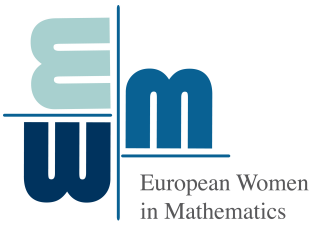
COMPOSITIO MATHEMATICA



V WOMEN IN MATHEMATICS SUMMER SCHOOL

MATHEMATICAL THEORIES TOWARDS ENVIRONMENTAL MODELS

FINAL REPORT

THE ABDUS SALAM
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS - ICTP,
TRIESTE MAY 27TH - JUNE 1ST, 2013

1. Venue, duration and dates

- Venue: The Abdus Salam International Centre for Theoretical Physics (ICTP), Main Lecture Hall (LB), Trieste (Italy);
- Duration: seven days (Sunday to Saturday), 6 working days (Monday to Saturday);
- Dates: May 27th-June 1st, 2013.

2. Description and Scopes of the School

The European Women in Mathematics summer schools aim at providing a stimulating intellectual environment for PhD students and post-docs from different countries and different mathematical disciplines. A major scopes of the whole EWM Summer School program is to encourage the initiative of young women in higher mathematics and push them to be propositive and take responsibility for organization and management. For this reason, in november 2011, EWM launched a call for proposals, aimed at gathering ideas of topics for minicourses from female mathematicians in their early stage career. The call received twelve proposals for mini courses and the proponents of the selected projects have joined the committee as Course Directors.

The school consisted of short courses focusing on four topics of the current research in mathematics. For the 2013 edition the selected topics are in the areas of Dynamical Systems, Partial Differential Equations and Numerical Analysis. Each short course featured of an introductory part, a more advanced one, together with problem solving and tutorial sessions. There was time for a poster session and also

a round table on gender issues. The round table addressed problems regarding gender balance within matematical departments, the hierarchical distributions of women there, collaborations and actions promoting the female presence in the scientific life, all in an international perspective.

A major aim of the fifth EWM school was the involvement and participation of women from developing countries, taking advantage of the location of the school at ICTP. As a matter of fact, due to a lack of female teachers in the higher education system and other possible discriminative facts, female mathematicians from developing countries may face serious problems in developing their career as researchers and may need to strengthen their motivations and professional self-confidence.

Finally, as the School's topics mainly belong to those domains of Mathematics that are relevant to understanding the physics and complexity of our planet, the EWM School joined the Mathematics of Planet Earth Programme 2013 (http://www. mpe2013.org/).

School webpages:
http://agenda.ictp.it/smr.php?2468
http://europeanwomeninmaths.org/activities/summer-school/women-in-mathematics-summer-school-ictp-2013

3. Scientific committee

Chair: Susanna Terracini, University of Torino (Italy), EWM standing committee. susanna.terracini@unito.it

- Lisbeth Fajstrup, Aalborg University (Denmark), EWM deputy convenor
- Tamara Grava, International School for Advanced Studies, Trieste (Italy)
- Stefanie Hittmeyer, University of Auckland (New Zealand), EWM member
- Emilia Mezzetti, University of Trieste (Italy), EWM member
- Marie-Francoise Ouedraogo, University of Ouagadougou (Burkina Faso), in charge of UMA committee for women in mathematics
- Marie-Francoise Roy, University of Rennes (France), EWM convenor
- Khanum Rashida Adeeb, University of Essex (UK), EWM local coordinator in Pakistan
- Local Organizer: Lothar Goettsche (ICTP)

4. Course Directors

- Giuseppina Autuori (Marche Polytechnic University)
- Francesca Colasuonno (University of Bari)
- Carlotta Giannelli (Johannes Kepler University, Linz)
- Stefanie Hittmeyer (University of Auckland)
- Karin Mora (University of Bath)
- Chiara Simeoni (University of LAquila)

5. Speakers

- *Manuel J. Castro Díaz* (University of Malaga, Spain),
- *Michel Chipot* (University of Zurich, Switzerland),
- *Ulrike Feudel* (University of Oldenburg, Germany),
- *Bert Jüttler* (Johannes Kepler University Linz, Austria),
- *Theodoros Katsaounis* (Foundation for Research and Technology Hellas - FORTH, Greece),

- *Carla Manni*, (Tor Vergata University in Rome, Italy),
- *Hinke Osinga*, (University of Auckland, New Zealand),
- *Kathrin Padberg-Gehle* (TU Dresden, Germany),
- *Ireneo Peral Alonso* (Autonomous University of Madrid, Spain),
- *Simona Perotto* (MOX Politecnico di Milano, Italy),
- *Patrizia Pucci*, (University of Perugia, Italy),
- *Vicentiŭ Rădulescu* (Institute of Mathematics "Simion Stoilow" of the Romanian Academy and University of Craiova, Romania)
- *Giancarlo Sangalli*, (University of Pavia, Italy).
- *Lawrie Virgin* (Duke University, USA).
- *Vladimir Zeitlin*, (École Normale Supérieure de Paris, France).

6. Participants

There were 80 participants from 34 countries, including 7 members of the scientific committee, 5 mini course directors, 15 speakers and 52 participants. The represented countries were: Argentina, Austria, Bulgaria, Burkina Faso, Czech Republic, Ecuador, Egypt, France, Germany, Greece, India, Islamic Republic of Iran, Italy, Kenia, Madagascar, Malaysia, Mexico, Netherlands, Nigeria, Pakistan, Philippines, People's Republic of China, Portugal, Romania, Russian Federation, Serbia, Slovak Republic, Spain, Sri Lanka, Uganda, Ukraine, United States of America, Viet Nam.

Table 1. Gender distribuiton

	Male	Female	Total
Scientific Committee	0	7	7
Course Directors	0	5	5
Local organiser	1	0	1
Speakers	9	6	15
Participants	14	38	52
Total	24	56	80

Participants were selected by the scientific committee and the course directors. Remarkably, the school received an enormous number of applications: more than 280 from all over the wold.

7. Sponsors

- The Abdus Salam International Centre for Theoretical Physics - ICTP (Trieste): 20000€
- Istituto Nazionale di Alta Matematica, Gruppo Nazionale per l'Analisi Matematica, la Probabilità e le loro applicazioni (GNAMPA), Gruppo Nazionale per la Fisica Matematica (GNFM): 4000€
- Compositio Mathematica Foundation: 4000€
- Department of Mathematics and Geosciences of the University of Trieste: 2000€
- Department of Mathematics, University of Torino through the Project of National Research Interest (PRIN2009) grant *Critical Point Theory and Perturbative Methods for Nonlinear Differential Equations*: 2000€
- Scuola Internazionale Superiore di Studi Avanzati, SISSA (Trieste): 2000€

- Department of Mathematics, University of L'Aquila through the Project of National Research Project (PRIN 2009) grant *Systems of Conservation Laws and Fluid Dynamics*: 1500€

8. Minicourses description

8.1. **Nonlinear Partial Differential Equations.** Directors: **Giuseppina Autuori**, University of Politecnica delle Marche (Italy), autuori@dipmat.univpm.it, and **Francesca Colasuonno**, University of Bari (Italy), colasuonno@dm.uniba.it

Speakers: *M. Chipot* (University of Zurich, Switzerland), *I. Peral Alonso* (Autonomous University of Madrid, Spain), *P. Pucci*, (University of Perugia, Italy), *V. Rădulescu* (Institute of Mathematics "Simion Stoilow" of the Romanian Academy and University of Craiova, Romania)

The mathematical description of many problems in science and engineering leads to linear and nonlinear partial differential equations. This minicourse brings together students and young researchers who are interested in obtaining some insight into the theory and applications of Nonlinear Analysis and PDEs and to offer an environment to acquire basic and more advanced techniques in the field. In a series of lectures, internationally known experts give an introduction and present new results and techniques on topics of recent interest. In particular, the courses will focus on several concrete models arising in biology, population genetics, chemistry, ecology, and mathematical physics that are described by nonlinear differential or partial differential equations. More precisely, existence and multiplicity of solutions are studied, and qualitative properties are presented, such as asymptotic behavior and distribution of singularities.

8.2. **Dynamical Systems and Bifurcation Theory with Applications to the Dynamics of Planet Earth.** Directors: **Karin Mora**, University of Bath (UK), K.Mora@bath.ac.uk, and **Stefanie Hittmeyer**, University of Auckland (New Zealand), stefanie.hittmeyer@auckland.ac.nz

Speakers: *Ulrike Feudel* (University of Oldenburg, Germany), *Hinke Osinga*, (University of Auckland, New Zealand), *Kathrin Padberg-Gehle* (TU Dresden, Germany), *Lawrie Virgin* (Duke University, USA).

Many phenomena on Planet Earth can be described by parameter-dependent dynamical systems. When these parameters are varied the behavior of the entire system can change dramatically. In order to understand these changes we can apply bifurcation theory. Although many essential characteristics of the system are not analytically accessible the modern and advanced methods of numerical analysis provide insights otherwise not attainable. This mini-course gives the students an introduction into the basic concepts in dynamical systems and equip them with the tools of bifurcation theory necessary to explore these systems. Students will gain an insight into the state of the art numerical techniques essential to dynamical systems and the current software packages that implement them. Furthermore, they will understand how these methods are applied to explore the dynamics of Planet Earth through important and interesting applications. On the one hand students learn how smooth (i.e. classical) dynamical systems are used to study the ocean and atmospheric dynamics and on the other hand how non-smooth (i.e. non-classical) dynamical systems are applied to the modelling of earthquakes. In both cases they will examine through one or more examples the phenomena specific to these type of applications.

8.3. **Isogeometric Analysis.** Director: **Carlotta Giannelli**, Johannes Kepler University Linz (Austria), carlotta.giannelli@jku.at

Speakers: *Bert Jüttler* (Johannes Kepler University Linz, Austria), *Carla Manni*, (Tor Vergata University in Rome, Italy), *Giancarlo Sangalli*, (University of Pavia, Italy).

Isogeometric analysis is a novel paradigm for numerical simulation which combines finite element analysis (FEA) with computer aided design (CAD) methods. Since its introduction in 2005 by Hughes et al., the interdisciplinary nature of the topic has encouraged a new kind of synergies between the scientific communities dealing with applied geometry and computational methods, which, so far, have only been connected through very limited interactions. For this reason, advanced techniques which were originally introduced for standard geometric design applications, became the topic of recent studies, taking into account the dual requirements of geometry and analysis. The resulting novel perspective opened new path of research for the identification of geometric representations suitable for analysis which simultaneously satisfy the demands imposed by their use in the simulation framework and the accuracy of the geometrical model.

8.4. **Numerical Analysis of Environmental Flows.** Director: **Chiara Simeoni**, University of L'Aquila (Italy), chiara.simeoni@dm.univaq.it

Speakers: *Manuel J. Castro Díaz* (University of Malaga, Spain), *Theodoros Katsaounis* (Foundation for Research and Technology Hellas - FORTH, Greece), *Simona Perotto* (MOX Politecnico di Milano, Italy), *Vladimir Zeitlin*, (École Normale Supérieure de Paris, France).

The suggested topic is the numerical analysis of environmental flows, which represents a major subject of applied mathematics especially for the 2013 Year of Planet Earth. The realistic simulation of geophysical flows is an issue of economic, social and scientific interest, with a variety of significant applications: prediction of tsunamis in shallow-water basins, management of irrigation systems, controls on pollutant transport for deposit-erosion events, estimation of dam breaking and debris avalanches, etc... As a matter of fact, beside proper mathematical formulations, the development of efficient techniques for forecasting such phenomena requires an accurate numerical modeling, thus involving also specific engineering tools from scientific computing in an intrinsically multidisciplinary approach.