



BULLETIN

INTERNATIONAL CENTER FOR MATHEMATICS

DECEMBER 2006

21

CONTENTS

Coming Events	1
CIM News	7
News from our Associates	8
Feature Article: <i>Chaotic Dynamics: physical measures and statistical features</i> by José F. Alves	9
Math in the Media	15
Interview: <i>James Yorke</i>	20
Gallery: <i>José Monteiro da Rocha</i>	26

COMING EVENTS

March 9-10, 2007: Follow-up Workshop on Statistics in Genomics and Proteomics

ORGANIZER

Antónia Turkman (University of Lisbon).

AIMS

This meeting follows the event “Workshop on Statistics in Genomics and Proteomics” which took place in Estoril from 5 to 8 of October 2005.

The objective of this “Follow-up Meeting” is to assess

the impact of the thematic term “Statistics in Genomics and Proteomics”, one and a half years after the event. We aim at a rather informal atmosphere to incite the discussion about the different perspectives on the development of the subject in Portugal and elsewhere.

Simon Tavaré, Sophie Schbath and Wolfgang Urfer will give talks on themes related with the themes of the Workshop. There will be round table discussions with the objective of identifying new (and perhaps not so new) important statistical issues on genomics, proteomics and other “omics”, as well as strengthening and/or establishing further collaboration on these

themes. There will be a contributed paper session where we incite participants to bring their work in progress, to gather ideas for further development and to promote a healthy flow of discussion.

The event will be held at Hotel Quinta das Lágrimas, Coimbra.

PROGRAMME

March 9 (Friday)

16:00 - 17:00 Simon Tavaré

17:00 - 17:30 Coffee-Break

17:30 – 18:30 Chris Cannings, *Theory of some regular discrete dynamical systems on networks*

18:30 – 20:00 Round-Table Discussion

20:00 Dinner

March 10 (Saturday)

9:00 - 11:00 Contributed Papers (Work in Progress)

11:00 - 11:30 Coffee-Break

11:30 - 12:30 Sophie Schbath, *On the assessment of exceptional motifs in biological networks*

12:30 Lunch

14:00 - 15:00 Wolfgang Urfer

15:00 - 16:30 Round-Table Discussion and Close-up

For more information about the event, see

wsgp.deio.fc.ul.pt/fup.html

April 10-14, 2007: Workshop on Mathematical Control Theory and Finance

ORGANIZERS

Manuel Guerra (Chairman) and Maria do Rosário Grossinho (Technical Univ. of Lisbon), Fátima Silva Leite (Univ. of Coimbra), Eugénio Rocha and Delfim Torres (Univ. of Aveiro).

AIMS

The “high tech” character of modern business has increased the need for advanced methods. These rely heavily on mathematical techniques and seem indispensable for competitiveness of modern enterprises. It became essential for the financial analyst to possess a high level of mathematical skills.

On the other hand, the complex challenges posed by the problems and models relevant to finance has, for a long time, been an important source of new research topics for mathematicians.

The use of techniques from stochastic optimal control constitutes a well established and important branch of mathematical finance. Other branches of control theory have, until now, found comparatively less application in financial problems. Deterministic and stochastic control theories have, to some extent, developed as different branches of mathematics. However, there are many points of contact between them and in recent years the exchange of ideas between these fields as intensified.

We strongly believe there is ample opportunity for fruitful collaboration between specialists of deterministic and stochastic control theory and specialists on finance, both from academic and business background. It is this kind of collaboration that we would like to foster by organizing a workshop with the participation of some of the leading specialists in control theory and its applications to finance.

Thus, the Workshop aims

To provide a state-of-the-art knowledge in the fields of deterministic and stochastic control theory and its applications to mathematical finance;

To increase the mutual knowledge of the mathematical tools developed by the control theory community and the issues and models relevant to financial applications;

To promote the development of interdisciplinary collaborations between researchers from different areas;

To increase interaction between the research community and the business sector.

Contributions are welcome in the fields of deterministic control theory, stochastic control theory, problems, methods and applications in finance, related to control theory.

TUTORIALS

Italo C. Dolcetta (Univ. of Rome “La Sapienza”, Italy)
Deterministic optimal control

Bronislaw Jakubczyk (Univ. of Warsaw, Poland)
Nonlinear control theory

Ioannis Karatzas (Columbia Univ., USA)
Stochastic differential equations

Dmitry Kramkov (Carnegie Mellon, USA)
Mathematical problems in finance

Nizar Touzi (CRES, France)
Stochastic optimal control

PLENARY LECTURES

Andrei Agrachev (SISSA-International School for Advanced Studies, Italy)

Ole E. Barndorff-Nielsen (Univ. of Aarhus, Denmark)

Eugene A. Feinberg (Univ. of New York at Stony Brook, USA)

Jean-Paul Gauthier (Univ. of Dijon, France)
Harmonic Analysis on Moore Groups for Pattern Recognition in Support-Vector-Machine Context

Ioannis Karatzas (Columbia Univ., USA)

Terry Lyons (Univ. of Oxford, UK)
Inverting the signature of a path – extensions of a theory of Chen

Goran Peskir (Univ. of Manchester, UK)
Optimal Prediction Problems

Andrei Sarychev (Univ. of Florence, Italy)
Existence and Lipschitzian regularity for relaxed minimizers

Albert Shiryaev (Steklov Institute, Russia)
On the Minimax Quickest Detection of a Change of the Drift of the Brownian Motion

Vladimir Zakalyukin (Univ. of Liverpool, UK and Moscow Univ., Russia)
Entropy estimations in motion planning

Xun-Yu Zhou (Chinese Univ. of Hong Kong)
Behavioral Portfolio Selection: Single Period vs Continuous Time

The event will be held at the Instituto Superior de Economia e Gestão, the School of Economics and Management of the Technical University of Lisbon.

For more information about the event, see

srv-ceoc.mat.ua.pt/conf/wmctf2007

April 13-19, 2007: The 60th Study Group Mathematics with Industry 2007

ORGANIZERS

Gonçalo Xufre Silva (ACMat/ISEL), José Carlos Quadrado (ISEL), José Francisco Rodrigues (CMAF-UL), Leonel Linhares da Rocha (ACMat/ISEL), Pedro Freitas (Dep. Math., FMH/TU Lisbon, GFM-UL), Tiago Charters de Azevedo (ACMat/ISEL).

AIMS

The purpose of these meetings is to strengthen the links between Mathematics and Industry by using Mathematics to tackle industrial problems which are proposed by industrial partners.

This meeting is part of the series of European Study Groups and will count with the participation of several European experts with a large experience in this type of events.

More information on study groups and related aspects is available at the [International Study Groups website](#), the [Smith Institute](#) and the [European Consortium for Mathematics in Industry](#).

How it works

At the beginning of the week, a representative from each invited company presents their industrial problem to the participating mathematicians. The academic participants then allocate themselves to the groups who work full-time on each problem over the next three days. By the last day, each group of mathematicians must ensure that their ideas are developed enough to collate them into a final presentation to the other study-group participants. The collaboration does not necessarily end at this point as a report will be provided by us for each of the problems considered. This will also function as a formal record of the work done for the company, and provides the possibility of encouraging further research, leading to new links between industry and academia.

Training session

“Mathematical modelling and analysis of industrial problems” This will consist of short courses on mathematical modelling and problem solving, aiming at familiarising participants with the type of situation that will be met at a typical study group. The course will be based on case studies from previous study groups and students will work in groups on these problems under the guidance of invited experts who have a wide experience of tackling industrial problems.

It will be a shorter version of the very successful [ECMI modelling weeks](#) which are run for students each year.

The event will be held at the Instituto Superior de Engenharia de Lisboa.

For more information about the event, see

pwp.net.ipl.pt/dem.isel/tazevedo

June 27-29, 2007: EPSA 2007: Workshop and Advanced School on Eigenvalue Problems, Software and Applications

ORGANIZERS

Paulo B. Vasconcelos and Maria J. Rodrigues (Univ. of Porto), Osni Marques (Lawrence Berkeley National Lab., USA), José Roman (Technical Univ. of Valencia, Spain).

AIMS

The goal of the Workshop and Advanced School is to bring together leading researchers in the numerical solution of eigenvalue problems to survey the state-of-the-art methods and computational tools to solve large eigenvalue problems.

It aims to encourage the interchange of new ideas, to create a suitable environment for the participants to get acquainted and involved in today's computational mathematics, in particular research and applications that involve eigenproblems and spectral analysis.

Specific objectives are

- (i) to survey and present recent developments in both theoretical and computational aspects of matrix eigenvalue problems,
- (ii) to report on important practical applications and on challenging problems using high performance computing and
- (iii) to foster new collaborations between the participants.

This event comes as a follow up of successful events, such as the [Advanced Summer School on Recent Development on Large Scale Scientific Computing](#) (a CIM event organized in 2001) and six Workshops on ACTS - [Advanced CompuTational Software Collection](#) (organized by DOE/LBNL). It will include a range of tutorials on methods and tools for the solution of eigenvalue problems and hands-on practices using the high performing clusters from the new Grid Computing infrastructure available at the University of Porto.

The target attendees are researchers and post-graduate students on Mathematics, Biomathematics, Engineering, Computer Science, Computational Economics and Finance, and other branches of Social Sciences. The course in the Advanced School will interest also graduate students and computational scientists whose research require the use of robust numerical algorithms, novel techniques, large amounts of eigenvalue calculations, or combinations of these.

The event is a Satellite Conference of ICIAM 07 and will take place at the Faculty of Science of the University of Porto.

INVITED SPEAKERS

James Demmel (Univ. of California at Berkeley, USA)
Peter Arbenz (ETH, Zürich, Switzerland)
Filomena Dias d'Almeida (Univ. of Porto)
Tony Drummond (Lawrence Berkeley National Lab., USA)
Rui Ralha (Univ. of Minho)

OTHER SPEAKERS

Osni Marques (Lawrence Berkeley National Lab., USA)
José Roman (Technical Univ. of Valencia, Spain)
Paulo Vasconcelos (Univ. of Porto)

For more information about the event, see

www.fep.up.pt/epsa2007

July 18-20, 2007: LQCIL'07 Workshop on Quantum Cryptography

ORGANIZERS

Pedro Adão, Paulo Mateus (Chair), Cláudia Nunes and Yasser Omar (all Technical University of Lisbon).

AIMS

This workshop will inaugurate the biannual Lisbon Quantum Computation, Information and Logic Meetings Series. It will be devoted to quantum cryptography and security, bringing together researchers from both classical and quantum information security to exchange ideas and discuss the latest results and future directions of the field. The workshop will be constituted by 7 invited lectures and 15 contributed talks. It is organized within the scope of the [QuantLog project](#) of SQIG - Security and Quantum Information Group, IT (formerly CLC - Center for Logic and Computation).

The event will take place at the Instituto Superior Técnico, Lisbon.

INVITED SPEAKERS

Claude Crépeau (McGill Univ., Canada)
Artur Ekert (Cambridge Univ., U.K.)
Virgil Gligor (Univ. of Maryland, U.S.A.)
Hoi-Kwong Lo (Univ. of Toronto, Canada)
Mike Mosca (Univ. of Waterloo, Canada)

Andre Scedrov (Univ. of Pennsylvania, U.S.A.)

Umesh Vazirani (Univ. of California, Berkeley, U.S.A.)

For more information about the event, see

wslc.math.ist.utl.pt/lqcil07

July 22-27, 2007: CIM/UC Summer School “Topics in Nonlinear PDEs”

SCIENTIFIC COORDINATORS

José Francisco Rodrigues (CMUC and Univ. Lisbon),
José Miguel Urbano (CMUC and Univ. Coimbra).

AIMS

Nonlinear Partial Differential Equations (PDEs) are central in modern Applied Mathematics, both in view of the importance of the concrete problems they model and the novel techniques that their analysis generates. The subject has developed immensely in recent years, in many unexpected and challenging directions, and a new range of applications emerged with the advent of Biomathematics.

The Summer School is a joint venture of the CIM and the University of Coimbra (UC), and is sponsored by the Gulbenkian Foundation. It will gather a group of leading specialists working on Partial Differential Equations and its main applications to Biology, Engineering and Physics, and will highlight emerging trends and issues of this fascinating research topic.

The School will consist of four short courses of six hours each, and of short communications by PhD students and Post-Docs. It will be held at University of Coimbra.

SHORT COURSES

Luis Caffarelli (Univ. of Texas at Austin, USA)
Problems and methods involving free boundaries

Charlie Elliott (Univ. of Sussex, UK)
Critical state models in superconductivity

Felix Otto (Univ. of Bonn, Germany)
Analysis of pattern formation in physical models

Benoit Perthame (École Normale Supérieure, France)
Nonlinear PDEs in Biology

For more information about the event, see

www.cim.pt/pdes07

September 17-19, 2007: ROBOMAT 2007 Workshop on Robotics and Mathematics

ORGANIZERS (CHAIRPERSONS)

Hélder Araújo (University of Coimbra), Maria Isabel Ribeiro (Technical University of Lisbon).

AIMS

This workshop will aim at discussing several problems from Robotics from the perspective of the mathematical problems that they raise. It will be a forum where specialists with backgrounds both in Engineering and Mathematics will have an opportunity to discuss relevant research issues not from the point of view of the application but essentially from the point of view of the mathematical models and principles required to solve them.

This workshop will be relevant for:

PhD and MSc students working in Robotics and in relevant mathematical aspects;

Established researchers in Robotics and in Mathematics interested in strengthening the domains of their research work that are relevant for both Robotics and Mathematics;

The following mathematical disciplines are likely to have strong relevance for robotics: Algebraic and differential topology, Dynamic systems theory, Optimization algorithms, Combinatorics, Differential algebraic inequalities, Statistical learning theory.

The workshop will be held at Hotel D. Luís, Santa Clara, Coimbra.

INVITED SPEAKERS

Henrik Christensen

(Director of the Centre for Autonomous Systems at the Royal Institute of Technology, Stockholm, Sweden, and a chaired professor of computer science specialising in autonomous systems, in the Department of Computer Science and Numerical Analysis.)

David Mumford

(Professor at the Division of Applied Mathematics of the Brown University, USA; in 1974 he was awarded the Fields Medal at the International Congress of Mathematics; his main topic of current research is Pattern Theory.)

Raja Chatila

(*Directeur de Recherche CNRS*, he is the Head of the Robotics and Artificial Intelligence Group, of the LAAS, Toulouse, France; he has numerous contributions in Mobile Robotics, Intervention Robots and

Planetary Rovers, Service Robots, Personal Robots, Cognitive Robots; he has an extensive number of publications in all these fields and he has been responsible for several important European projects.)

For more information about the event, see

<http://labvis.isr.uc.pt/robomat>

October 26-27, 2007: Follow-up Workshop on Optimization in Finance

ORGANIZER

Luís Nunes Vicente (Univ. of Coimbra).

OTHER CIM EVENTS IN 2007:

WORKING AFTERNOONS SPM/CIM

CIM, Coimbra

A joint initiative of the Portuguese Mathematical Society (SPM) and CIM. Programme for 2007:

January 13, 2007 - Computational Mechanics
Organizer: Isabel Figueiredo (Univ. Coimbra)

March 3, 2007 - Probability and Stochastic Analysis
Organizer: Ana Bela Cruzeiro (Tech. Univ. Lisbon)

May 5, 2007 - Computation
Organizer: Cristina Sernadas (Tech. Univ. Lisbon)

September 29, 2007 - Calculus of Variations
Organizer: Luísa Mascarenhas (New Univ. Lisbon)

November 24, 2007 - Algebraic Topology
Organizer: Margarida Mendes Lopes (Tech. Univ. Lisbon)

For more information, see

www.spm.pt/investigacao/spmcim/spmcim.phtml

February 9, 2007

Title: *Mathematical Models for Trading Volatility*

Lecturer: Marco Avellaneda (Courant Institute, USA)

February 12, 2007

Title: *Flat Surfaces*

Lecturer: Marcelo Viana (IMPA, Brazil)

May 25, 2007

Title: *Trends in Theoretical Epidemiology*

Lecturer: Gabriela Gomes (Inst. Gulbenkian Ciência)

October 13, 2007

Title: *Mathematics and Games*

Lecturer: Jorge Nuno Silva (Univ. Lisboa)

MEETINGS SPE/CIM

Hotel Quinta das Lágrimas, Coimbra

A joint initiative of CIM and the Portuguese Statistical Society (SPE) with the support of the National Institute for Statistics (INE).

May 12, 2007

Probability and Statistics in Telecommunications

Coordinator: António Pacheco (Tech. Univ. Lisbon)

November 17, 2007

Methodological Issues in Official Statistics

Coordinator: Pedro Corte-Real (INE)

CIM SHORT COURSES

Hotel Quinta das Lágrimas, Coimbra

For updated information on these events, see

www.cim.pt/?q=events