



# BULLETIN

## INTERNATIONAL CENTER FOR MATHEMATICS

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15

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### COMING EVENTS

#### THEMATIC TERM ON MATHEMATICS AND THE ENVIRONMENT

##### COORDINATORS

Juha H. Videman (Instituto Superior Técnico)

José Miguel Urbano (University of Coimbra)

##### DATES

May-July 2004

The **CIM Thematic Term** for 2004 will be about Mathematics and the Environment. The topic could hardly be more timely. The knowledge about the impact of human activities on our planet's ecosystems is nowadays more vital than ever. Increasing human population to the detriment of others, cutting and burning vast areas of forest, polluting soil, air and water, are just few examples of how we humans have altered our environment. Within this Thematic Term we intend to address some of these issues from a mathematical and a physical modelling point of view.

The first event, School and Workshop on Dynamical Systems and Applications, is aimed at consolidating the research activities in Portugal in this area of mathematics fundamental for the understanding of evolution of ecological environments and monitoring of global changes. The Workshop on Forest Fires attempts to promote the communication among researchers with an interest on theoretical modelling of forest fires, in particular on fire front propagation. The third and fourth events, School on Atmospheric Sciences and Climate Dynamics and School and Workshop on Oceanography, Lakes and Rivers, are closely related and, hence, planned to be organized in two consecutive weeks. As their titles indicate, they address probably the most important natural processes for the world's ecosystem, and will touch on issues such as air quality, weather prediction, ocean waves and currents, estuarine dynamics, and avalanches, among others.

The programme of events is the following:

### 3-8 May: School and Workshop on Dynamical Systems and Applications

#### ORGANIZERS

José Ferreira Alves (Univ. Porto), Marcelo Viana (IMPA, Brazil).

#### AIMS

The main scientific goals of the workshop are: to present recent developments in the field of dynamical systems and its applications, especially in directions relevant to the sciences of the environment; to promote the interdisciplinary character of this field, and explore its connections to other areas of mathematics and science; to help consolidate the research groups in dynamical systems at Portuguese universities.

The event includes an advanced school as well as a research workshop, thus aiming at an audience ranging from doctoral students to active researchers. We expect most of the students to come from European institutions and networks, including a substantial participation of Portuguese students. The workshop covers several very active research topics in dynamics from fundamental aspects to various applications (e.g. in biology, chemistry, weather prediction). We believe it will attract a good number of experts, in mathematics and in experimental sciences.

Dynamical systems was born and developed as an interdisciplinary field, driven by requests from experimental sciences and aiming at providing a conceptual framework for explaining and predicting their observations. Indeed, some of its spectacular advances were prompted by such issues as the behaviour of the solar system (homoclinic phenomena, non-integrability of the equations of motion), the Earth's atmosphere (convection, Lorenz strange attractors), or the evolution of ecological environments (Lotka-Volterra equations, invading species). The sciences of the environment are providing some new and very exciting new challenges, from the modelling of physical and biological systems, to the monitoring of global changes, just to mention a few.

The meeting will bring together a good number of researchers, both young and experienced. It will include advanced courses and research lectures, covering a wide spectrum of subjects, and aimed at a broad audience of doctoral students and researchers interested in this field and its applications. The meeting should also contribute to enhance the visibility of the research currently carried out in Portugal in this field.

The workshop will be held at the Pure Mathematics Department - University of Porto.

#### LECTURES

*Title to be announced*

José Ferreira Alves, University of Porto, Portugal

*Markov partitions for non-uniformly expanding maps*

Vítor Araújo, University of Porto, Portugal

*Stability of differential equations and the forgotten work of Lyapunov*

Luís Barreira, Technical University of Lisbon, Portugal

*Genericity and transitivity*

Christian Bonatti, University of Dijon, France

*Cycles and iterated functions systems*

Lorenzo J. Díaz, PUC-Rio de Janeiro, Brazil

*Title to be announced*

Celso Grebogi, University of São Paulo, Brazil

*KAM and rigidity of group actions*

Anatole Katok, Penn State University, USA

*Rigidity theory for circle homeomorphisms*

Konstantin Khanin, Newton Institute, Cambridge, UK

*Hamiltonian homeomorphisms of surfaces*

Patrice Le Calvez, University Paris-Nord, France

*Arithmetics and solutions of cohomological equations for interval exchange maps*

Stefano Marmi, Scuola Normale Superiore di Pisa, Italy

*The Lorenz attractor revisited*

Maria José Pacifico, Universidade Federal do Rio de Janeiro, Brazil

*A global view of dynamical systems*

Jacob Palis, IMPA, Brazil

*Title to be announced*

Carles Simó, University of Barcelona, Spain

*Hard ball systems and the Lorentz gas*

Domokos Szasz, Technical University of Budapest, Hungary

*Validated numerics and dynamical systems*

Warwick Tucker, University of Uppsala, Sweden

*Title to be announced*

Marcelo Viana, IMPA, Brazil

*Title to be announced*

Jean Christophe Yoccoz, Collège de France, France

For more information on this event, please visit the site

<http://www.mat.uc.pt/~tt2004/dynsystems>

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## June 3 - 5: Workshop on Forest Fires

### ORGANIZERS

Jorge André (Univ. Coimbra), José Miguel Urbano (Univ. Coimbra).

AIMS

Along the past century, in many parts of the world, for human and natural causes, forest fires have become an increasing threat to ambient and man. At the broadest scale, forest fires interest researchers from very different areas, such as: forestry, ecology, geography, physics and chemistry, mechanical and chemical engineering, and applied mathematics. At a finer scale, forest fire physics can be considered mainly as a sub-area of fire science, itself a part of combustion science, but has also important intersections with forestry (fuels characterisation) and meteorology (interactions between the fire and the atmosphere, at various spatial and temporal scales). Within the different phenomena that have been studied, the quasi-steady propagation of surface forest fire fronts of low-to-medium intensity is the most developed research subject of forest fire physics, which justifies the emphasis of the workshop. Since the nineties, the two-sided challenge of constructing models describing the behaviour of the fire front that are, on the one hand, physically sound and general, and, on the other hand, potentially applicable on operational grounds, has originated the proposal of a diversity of modelling strategies, each one of them giving rise to some hard mathematical problems. Such strategies are in different stages of theoretical development and antagonize or complement each other in a larger or lesser extent, none of them self-imposing as clearly superior to the others. The choice of the lecturers precisely reflects the desire to encompass the most relevant strategies that have been proposed.

The main goals of the event are:

- to promote the communication (i.e., mutual knowledge, criticisms, possible future synergies respecting results and, above all, strategies of research) among researchers with a common interest and competence on theoretical modelling issues of forest fires, with an emphasis on fire front propagation;
- to introduce to the Portuguese mathematicians the open mathematical and physical research problems brought up by some representative theoretical modelling strategies that are being used to describe the behaviour of forest fire fronts.

The workshop will be held at the Departamento de Engenharia Mecânica da Universidade de Coimbra located in Pólo II.

## LECTURES

### *Numerical simulation of wild fires*

Terry L. Clark (University of British Columbia, Canada)

### *What is missing from fire ecology?*

Edward A. Johnson (University of Calgary, Canada)

### *Title to be announced*

Olivier Séro-Guillaume (CNRS, France)

### *Convection in forest fires*

Jacques Simon (Université Blaise Pascal/CNRS, France)

### *Some developments in premixed combustion modeling*

Gregory Sivashinsky (Tel-Aviv University, Israel)

For more information about the event, see

<http://www.mat.uc.pt/~tt2004/fire>

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## **July 12 - 16: School on Atmospheric Sciences and Climate Dynamics**

### ORGANIZERS

Didier Bresch (CNRS/Univ. Joseph-Fourier, France),  
José Miguel Urbano (Univ. Coimbra), Juha Videman  
(Instituto Superior Técnico, Lisbon)

### AIMS

The understanding of the fluid dynamics of the atmosphere and oceans and the development of techniques to simulate weather and climate are among the most important challenges for today's science. To make progress in this field and deepen our understanding of the complex processes that control the climate, the chemistry of the coupled atmosphere-ocean system, and the physics of the upper atmosphere, it is fundamental to intensify interdisciplinary collaborations amongst applied mathematicians and geophysicists.

The main goals of the event are:

- to promote the exchange of ideas among the distinct fields that share a common interest in Atmospheric Sciences, including fluid dynamics, physical oceanography, meteorology and applied mathematics;
- to provide students with a broad overview of this challenging topic.

The school will be held in Lisbon at the Complexo Interdisciplinar of the Instituto Superior Técnico.

### SHORT COURSES

#### *Evidence for human influence on climate and implications for climate forecasting*

Myles Allen (University of Oxford, UK)

#### *Energy balance models in climate dynamics*

Jesus Ildefonso Diaz (Universidad Complutense de Madrid, Spain)

#### *The nonlinear dynamics of large-scale atmospheric flows*

Michael Ghil (UCLA, USA and ENS-Paris, France)

#### *Transport, stirring and mixing in atmospheric chemistry and dynamics*

Peter Haynes (University of Cambridge, UK)

#### *Modeling ocean mixing*

Esteban G. Tabak (Courant Institute, NYU, USA)

For more information about the event, see

<http://www.mat.uc.pt/~tt2004/atmosphere>

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## July 19-24: Summer School and Workshop on Oceanography, Lakes and Rivers

### ORGANIZERS

Didier Bresch (CNRS/Univ. Joseph-Fourier, France), José Miguel Urbano (Univ. Coimbra), Juha Videman (Instituto Superior Técnico, Lisbon)

### AIMS

Mathematics has always played a fundamental role in the study of oceans and river flows, although these research fields are still perhaps more familiar to oceanographers, geophysicists and environmental engineers than to mathematicians. Nonlinear PDEs are crucial in describing ocean processes such as internal and surface waves, ocean tides and currents, turbulence, changes in salinity and temperature, just to mention a few.

The main goals of the event are:

- to promote the communication and interactions between the specialists working on different frontiers of Oceanography;
- to introduce to the Portuguese applied mathematicians, in particular to graduate and PhD students, the fundamentals, as well as some of the most relevant current problems, of Environmental and Geophysical Fluid Dynamics;
- to provide an opportunity for physical oceanographers and mathematicians to establish contacts and develop common research projects.

The event consists of a four-day summer school and a two-day workshop and will be held in Lisbon at the Complexo Interdisciplinar of the Instituto Superior Técnico.

### SHORT COURSES IN THE SUMMER SCHOOL

*Turbulent geophysical flows and transport in rotating fluids*

Peter Constantin (University of Chicago, USA)

*Hydrodynamics of rivers and estuaries*

Benoît Cushman-Roisin (Dartmouth College, USA)

*Rotating fluids and associated boundary layers*

Emmanuel Grenier (ENS-Lyon, France)

*Elements of geophysical fluid dynamics*

Joseph Pedlosky (Woods Hole Oceanographic Institution, USA)

*The Saint-Venant system for shallow water. Derivation from Navier-Stokes and numerical solution*

Benoît Perthame (ENS-Paris, France)

### PLENARY LECTURES AT THE WORKSHOP

*Stability of Ekman boundary layers and applications*

Benoît Desjardins (École Polytechnique, France)

*Avalanches: models and mathematical results*

Reinhard Farwig (TU Darmstadt, Germany)

*Mathematical and numerical analysis of the primitive equations in oceanography*

Francisco Guillén-González (Universidad de Sevilla, Spain)

*Adjustment of the global thermohaline circulation to local forcing anomalies*

David Marshall (University of Reading, UK)

*Bifurcations and pattern formation in Geophysical Fluid Dynamics*

João Teixeira (UCAR/NRL, USA)

*Turbulence, clouds and climate models*

Shouhong Wang (Indiana University, USA)

For more information about the event, see

<http://www.mat.uc.pt/~tt2004/ocean>

**Other CIM events in 2004:**

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WORKSHOP ON NONSTANDARD  
MATHEMATICS

5-11 July, 2004

Organizers:

Imme van den Berg, University of Évora, Portugal  
Francine Diener, Université de Nice, France  
A. J. Franco de Oliveira, University of Évora, Portugal  
Vítor Neves, University of Aveiro, Portugal  
Keith D. Stroyan, University of Iowa, USA  
João Paulo Teixeira, IST, Lisbon, Portugal

AUTUMN SCHOOL AND INTERNATIONAL  
CONFERENCE ON STOCHASTIC FINANCE

20-30 September, 2004

Organizers:

Paulo Brito, ISEG, Lisbon, Portugal  
Manuel L. Esquível, New University of Lisbon, Portugal  
Maria do Rosário Grossinho, ISEG, Lisbon, Portugal  
João Nicolau, ISEG, Lisbon, Portugal  
Paulo Eduardo Oliveira, Uni. of Coimbra, Portugal

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SUMMER SCHOOL ON MATHEMATICS IN  
BIOLOGY AND MEDICINE

20-24 September, 2004

Organizers: Jorge Careneiro, IGC, Oeiras, Portugal  
Francisco Dionísio, IGC, Oeiras, Portugal  
José Faro, IGC, Oeiras, Portugal  
Gabriela Gomes, IGC, Oeiras, Portugal  
Isabel Gordo, IGC, Oeiras, Portugal

For more information about this event, see

<http://pascal.iseg.utl.pt/~stochfin2004/>

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For updated information on these events, see  
<http://www.cim.pt/cimE/eventos04.html>.