA), since May 2005. Supervisor: Amílcar Sernadas.
- Luís Cruz-Filipe (PhD in Mathematics, University of Nijmegen, The Netherlands), since October 2004. Supervisor: Amílcar Sernadas.

6 Postgraduate program

During 2006, the following theses were concluded or in preparation by current CLC student members at the Center or elsewhere:

6.1 PhD theses concluded in 2006

[1] P. Adão. *Formal Methods for the Analysis of Security Protocols.* PhD thesis, IST, Universidade Técnica de Lisboa, 2006. Supervised by P. Mateus and A. Scedrov.

6.2 On going PhD theses

[1] P. Baltazar. *Topic: Model Checking of Quantum Systems.* PhD thesis, IST, Universidade Técnica de Lisboa, in preparation. Expected submission: 2008. Supervised by P. Mateus.

[2] L. Camacho. *Topic: Colorings of Knots versus Polynomial Invariants.* PhD thesis, Universidade da Madeira, in preparation. Expected submission: 2008. Supervised by F. M. Dionísio and P. Lopes.

[3] M. Gamboni. *Topic: Models and Proof Methods for Information Protection.* PhD thesis, IST, Universidade Técnica de Lisboa, in preparation. Expected submission: 2009. Supervised by A. Ravara.

[4] R. Gonçalves. *Topic: Algebraizability of Quantum Logics.* PhD thesis, IST, Universidade Técnica de Lisboa, in preparation. Expected submission: 2007. Supervised by C. Caleiro.

[5] T. Reis. *Topic: Probabilistic Models in Security.* PhD thesis, ETH, Zurich, in preparation. Expected submission: 2009. Supervised by L. Viganò and P. Mateus.

[6] P. Ribeiro. *Topic: Theoretical Problems in Quantum Information.* PhD thesis, Laboratoire de Physique Théorique de la Matière Condensée, Université Pierre et Marie Curie, in preparation. Expected submission: 2008. Supervised by R. Mosseri.

[7] K. G. Roggia. *Topic: Deduction Systems for Quantum Logic.* PhD thesis, IST, Universidade Técnica de Lisboa, in preparation. Expected submission: 2009. Supervised by C. Sernadas.

7 Projects

7.1 Current

- KLog: Kleistic Logic (FCT - POCI) (approved in 2006)
- QuantLog: Logic in Quantum Computation and Information (FCT - POCI)
- Space-Time-Types: Behavioural and Spatial Type Systems (FCT - POSC)
- ConTComp: Continuous Time Computation and Complexity (FCT - POCTI)
- Sensoria (EU)

- Multiparticle quantum walks and their algorithmic applications (Anglo-Portuguese)
- Communication protocols in session types (Anglo-Portuguese)
- Calculabilité et complexité des modèles de calculs à temps continu (Franco-Portuguese)

7.2 Submitted

- QSec: Quantum Security (submitted to FCT).

8 Invited talks and communications

1. Seminário do Departamento de Ciência de Computadores, FCUN, Porto, Portugal, December 13, 2006.
   P. Mateus: Transferring proofs of zero-knowledge systems with quantum correlations.
2. Portuguese Category Seminar, University of Coimbra, December 11, 2006.
   A. Sernadas: Towards a universal theory of fibring.
   C. Caleiro: Quantum institutions.
3. QNET Workshop 2006, University of Glasgow, UK, December 4-5, 2006.
   P. Mateus: Exogenous quantum logics.
4. Seminário de Lógica Matemática, IST/FCUL, Lisboa, Portugal, November 24, 2006.
   J. Rasga: A complete axiomatization of discrete-measure almost-everywhere quantification.
5. Seminários do Centro de Informática e Tecnologias da Informação, FCT/UNL, Lisboa, Portugal, November 22, 2006.
   P. Mateus: Quantum cryptography and security.
6. II International Colloquium on Metaphysics, Universidade Federal do Rio Grande do Norte, Natal, Brazil, November 6-9, 2006.
   J. Marcos: Essential and accidental propositions.
7. Third International Conference on Computability and Complexity in Analysis, Gainesville, Florida, USA, November 1-5, 2006.
   K. Ojakian: The methods of approximation and lifting in real computation.
8. Seminário de Lógica Matemática, IST/FCUL, Lisboa, Portugal, October 19, 2006.
   L. Cruz-Filipe: Reasoning about probabilistic sequential programs.

9. Segurança Informática nas Organizações (SINO 2006), Universidade de Aveiro, Portugal, October 10-11, 2006.
   P. Mateus: Análise de sistemas de prova de conhecimento nulo.

10. Computer Science Logic (CSL 2006), Szeged, Hungary, September 25-29, 2006.
    P. Mateus: Reasoning about states of probabilistic sequential programs.

11. International Conference on Quantum Foundation and Technology: Frontier and Future (ICQFT'06), Hangzhou, China, August 25-31 2006.
    Y. Omar: Generation of entanglement in a quantum wire and application to single-electron transmittivity.

12. Seminário do Departamento de Engenharia Elétrica, Universidade Federal de Campina Grande, Campina Grande, Brazil, August 17, 2006.
    P. Mateus: Ataques quânticos a protocolos clássicos.

13. Seminário do Grupo de Informação Quântica, Universidade Federal do Ceará, Fortaleza, Brazil, August 8, 2006.
    P. Mateus: Ataques quânticos a protocolos clássicos.

14. Encontros de Quarta Feira, Departamento de Informática, Faculdade de Ciências da Universidade de Lisboa, Portugal, July 26, 2006.
    A. Ravara: Cryptographic primitives in a calculus with polyadic synchronisation.

15. 7th Conference on Real Numbers and Computers (RNC 7), Nancy, France, July 10-12, 2006.
    D. S. Graça: An ordinary differential equation defined by a computable function whose maximal interval of existence is non-computable.

16. 33rd International Colloquium on Automata, Languages and Programming (ICALP 2006), San Servolo, Venice, Italy, July 9-16, 2006.
    P. Adão: Cryptographically sound implementations for communicating processes.

17. Five minute talks session, 19th IEEE Computer Security Foundations Workshop (CSFW 2006), San Servolo, Venice, Italy, July 5-7, 2006.
    P. Adão: Towards a quantitative analysis of security protocols.
    R. Chadha: Decidable quantum reasoning.

18. Computability in Europe 2006, Swansea, Wales, UK, June 30 - July 5, 2006.
    K. Ojakian: The method of approximation in real computation.

19. Encontros de Quarta Feira, Departamento de Informática, Faculdade de Ciências da Universidade de Lisboa, Portugal, June 28, 2006.
    M. Gamboni: Deciding deterministic responsiveness and closeness in pi-calculus.

20. Algebra, Meaning and Computation - A Festschrift Symposium in Honor of Joseph Goguen, San Diego CA, USA, June 27-29, 2006.
C. Caleiro: Quantum institutions.

21. Encontro Nacional de Matemática'06 da Sociedade Portuguesa de Matemática, Instituto Superior de Engenharia de Lisboa, June 20-23, 2006.
C. Caleiro: Lógica temporal distribuída para análise de protocolos de segurança.
D. S. Graça: Algumas limitações fundamentais na resolução numérica de equações diferenciais ordinárias.
P. Adão: Lógicas de indistinguibilidade para verificação de protocolos criptográficos.

22. 25th Weak Arithmetics Days, Clermont-Ferrand, France, June 19-21, 2006.
K. Ojakian: Bounded arithmetic with bounded finite types.

23. 18th Workshop on Algebraic Development Techniques (WADT'06), La Roche, Belgium, June 1-3, 2006.
J. Ramos: Probabilistic and quantum institutions revisited.
R. Gonçalves: On the algebraization of many-sorted logics.

24. 22nd Annual Conference on Mathematical Foundations of Programming Semantics (MFPS'06), Genova, Italy, May 23-27, 2006.
P. Mateus [invited talk]: Reasoning about imperative quantum programs.

25. ASL 2006 Annual Meeting, Université du Québec à Montréal, Canada, May 17-21, 2006.
C. Hermida: On modalities induced by categorical relations.

26. Theory and Applications of Models of Computation (TAMC06), Beijing, China, May 15-20, 2006.
D. S. Graça: The General Purpose Analog Computer and Computable Analysis are two equivalent paradigms of analog computation.

27. Simpósio de Matemática - Centenário do nascimento de Kurt Gödel, Universidade de Coimbra, Portugal, April 28, 2006.
A. Sernadas: Lógica de demonstrabilidade.

28. 14th European Symposium on Artificial Neural Networks, Bruges, Belgium, April 26-28, 2006.
C. Lourenço: Dynamical reservoir properties as network effects.

29. XIV Encontro Brasileiro de Lógica, Itatiaia, RJ, Brazil, April 24-28, 2006.
J. Marcos: Beyond truth-functionality.

30. Seminário de Lógica e Computação, Departamento de Matemática, Universidade de Coimbra, Portugal, April 6, 2006.
K. Ojakian: Bounded arithmetic with bounded finite types.

31. Seminário do Núcleo de Estudantes de Engenharia Informática, IST, Lisboa, Portugal, March 20, 2006.
P. Mateus: Computação quântica.

32. Séminaire du Laboratoire Spécification et Vérification, École Normale Supérieure de Cachan, Paris, France, March 7, 2006.
P. Adão: Soundness of formal encryption - the case of key-cycles.

33. 2º Encontro Nacional de Estudantes de Informática, Universidade de Évora, Portugal, March 3-5, 2006.
P. Mateus: Computação e informação quânticas.

34. Workshop on Computable Analysis, U. Cincinnati, USA, February 4, 2006.
M. Campagnolo: Polynomial differential equations and real computable functions.
D. S. Graça: The ordinary differential equation defined by a computable function whose maximal interval of existance is non-computable.

35. A Investigação na Universidade Técnica de Lisboa, IST, February 2-3, 2006.
A. Sernadas: Computação e informação quânticas.

36. Days in Logic (DiL'06), Coimbra, Portugal, January 19-21, 2006.
D. S. Graça: On the evolution of systems defined by computable initial value problems.
J. Rasga: Some complexity results on cut elimination in first order based logics.

9 Publications

9.1 Articles in international journals with refereeing

[1] P. Adão, P. Mateus, T. Reis, and L. Viganò. Towards a quantitative analysis of security protocols. *Electronic Notes in Theoretical Computer Science*, 164(3):3–25, 2006.

[2] C. Caleiro, L. Viganò, and D. Basin. On the semantics of Alice&Bob specifications of security protocols. *Theoretical Computer Science*, 367(1-2):88–122, 2006.

[3] J. M. B. Carreiras, J. M. C. Pereira, M. L. Campagnolo, and Y. E. Shimabukuro. Assessing the extent of agriculture/pasture and secondary succession forest in the Brazilian Legal Amazon using SPOT VEGETATION data. *Remote Sensing of Environment*, 101:283–298, 2006.

[4] R. Chadha, P. Mateus, and A. Sernadas. Reasoning about quantum imperative programs. *Electronic Notes in Theoretical Computer Science*, 158:19–40, 2006. Invited talk at the Twenty-second Conference on the Mathematical Foundations of Programming Semantics, May 24-27, 2006, Genova.

[5] J. Marcos. Generalizing truth-functionality (abstract). *Bulletin of Symbolic Logic*, 12(3):511–511, 2006.

[6] P. Mateus and A. Sernadas. Weakly complete axiomatization of exogenous quantum propositional logic. *Information and Computation*, 204(5):771–794, 2006. ArXiv math.LO/0503453.

[7] Y. Omar, N. Paunkovic, L. Sheridan, and S. Bose. Quantum walk on a line with two entangled particles. *Physical Review A*, 74:042304, 2006.

[8] L. Sheridan, N. Paunkovic, Y. Omar, and S. Bose. Discrete time quantum walk on a line with two particles. *International Journal of Quantum Information*, 4(3):573–583, 2006.

[9] A. Vallecillo, V. Vasconcelos, and A. Ravara. Typing the behavior of software components using session types. *Fundamenta Informaticae*, 73(4):64–87, 2006.

[10] V. T. Vasconcelos, A. Ravara, and S. Gay. Session types for functional multithreading. *Theoretical Computer Science*, 368(1-2):64–87, 2006.

[11] P. Adão and P. Mateus. A process algebra for reasoning about quantum security. *Electronic Notes in Theoretical Computer Science*, in print. Preliminary version to be presented at 3rd International Workshop on Quantum Programming Languages, June 30 - July 1, 2005, Chicago, Affiliated Workshop of LICS 2005.

[12] P. Baltazar, P. Mateus, R. Nagarajan, and N. Papanikolaou. Exogenous probabilistic computation tree logic. *Electronic Notes in Theoretical Computer Science*, in print.

[13] P. Barcia, M. N. Bugalho, M. L. Campagnolo, and J. O. Cerdeira. Using N-alkanes to estimate diet composition of herbivores: a novel mathematical approach. *Animal*, in print.

[14] O. Bournez, M. L. Campagnolo, D. S. Graça, and E. Hainry. Polynomial differential equations compute all real computable functions on computable compact intervals. *Journal of Complexity*, in print.

[15] C. Brukner, N. Paunkovic, T. Rudolph, and V. Vedral. Entanglement-assisted orientation in space. *International Journal of Quantum Information*, to appear. ArXiv quant-ph/0509123.

[16] C. Caleiro and J. Ramos. From fibring to cryptofibring: a solution to the collapsing problem. *Logica Universalis*, in print.

[17] R. Chadha, L. Cruz-Filipe, P. Mateus, and A. Sernadas. Reasoning about probabilistic sequential programs. *Theoretical Computer Science*, in print.

[18] L. Cruz-Filipe and P. Letouzey. A large-scale experiment in executing extracted programs. *Electronic Notes in Theoretical Computer Science*, in print. Presented at CALCULEMUS 2005, July 18-19, 2005, Newcastle upon Tyne, Affiliated Workshop of Formal Methods 2005.

[19] D. S. Graça, N. Zhong, and J. Buescu. Computability, noncomputability and undecidability of maximal intervals of IVPs. *Transactions of the American Mathematical Society*, in print.

[20] C. Lourenço. Dynamical computation reservoir emerging within a biological network. *Neurocomputing*, in print.

[21] J. Marcos. Possible-translations semantics for some weak classically-based paraconsistent logics. *Journal of Applied Non-Classical Logics*, in print.

[22] F. van Breugel, C. Hermida, M. Makkai, and J. Worrell. Recursively defined metric spaces without contraction. *Theoretical Computer Science*, in print.

[23] P. Zanardi and N. Paunkovic. Ground state overlap and quantum phase transitions. *Physical Review E*, in print.

9.2 Articles in international serials with refereeing

[1] P. Adão and C. Fournet. Cryptographically sound implementations for communicating processes. In M. Bugliese, B. Preneel, V. Sassone, and I. Wegener, editors, *Proceedings of the 33rd International Colloquium on Automata, Languages and Programming (ICALP'06)*, volume 4052 of *Lecture Notes in Computer Science*, pages 83–94. Springer-Verlag, 2006.

[2] M. Boreale, R. Bruni, L. Caires, R. de Nicola, I. Lanese, M. Loreti, F. Martins, U. Montanari, A. Ravara, D. Sangiorgi, V. Vasconcelos, and G. Zavattaro. SCC: a service centered calculus. In Mario Bravetti, Manuel Núñez, and Gianluigi Zavattaro, editors, *Proceedings of WS-FM 2006, 3rd International Workshop on Web Services and Formal Methods*, volume 4184 of *Lecture Notes in Computer Science*, pages 38–57. Springer-Verlag, 2006.

[3] O. Bournez, M. L. Campagnolo, D. S. Graça, and E. Hainry. The General Purpose Analog Computer and Computable Analysis are two equivalent paradigms of analog computation. In J.-Y. Cai, S. B. Cooper, and A. Li, editors, *Theory and Applications of Models of Computation TAMC'06*, volume 3959 of *Lecture Notes in Computer Science*, pages 631–643. Springer-Verlag, 2006.

[4] C. Caleiro, P. Mateus, A. Sernadas, and C. Sernadas. Quantum institutions. In K. Futatsugi, J.-P. Jouannaud, and J. Meseguer, editors, *Algebra, Meaning, and Computation – Essays Dedicated to Joseph A. Goguen on the Occasion of His 65th Birthday*, volume 4060 of *Lecture Notes in Computer Science*, pages 50–64. Springer-Verlag, 2006.

[5] R. Chadha, P. Mateus, and A. Sernadas. Reasoning about states of probabilistic sequential programs. In Z. Ésik, editor, *Computer Science Logic 2006 (CSL06)*, volume 4207 of *Lecture Notes in Computer Science*, pages 240–255. Springer-Verlag, 2006.

[6] J. Marcos. Ineffable inconsistencies. In J.-Y. Béziau and W. A. Carnielli, editors, *Paraconsistency with no Frontiers,* Proceedings of the III World Congress on Paraconsistency, held in Toulouse, FR, July 28-31, 2003, volume 4 of *Studies in Logic and Practical Reasoning*, pages 301–311. Elsevier Science, Amsterdam, 2006.

[7] C. Caleiro and R. Gonçalves. On the algebraization of many-sorted logics. In J. Fiadeiro and P.-Y. Schobbens, editors, *Recent Trends in Algebraic Development Techniques - Selected Papers*, Lecture Notes in Computer Science. Springer-Verlag, in print.

9.3 Articles in international collections with refereeing

[1] W. A. Carnielli, M. E. Coniglio, and J. Marcos. Logics of formal inconsistency. In D. Gabbay and F. Guenthner, editors, *Handbook of Philosophical Logic*, volume 14. Kluwer Academic Publishers, 2nd edition, in print.

9.4 Articles in proceedings of international conferences with refereeing

[1] D. S. Graça, N. Zhong, and J. Buescu. The ordinary differential equation defined by a computable function whose maximal interval of existence is non-computable. In G. Hanrot and P. Zimmermann, editors, *Proceedings of the 7th Conference on Real Numbers and Computers (RNC 7)*, pages 33–40. LORIA/INRIA, 2006.

[2] C. Lourenço. Dynamical reservoir properties as network effects. In M. Verleysen, editor, *Proceedings of the 14th European Symposium on Artificial Neural Networks (ESANN'06)*, pages 503–508. d-side, 2006.

[3] C. Lourenço. A very small chaotic neural net. In *Proceedings of the 2006 International Joint Conference on Neural Networks (IJCNN'06) at the 2006 IEEE World Congress on Computational Intelligence*, pages 8341–8344. IEEE, 2006.

[4] M. L. Campagnolo and J. O. Cerdeira. Contextual classification of remotely sensed images with integer linear programming. In *Proceedings of CompIMAGE - Computational Modelling of Objects Represented in Images: Fundamentals, Methods and Applications*, in print.

[5] P. Mateus and Y. Omar. A quantum algorithm for closest pattern matching. In D. Angelakis and M. Christandl, editors, *Proceedings of NATO ASI Quantum Computation and Information 05*, Chania, Crete, Greece, May 2-13, in print. IOS Press. Short version of [**?**].

9.5 Articles submitted for publication

[1] P. Adão, G. Bana, J. Herzog, and A. Scedrov. Soundness and completeness of formal encryption: the cases of key-cycles and partial information leakage. Preprint, CLC, Department of Mathematics, Instituto Superior Técnico, 1049-001 Lisboa, Portugal, 2005. Submitted for publication.

[2] W. A. Carnielli, M. E. Coniglio, D. Gabbay, P. Gouveia, and C. Sernadas. *Analysis and Synthesis of Logics - How To Cut And Paste Reasoning Systems*. Submitted to Springer - Applied Logic Series, 2006.

[3] R. Chadha, P. Mateus, A. Sernadas, and C. Sernadas. Extending classical logic for reasoning about quantum systems. Preprint, CLC, Department of Mathematics, Instituto Superior Técnico, 1049-001 Lisboa, Portugal, 2005. Submitted for publication.

[4] L. Cruz-Filipe, J. Rasga, A. Sernadas, and C. Sernadas. A complete axiomatization of discrete-measure almost-everywhere quantification. Preprint, SQIG - IT and IST, 1049-001 Lisboa, Portugal, 2006. Submitted for publication.

[5] L. Cruz-Filipe, A. Sernadas, and C. Sernadas. Heterogeneous fibring of deductive systems via abstract proof systems. Preprint, CLC, Department of Mathematics, Instituto Superior Técnico, 1049-001 Lisboa, Portugal, 2005. Submitted for publication.

[6] L. Cruz-Filipe and C. Sernadas. Sequent calculi based on derivations. Preprint, CLC, Department of Mathematics, Instituto Superior Técnico, 1049-001 Lisboa, Portugal, 2005. Submitted for publication.

[7] L. Cruz-Filipe and F. Wiedijk. Equational reasoning in algebraic structures: a complete tactic. Preprint, CLC, Department of Mathematics, Instituto Superior Técnico, 1049-001 Lisboa, Portugal, 2004. Submitted for publication.

[8] D. S. Graça, M. L. Campagnolo, and J. Buescu. Computability with polynomial differential equations. Preprint, CLC, Department of Mathematics, Instituto Superior Técnico, 1049-001 Lisboa, Portugal, 2006. Submitted for publication.

[9] C. Hermida and R. D. Tennent. Monoidal indeterminates and categories of possible worlds. Preprint, SQIG - IT and IST, 1049-001 Lisboa, Portugal, 2007. Submitted for publication.

[10] I. Lanese, V. Vasconcelos, F. Martins, and A. Ravara. Disciplining orchestration and conversation in service-oriented computing. Preprint, SQIG - IT and IST, 1049-001 Lisboa, Portugal, 2007. Submitted for publication.

[11] P. Ribeiro and R. Mosseri. Adiabatic computation - A toy model. Preprint, Laboratoire de Physique Théorique de la Matière Condensée, Université Pierre et Marie Curie, Place Jussieu, 75252 Paris Cedex 05, France, 2006. ArXiv quant-ph/0606194. Submitted for publication.

10 Awards and distinctions

Paulo Mateus was awarded with the Portuguese IBM Scientific Prize, IBM, Portugal, 2005 with a work on the Analysis of Zero Knowledge Proof Systems.

11 Membership

11.1 Full members

- Amílcar SERNADAS
- António RAVARA
- Carlos CALEIRO
- Carlos LOURENÇO
- Claudio HERMIDA
- Cristina SERNADAS
- Jaime RAMOS
- João MARCOS
- João RASGA
- Kerry OJAKIAN
- Luís CRUZ-FILIPE
- Manuel CAMPAGNOLO
- F. Miguel DIONÍSIO
- Nikola PAUNKOVIC
- Paula GOUVEIA
- Paulo MATEUS
- Rohit CHADHA

11.2 Student members

- Daniel GRAÇA
- Karina ROGGIA
- Luís CAMACHO
- Maxime GAMBONI
- Pedro ADÃO
- Pedro BALTAZAR
- Pedro RIBEIRO
- Ricardo GONÇALVES
- Sérgio MARCELINO
- Tiago REIS

Other Research Units
2006

Contents

1 Publications in 2006

1.1 Books (authored or edited)

J. Félix Costa,

- and F. Dória, Guest Editors of the Special Issue on Hypercomputation of (the Journal of) Applied Mathematics and Computation, 178(1), 2006, Elsevier.

M. F. Ramalhoto

- and A.E. Akay, Guest Editors of the Special issue on *Globalization and Its Impact on Engineering Education and Research*, of the European Journal of Engineering Education, Vol. 31, No.3, 2006.

1.2 Chapters/articles in books with international refereeing

R. Coutinho,

- and B. Fernandez, *Spatially extended monotone mappings*, in Dynamics of coupled map lattices and of related spatially extended systems, J.-R. Chazottes e B. Fernandez (Eds.), Lecture Notes in Physics 671, Springer-Verlag GmbH, 2006, pp. 265-284.

A.B. Cruzeiro,

- *Malliavin Calculus, in Encyclopedia of Mathematical Physics*, Elsevier, ed. J. P. Françoise, G. Naber, T. S. Tsun, Oxford : Elsevier (2006), v.3, p 383.

M.F. Ramalhoto,

- and R. Goeb, *Industrial Aspects of Data Quality*, In "Safety and Reliability for Managing Risk", Editores: Guedes Soares and Zio. Publisher: Taylor & Francis. Vol.2, 949-955.

1.2.1 Articles in international serials

J. Félix Costa

- and J. Mycka, F. Coelho, *Euclid abstract machine: the trisection of the angle and the halting problem*, in Cristian S. Calude, Michael J. Dinneen, Gheorghe Paun, Grzegorz Rosenberg, and Susan Stepney (eds), Unconventional Computation (UC 2006), Lecture Notes in Computer Science, 4135, Springer-Verlag, 2006, 195-206.

M.F. Ramalhoto,

- and R. Kenett, J. Shade, *Statistical Practitioners: A New Profession in Business and Industry*, Scientific Computing World, Issue 81, March/April 2006, 41-42.

1.3 Articles in international journals

J. Félix Costa,

- with F.A. Doria, *Introduction to the special issue on hypercomputation,* Editorial, In Press, Corrected Proof, Available online 9 November (2006).
- with J. Mycka, *Undecidability over continuous-time*, Logic Journal of the IGPL, Oxford University Press, in print.

- with J. Mycka, T*he P =/= NP conjecture in the context of real and complex analysis*, Journal of Complexity, (2) 22, 2006. In Science Direct since November 8, (2006), 287-303.
- with J. Mycka, *What lies beyond the mountains, computational systems beyond the Turing limit*, Bulletin of the European Association for Theoretical Computer Science, 85, (2006), 181-189.

A.B. Cruzeiro,

- with X. Zhang, *L^p gradient estimates of symmetric Markov semigroups for 1<p|leq 2*, Acta Math. Sinica, Vol. 22, nº1 (2006), p. 101-104.
- with P. Malliavin, *Numerical approximation of diffusions in R^d using normal charts of a Riemannian manifold*, Stoch. Proc. and their Applic., 116 (2006), p. 1088-1095
- with X. Zhang, *Bismut type formulae for diffusion semigroups on Riemannian manifolds*, Pot. Anal., 25 (2006), p. 121-130.

M.F. Ramalhoto,

- with R. Goeb and A. Pievatolo, *Variable sampling intervals in Shewhart charts based on stochastic failure time modeling*, Special Issue on "Statistical Control Charts (Part I)" of the international scientific jounal QTQM, Vol.3, No.3, (2006), 361-381.
- with A. Akay, "Editorial" of the Special issue on *Globalization and Its Impact on Engineering Education and Research*, of the EJEE, Vol. 31, No.3, (2006), 247-248.
- *Transforming Academic Globalization Into Globalization for All*, of the Special Issue on "Globalization and Its Impact on Engineering Education and Reseach" of the EJEE, Vol. 31, No.3, (2006), 349-358.
- with R. Goeb, *An Innovative Strategy to Put Integrated Maintenance, Reliability and Quality Improvement Concepts Into Action*, International Journal of Materials & Structural Reliability. Vol.4, No. 2, (2006), 207-223 ("invited paper, extension of the 2005 paper with the same title").

M. Santos

- and A. Porta Nova, Statistical fitting and validation of nonlinear simulation metamodels: A case study. European Journal of Operational Research, vol. 171, nº 1, (2006) pp 53-63.

1.3.1 Articles/communication in proceedings of international conferences

J. Félix Costa

- and J. Mycka, *Polynomial complexity for analog computation* (abstract), in S. Barry Cooper, Benedikt Löwe, and Leen Torenvliet (Eds.), (CiE 2006), New Computational Paradigms, Institute for Logic, Language and Computation, (June 2006), 59.

A.B. Cruzeiro,

- *On some probabilistic estimates of heat kernels and applications*, Publicaciones de la Real Sociedad Matemática Española, vol. 9, Proceedings of the XIII Fall Workshop on Geometry and Physics, Murcia (2006).

2 Publications accepted or submitted in 2006

J. Félix Costa,

- with J. Mycka, F. Coelho, *Euclid abstract machine: the trisection of the angle and the halting problem*, submitted.
- with J. Mycka, *An analytic condition for P =/= NP*, submitted.
- with L. M. Gomes, *Hybrid finite computation*, submitted.
- with J. Mycka, *A new conceptual framework for analog computation*, submitted.
- with Hélia Guerra, *Processes with local and global liveness requirements*, submitted.
- with J. Mycka, *The conjecture P =/= NP presented by means of some classes of real functions*, accepted for presentation at Computability in Europe 2006: Logical Approaches to Computational Barriers, 30 June - 5 July, University of Swansea, in print.

R. Coutinho,

- and B. Fernandez, R. Lima, A. Meyroneinc, *Discrete time piecewise affine models of genetic regulatory networks*, J. Math. Biol. DOI: 10.1007/s00285-005-0359-x (2006).

A.B. Cruzeiro,

- with F. Flandoli and P. Malliavin, *Brownian motion on volume preserving diffeomorphisms group and existence of global solutions of 2D stochastic Euler equation*, accepted for publication in J. Funct. Anal.
- with F. Cipriano, *Diffusions on the group of homeomorphisms of the torus and the Navier Stokes equation*, submitted.
- with F. Cipriano, *Variational principle for diffusions on the diffeomorhism group with the H^2 metric*, submitted.
- with P. Malliavin, *Stochastic evolution of inviscid Burgers fluid*, submitted.
- with C. J. S. Alves, *Monte-Carlo simulation of stochastic differential systems - a geometrical approach*, submitted.

M. F. Ramalhoto,

- and E. Elsayed, Guest Editors of the Special issue on "New and Emerging Trends in Reliability" of the QTQM, Vol. 4, No.1, dedicated to Methodology (to be published in 2007).
- and E. Elsayed, Guest Editors of the Special issue on "New and Emerging Trends in Reliability" of the QTQM, Vol. 4, No.2, dedicated to "Frameworks" (to be published in 2007).
- with R. Goeb and C. McCollin, "Ordinal Methodology in the Analysis of Likert Scales", in the International Scientific Journal "Quality and Quantity" (to be published in 2007).
- and E. Elsayed, "Editorial" of the Special Issue on "News and Emerging Trends in Reliability" of the International Scientific Journal QTQM, Vol. 4, No.1 (to be published in 2007).
- "Stochastics for the Quality Movement: An Integrated Approach to Reliability and Safety. Chapter 12: Safety and Reliability Engineering, Part II", in the book "Statistical Practice in Business and Industry". Editors: S.Y.Coleman, T.Greenfield, D. Montgomery and D.J.Stewardson. Publisher: Wiley (accepted for publication in 2006).

3 Research lectures and Seminars

J. Félix Costa,

- *Quarta Dimensão: Arte, Ciência e Cristianismo: A crucificação à luz da ciência moderna*, Club Setubalense, December 13, 2006.
- *A história e a filosofia da ciência como ciência*, Workshop Ciência e Filosofia entre Rómulo de Carvalho e António Gedeão, November 24, 2006.
- *Computability and physics: An essay on the unity of science through computation*, presented at the First Lisbon Colloquium for the Philosophy of Science, The Unity of Science: Non Traditional Approaches, 25-28 October 2006.
- *The computing universe*, Centro de Filosofia das Ciências da Universidade de Lisboa, March 8, 2006.
- *A new conceptual framework for analog computation*, Departamento de Matemática da Universidade de Coimbra, March 2, 2006.
- *Physics and computation Complexity Studies* Institute at Lisbon, December 9, 2006.
- *Caminhos da Complexidade: Ciência e Arte*, Invited Lecturer in the Workshop, Encontros Arrábida, Fundação Oriente, July 4-6, 2006.
- P*oly analog computation and the P =/= NP conjecture*, The First CiE conference, CiE 2006 – Computability in Europe 2006: New Computational Paradigms, University of Amsterdam, June 8-12, and presented the draft paper, by J. Mycka and myself.

R. Coutinho,

- *Modelos simples, com tempo discreto, de circuitos de regulação genética*, seminário do grupo ALGOS do Inesc-id, Lisboa, 28 de Abril de 2006.
- *Mistérios de uma dinâmica simples*, sessão de A ciência do não linear; estágio de iniciação científica para alunos do 10^{o} e 11^{o} anos, DM IST, Lisboa, 29 de Junho de 2006.
- *Modelação simples de regulação genética*, seminário do Grupo de Física Matemática, GFM-UL, Lisboa, 30 de Junho de 2006.
- *Simple difference equations models of genetic regulatory networks*, International Conference on Difference Equations and Applications, Quioto, 25 de Julho de 2006.
- *Planar fronts in bistable coupled map lattices*, Conference on Difference Equations, Special Functions and Applications, Munich, Germany, July 25-30, 2006, contributed talk.

A.B. Cruzeiro,

- Colloque sur le thème *Discrétisation de processus* , INRIA Sophia Antipolis, Janeiro de 2006, with the lecture *Approximations géométriques d'équations différentielles stochastiques.*
- *Stochastic Fluid Mechanics and SPDEs* , Centro de Giorgi, Pisa, 24 July 2006 - 28 July 2006, with the lecture *Brownian motion on the diffeomorphisms group and global solution of a 2D stochastic Euler equation.*
- DMV meeting, Minisymposium Probability and Geometry, Bonn, September 2006, with the lecture *On a stochastic Euler equation.*

M.F. Ramalhoto,

- "Industrial Aspects of Data Quality". Conference on "Safety and Reliability for Managing Risk"-ESREL'06, Lisbon, September 27- 30, 2006 (invited section talk on September 29).

4 Participation in research projects

A. B. Cruzeiro,

- POCTI *Integração Funcional e Aplicações* (POCTI/MAT/55977/2006)
- POCI *Física - Matemática* (PTDC/MAT/69635/2006).

M.F. Ramalhoto,

- Research Line 3 - Queueing Systems and Quality Management - in the UETN (Marine Technology and Engineering Unit)-IST.

5 Organizations of scientific events

5.1 Events which took place in 2006

J. Félix Costa,

- member of the program committee of the II Workshop de Estatística, Matemática e Computação, Universidade Aberta, November 8-9, 2006.

A. B. Cruzeiro,

- Organizer of the Session *Stochastic Analysis* in the 31st Conference on Stochastic Processes and their Applications, Paris, 17-21 July, 2006.
- Sessão temática *Análise Estocástica* no Encontro Nacional da SPM 2006, ISEL, Junho de 2006.
- Member of the scientific Comittee and of the Organization Comittee of the Conference Stochastic Analysis in Mathematical Physics, Satellite Conference of the International Congress of Mathematicians (ICM2006). 4-8 September 2006, CIUL, Lisboa.

M. F. Ramalhoto,

- Member of the "Scientific Program Committee" of the "International Conference on Degradation, Damage, Fatigue and Accelerated Life Models in Reliability Testing", 22-23 May 2006, sponsored by IEEE, in "University of Angers", France.
- Member of the "International Technical Programme Committee" of the "ESREL' 06- Safety and Reliability for Managing Risk" (and "Co-Chair" og two invited sessions), Lisbon, Portugal, 27-30 September 2006.

5.2 Events taking place after 2006

A. B. Cruzeiro,

- Member of the Scientific Comittee of the *International Conference on Stochastic Analysis and Applications*, Hammamet, Tunisia, November 2007.

M. F. Ramalhoto,

- Member of the "International Scientific Committee" of the "ISBIS 2007 Conference" (sponsored by the International Statistical Institute), Azores, Portugal, 18-20 August 2007.
- Member of the "International Technical Programme Committee" of the "ESREL' 07- Safety and Reliability Conference", Stavanger, Norway, 25-27 June 2007.

6 Other information

6.1 Editorial boards

- A. B. Cruzeiro, Member of the Editorial Board of the EMS Newsletter.

M. F. Ramalhoto,

- "Associate Editor" of the Editorial Board of the international scientific journal Quality Technology and Quantitative Management (QTQM).
- Member of the Editorial Board, till 2006, of the European Journal of Engineering Education (EJEE).
- "Associate Editor", since 2006, of the Editorial Board of the European Journal of Engineering Education (EJEE).

6.2 Scientific management positions

A. B. Cruzeiro,

- Member of the Mathematical Physics Comittee (C18) of the IUPAP (International Union of Pure and Applied Physics).
- Member for the Comittee for meetings of the European Mathematical Society.

M. F. Ramalhoto

- Founder member and former Vice- President of ENBIS (European Network for Business and Industrial Statistic).
- Member of the International Advisory Board of Reliability Conferences of the ISI.

6.3 Personal notes

J. Félix Costa,

- Luís Miguel Pacheco Mendes Gomes, *Applications of Real Recursive Infinite Limits*, Doutoramento em Informática (Teoria da Computação), Universidade dos Açores.
- Bruno Loff Barreto, *Analog Complexity Classes*, Mestrado em Informática, Instituto Superior Técnico.
- Member of the jury (Agregação) of Dr. Olivier Bournez, Institut National Polytechnique de Lorraine, Monograph entitled *Modèles continus. Calculs. Algorithmique distribuée*, Villerslès-Nancy, France, December 2006.
- Member of the jury (PhD) of Mr. Emmanuel Hainry (Docteur de L'Institut National Polytechnique de Lorraine), Institut National Polytechnique de Lorraine, Dissertation entitled, *Modèles de calcul sur les réels, résultats de comparison*, Villers-lès-Nancy, France, December 2007.
- Member of the jury (PhD) of Mr. Fábio Cunha Conde, Departamento de Física da Universidade de Évora, Dissertation entitled, *Um Estudo Biometeorológico em São Paulo: Elaboração de um Índice de Risco Meteorotrópico (IRM) sobre a Morbidade por Doenças Respiratórias na Cidade de São Paulo*, Phd in Physics.
- Editor of the Series «Máquina do Mundo» (World's Machine), Bizâncio, Lisbon, 3 volumes published in 2006.

R. Coutinho,

- Colaboração científica no Centre de Physique Théorique do CNRS de Marselha a convite do Prof. Bastien Fernandez, 16 a 27 de Janeiro de 2006.
- Participação na Réunion de l'ACI VicAnne: Abstraction, modularité et compositionalité dans les réseaux géniques et protéiques, Institut Henri Poincaré, Paris, 24 e 25 de Janeiro de 2006.
- Participação na International Conference on Difference Equations and Applications, Quioto, 24 a 28 de Julho de 2006.
- Colaboração científica no Centre de Physique Théorique do CNRS de Marselha a convite do Prof. Bastien Fernandez, 31 de Outubro a 5 de Novembro de 2006.

A. B. Cruzeiro,

- Presidente da Mesa da Assembleia Geral da S.P.M.

M.F. Ramalhoto,

- Expert-Evaluateur for the European Commission Fifth Framework and the Sixth Framework.
- A visiting researcher from University of Palermo, Italy, came to IST to do research work with Ramalhoto from March 1, to September 30, 2006 (with a scholarship from the University of Palermo). Most of the joint research work produced is in the "Technical Report-SQM Applied to Maritime Ports Logistics and Management", IST, September 2006.
- Member of the Committee to Coordinate the Doctoral Program of the Mathematics Department (Comissão de Coordenação do Programa de Doutoramento do DM).
- Participation in the creation of the Third Cycle of Higher Studies: Ph.D. and Advanced Studies Diploma in Statistics and Stochastic Processes "3º ciclo de Estudos Superiores: Doutoramento e Diploma de Estudos Avançados em Estatística e Processos Estocásticos", implemented under the so called Bologna Process.