



# BULLETIN

## INTERNATIONAL CENTER FOR MATHEMATICS

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### COMING EVENTS

#### THEMATIC TERM ON MATHEMATICS AND BIOLOGY

The programme of events is the following:

**17-21 June: Advanced School and Workshop on Mathematical and Computational Modelling of Biological Systems**

ORGANIZERS: João A. C. Martins and E. B. Pires (IST, Lisbon, Portugal).

#### DESCRIPTION

The event has two components: advanced course and research workshop.

The aim of the event is to provide an updated overview of some typical models and tools used in mathematical and computational studies of biological tissues, organs and systems.

The advanced course will include lectures on the:

- mechanics of soft tissues
- thermo-chemo-electro-mechanics of porous media
- skeletal muscles and neuromuscular control
- control and mechanics of human movement systems
- physiological fluid mechanics
- mechano-electrical function of the heart.

The course is directed to PhD students, applied mathematicians, physicists, biologists, medical doctors, engineers and other researchers working in related areas who wish a better understanding of biological phenomena and want to develop reliable models for them.

In the workshop, research papers submitted by the participants will describe new developments and discuss future research directions. It will also provide an opportunity for the establishment or development of interdisciplinary collaborations between researchers from different areas.

These events will be held at IST, Lisbon.

#### ADVANCED LECTURES:

- *Mechanics of soft tissues, Finite Element Models*, Gerhard A. Holzapfel, Graz University of Technology, Institute for Structural Analysis - Computational Biomechanics, Austria.
- *Electro-mechanics of the heart, Finite Element Models*, Peter J. Hunter, Engineering Science Department, University of Auckland, New Zealand.
- *Thermo-chemo-electro-mechanics of saturated porous media*, Jacques Huyghe, Department of Biomedical Engineering, Technical University of Eindhoven, The Netherlands.
- *Dynamics of skeletal muscles, Neuromuscular control*, J. L. van Leeuwen, Wageningen University, Experimental Zoology Group, Department of Animal Sciences & Wageningen Institute of Animal Sciences, The Netherlands.
- *Control and mechanics of human movement systems*, Clyde F. Martin, Department of Mathematics and Statistics, Texas Technical University, Lubbock, Texas, U. S. A.
- *Physiological fluid mechanics*, Oliver E. Jensen, Division of Theoretical Mechanics, School of Mathematical Sciences, University of Nottingham, United Kingdom.

For more information on this event, please visit the site

<http://www.civil.ist.utl.pt/bio.systems/>

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*24-28 June: Advanced School and Workshop on Bone Mechanics - Mathematical and Mechanical Models for Analysis and Synthesis*

ORGANIZERS: Helder C. Rodrigues and José M. Guedes (IST, Lisbon, Portugal).

#### DESCRIPTION

The event has two components: Advanced course and research workshop.

The course component will address the most significant problems in bone mechanics and describe the respective mechanical and mathematical modelling. Lectures will also be taught on specific topics of applied mathematics (e.g. homogenization, generalized shape design, convex analysis, optimization) which are important and may have a key role in overcoming the limitations observed in the more traditional models used in biomechanics. The course part is geared to an audience of postgraduate students and researchers (in applied mathematics, mechanics and biomechanics) who want to have an introduction to bone mechanics and the respective mechanical-mathematical modelling.

In the workshop component research papers, submitted by the participants, will describe new developments and discuss future research directions. The workshop is aimed at a mixed audience of postgraduate students and experienced researchers in mathematics, mechanics and medicine. It is the perfect forum to identify new areas of research within mathematics and biomechanics, to extend methodologies developed within the context of material design and optimization to the modelling of bone mechanics problems and to promote collaboration between researchers from the different areas.

These events will be held at IST, Lisbon.

#### ADVANCED LECTURES:

- *Material models in topology optimization of structures*, Martin P. Bendsoe, Technical University of Denmark- Mathematical Institute, Lyngby, Denmark.

- *Optimization and biological designs*, Andrej Cherkaev, Department of Mathematics, University of Utah, Salt Lake City, USA.
- *Mechanosensation system in bone, Adaptive elasticity*, Stephen C. Cowin, Department of Mechanical Engineering at City College, City University of New York, New York, USA.
- *Bone prostheses and implants*, Manuel Doblaré, University of Zaragoza, Centro Politecnico Superior, Zaragoza, Spain.
- *Computational assessment of bone mechanical quality, Biological versus topological optimization models of bone*, Rik Huiskes, Department of Biomedical Engineering, Eindhoven University of Technology, Eindhoven, The Netherlands.
- *Bone remodelling: Analytical and computational models*, Harrie Weinans, Erasmus University Rotterdam, Erasmus Orthopaedic Research Lab, Rotterdam, The Netherlands.
- *Homogenization models for cellular materials*, José M. Guedes, Department of Mechanical Engineering, Instituto Superior Técnico, Lisbon, Portugal.
- *Material optimization models applied to bone remodelling simulation*, Helder Rodrigues, Department of Mechanical Engineering, Instituto Superior Técnico, Lisbon, Portugal.

For more information on this event, please visit the site

<http://www.dem.ist.utl.pt/~bonemec/>

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*27-29 June: Workshop on Molecular Geometry Optimization*

ORGANIZER: Fernando Nogueira (Univ. Coimbra, Portugal).

#### AIMS

The workshop is intended to bring together mathematicians, chemists and physicists who work in molecular geometry optimization. Its main goal is, therefore, to allow the interchange of ideas between scientists with very different backgrounds and to provide a basepoint for the development of joint research projects. The use of high-performance computing software and hardware for performing realistic calculations of molecular structure will also be highlighted.

This event will be held at the Physics Department, University of Coimbra.

#### INVITED TALKS:

- *How to avoid optimising molecular geometry*, Hugh Cartwright, Department of Chemistry, Oxford University, UK.
- *Structure prediction in protein folding*, Christodoulos A. Floudas, Department of Chemical Engineering, Princeton University, USA.
- *Geometry optimization and molecular dynamics in internal coordinates*, Peter Pulay, Department of Chemistry and Biochemistry, University of Arkansas, USA.
- *Enhanced sampling and global optimization techniques for complex systems*, John E. Straub, Chemistry Department, Boston University, USA.
- *Energy landscapes of clusters, biomolecules and solids*, David J. Wales, Department of Chemistry, Cambridge University, UK.
- *Genetic algorithms for molecular geometry optimisation*, Ron Wehrens, Laboratory of Analytical Chemistry Catholic University of Nijmegen, The Netherlands.

For more information on this event, please visit the site

<http://cfc.fis.uc.pt/events/MGO2002/>

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*15-19 July: Summer School on Mathematical Biology*

ORGANIZERS: Alessandro Margheri (Univ. Lisbon, Portugal), Carlota Rebelo (Univ. Lisbon, Portugal) and Fabio Zanolin (Univ. Udine, Italy).

#### AIMS

The aim of this school is to present instances of interaction between two major disciplines, Biology and Mathematics, featuring recent issues from epidemiology and dynamics of populations. In this way, we expect to motivate the participants, biologists and mathematicians, to develop some future collaborations.

We intend to address a fairly wide audience, composed by mathematicians who work in differential equations

and are interested in examples of applications of mathematics to real-life problems, and by biologists who intend to learn or deepen their knowledge of differential equations methods currently used in modelling. As little background as possible (both in mathematics and in biology) will be assumed throughout the lectures, so that advanced undergraduate, Master and PhD students both in Mathematics and in Biology will find most of the topics accessible.

The school will consist of several courses and a few seminars.

This event will be held at the Complexo Interdisciplinar (Univ. Lisbon).

#### SHORT COURSES:

- *On Problems Related to Persistence and Extinction of Species*, Shair Ahmad, Division of Mathematics and Statistics, University of Texas at San Antonio, Texas, USA.

- *The Use of Mathematical Models in Epidemiology with Applications to Communicable and Sexually-Transmitted Diseases*, Carlos Castillo-Chavez, Biometrics Unit, Cornell University, USA.
- *Adaptive Dynamics*, Odo Diekmann, University of Utrecht, The Netherlands.
- *Population Dynamics of Multi-Strain Pathogens*, M.Gabriela M. Gomes, Ecology and Epidemiology Group, Department of Biological Sciences, University of Warwick, England.
- *From Simple Models of Transmission Dynamics to Understanding Infections Disease Epidemiology*, G. Medley, Ecology and Epidemiology Group, Department of Biological Sciences, University of Warwick, England.

For more information on this event, please visit the site

<http://cmaf.lmc.fc.ul.pt/events/2002/ssmb/>

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## MEETING ON BOUNDED SYSTEMS AND COMPLEXITY CLASSES

#### ORGANIZER

Fernando Ferreira (Univ. Lisbon, Portugal).

#### DATE

28-29 June.

#### AIMS

To draw together people interested in bounded formal systems related to computational complexity classes in order to discuss current work and assess directions of research. If sufficient interest arises, international proceedings may be published.

This event will be held at the Complexo Interdisciplinar (Univ. Lisbon).

#### INVITED SPEAKERS

- Jeremy Avigad - Department of Philosophy, Carnegie-Mellon University, USA.

- Martin Hofmann - Department of Computer Science, The University of Edinburgh, United Kingdom.
- Ulrich Kohlenbach - Department of Computer Science, University of Aarhus, Denmark.
- Jan Krajíček - Mathematical Institute of the Academy of Sciences of the Czech Republic in Prague, Czech Republic.
- Thomas Strahm - Forschungsgruppe für theoretische Informatik und Logik, Institute für Informatik und angewandte Mathematik, Universität Bern, Switzerland.

For more information on this event, please visit the site

<http://alf1.cii.fc.ul.pt/~ferferr/bacc2002/bacc.html>