



SIXTH FRAMEWORK PROGRAMME

Project no. 15661

# **MATHFSS**

**Shaping New Directions in Mathematics for Science and Society**

NEST Support

Coordination Action

**Interim activity report**

*Period covered:* from December 1, 2005 to May 31, 2006

*Date of preparation:* June 15, 2006

*Start date of project:* December 1, 2005

*Duration:* 24 months

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## Section 1 – Overview and workpackage progress of the period

### Workpackage 1: Digital Content Security

#### *Expert Group*

The group of experts on this specialty of the project is currently made of the following members. All of them have already accepted to participate.

- Touradj Ebrahimi, École Polytechnique Fédérale de Lausanne, Switzerland
- Franck Leprévost, Université du Luxembourg
- Enric Nart, Universitat Autònoma de Barcelona, Spain (Chair)
- Jorge Villar, Universitat Politècnica de Catalunya, Spain

#### *Events*

Preparations have started for a conference on *Cryptography and Digital Content Security* that will be held at the CRM Barcelona in June 2007. The coordinator will be Enric Nart, from the Universitat Autònoma de Barcelona.

### Workpackage 2: Systems Biology

#### *Expert Group*

A number of researchers in the interface between Mathematics and Biology have been contacted during the early stages of the project. A shortlist of expert group members is being prepared, with the aim of gathering them together on the occasion of a forthcoming project event at IHÉS, Bures-sur-Yvette, France.

A preliminary contact has been made with William Bialek, Princeton University, USA, a world-leading specialist on interactions between Physics with Biology, for a visit of him to the CRM.

#### *Events*

A workshop on *Systems Biology from a Truly Interdisciplinary Point of View with a Mathematical Twist* is planned at the IHÉS before the end of 2006.

## Workpackage 3: Mathematical Neuroscience

### *Expert Group*

To this date, the group of experts on this specialty consists of the following people:

- Antoni Guillamon, Universitat Politècnica de Catalunya, Barcelona, Spain
- Jürgen Jost, MPI für Mathematik in den Wissenschaften, Leipzig, Germany
- Mina Teicher, Emmy Noether Research Institute, Bar-Ilan, Israel (Chair)

### *Events*

Full preparations have been made for a conference on *Mathematical Neuroscience* (Neuromath 06) that will be held at the *Centre Cultural i de Congressos Lauredià*, Andorra, from September 1 to 4, 2006, organized jointly by the CRM and the Universitat d'Andorra. A summary of the event follows.

### *Coordinator:*

Antoni Guillamon, Universitat Politècnica de Catalunya, Barcelona, Spain

### *Scientific committee:*

Albert Compte, Universitat Miguel Hernández, Alacant, Spain

Antoni Guillamon, Universitat Politècnica de Catalunya, Barcelona, Spain

Horacio G. Rotstein, Boston University, USA

David Terman, Ohio State University, USA (Chair)

The meeting will analyse the current state of research in Mathematical Neuroscience, with the aim of being a forum for discussing current challenges and hot topics in the field, advancements in mathematical approaches to brain modeling, and exciting mathematical questions posed by new experiments. An additional goal of the meeting is to bring together active mathematical neuroscientists with other mathematicians willing to learn about and participate in this emergent scientific area.

### *List of speakers:*

Ad Aersten, Universität Freiburg, Germany

Janet Best, Ohio State University at Columbus, USA

Alla Borisyuk, University of Utah, USA

Amithaba Bose, New Jersey Institute of Technology, USA

Paul Bressloff, University of Utah, USA

Eric Brown, New York University, USA

Nicolas Brunel, Université de Paris V, France

Stephen Coombes, University of Nottingham, UK

Gustavo Deco, Universitat Pompeu Fabra, Spain

Bard Ermentrout, University of Pittsburgh, USA

Jean-Pierre Francoise, Université de Paris VI, France

Boris Gutkin, Institut Pasteur, France

David Hansel, Université de Paris V, France

John Hertz, NORDITA, Denmark

Kresimir Josic, University of Houston, USA

Nancy Kopell, Boston University, USA

Peter Latham, Gatsby Computational Neuroscience Unit, UK

Tim Lewis, University of California, Davis, USA  
Georgi Medvedev, Drexel University, USA  
John Rinzel, New York University, USA  
Jonathan Rubin, University of Pittsburgh, USA  
Michelle Rudolph, CNRS, France  
María Victoria Sánchez-Vives, Universidad Miguel Hernández, Alacant, Spain  
Walter Senn, Universität Bern, Switzerland  
Brian Smith, Ohio State University, USA  
Jeffrey C. Smith, National Institute of Health, USA  
Louis Tao, New Jersey Institute of Technology, USA  
Mina Teicher, Emmy Noether Research Institute, Bar-Ilan, Israel  
J. Leo van Hemmen, Technische Universität München, Germany

Preparations have also been made for a workshop on *Mathematical Aspects of Brain Functions; Compositionality and Synchronization* at the Accademia dei Lincei, Roma, Italy, from October 9 to 11, 2006. A short description follows.

*Coordinator:*

Mina Teicher, Emmy Noether Research Institute, Bar-Ilan, Israel

*List of speakers:*

Moshe Abeles, Gonda Brain Research Center, Bar-Ilan, Israel  
Enrico Arbarello, Università di Roma “La Sapienza”, Roma, Italy  
Francesco Battaglia, Universiteit van Amsterdam, The Netherlands  
Emilio Bizzi, European Brain Research Institute, Roma, Italy  
Markus Diesmann, Bernstein Center for Computational Neuroscience, Freiburg, Germany  
Tamar Flash, Weizmann Institute of Science, Rehovot, Israel  
Theo Geisel, MPI for Dynamics and Self-Organization, Göttingen, Germany  
Toni Guillamon, Universitat Politècnica de Catalunya, Spain  
Michael Herrmann, Georg-August Universität Göttingen, Germany  
Jürgen Jost, MPI für Mathematik in den Wissenschaften, Leipzig, Germany  
Jacques Mehler, SISSA, Trieste, Italy  
Edmund Rolls, Oxford University, UK  
Tim Shallice, SISSA, Trieste, Italy  
Angela Sirigu, Institut des Sciences Cognitives, CNRS, Lyon-Bron, France  
Mina Teicher, Emmy Noether Research Institute, Bar-Ilan, Israel  
Alessandro Treves, SISSA, Trieste, Italy  
Misha Tsodyks, Weizmann Institute of Science, Rehovot, Israel

## Workpackage 4: Risk Assessment

### *Expert Group*

To this date, the group of experts on this specialty of the project consists of the following people:

- Jef Teugels, Katholieke Universiteit Leuven, Belgium
- Henry Wynn, London School of Economics, UK (Chair)

### *Events*

A workshop entitled *Risk Measures and Risk Management for High-Frequency Data* was held, as planned, from March 6 to 8 at EURANDOM, Eindhoven, The Netherlands. A report on the event follows.

### *Topics and objectives:*

The new area of statistics dealing with high-frequency data enjoys a rapid development. Techniques from traditional statistics in general, even from data mining in particular, are not capable to cope with the vast amount of information that comes out of tick-by-tick or intraday financial data. The number of incoming data is enormous; moreover this inflow is not a one-time event but repeats itself at high speed. Of course, not all incoming information is equally useful. High-frequency statistics needs to find sound indicators to single out what information is relevant and how it needs to be incorporated in further decision making and risk management. As asset trading is currently done via high-speed computer programs, it becomes a genuine challenge for the statistician to single out what incoming information needs to be taken into account and what part can be safely neglected. Often this information can be crystallized into specific measures that again require an appropriate kind of statistical treatment.

While a lot of scientific activity emerges from stochastic finance, there are other areas that cope with similar issues. We mention computational biology, fast on-line computation and simulation, network management as a few prominent examples.

This workshop was planned to stimulate further research in stochastic and statistical thinking when dealing with high-frequency data. The idea of the workshop was to provide a platform where experts both from academia and from practice could meet, discuss and exchange ideas and expertise. Each speaker gave a 40 minutes lecture with additional discussion. A part of the workshop was reserved for a round table discussion.

The main themes of the workshop were the following:

1. Description and modelling of high-frequency data
2. Risk measures for high-frequency data
3. Risk management for high-frequency data
4. Computational and statistical aspects
5. Multivariate high-frequency data
6. Applications

*List of speakers:*

Wolfgang Breymann, Institut für Physik, ETH Zürich, Switzerland  
Michel Dacorogna, Converium, Zürich, Switzerland  
Vicky Fasen, Technische Universität München, Germany  
Joachim Grammig, Universität Tübingen, Germany  
Ivo Grosse, Institut für Pflanzengenetik, Gatersleben, Germany  
Laszlo Gulyas, AITIA, Budapest, Hungary  
Stephan Haug, Technische Universität München, Germany  
Takaki Hayashi, Columbia University, NY, USA  
Dimitrios Konstantinidis, University of the Aegean, Greece  
Alexander Lindner, Technische Universität München, Germany  
Asger Lunde, Aarhus School of Business, Denmark  
Loriano Mancini, Universität Zürich, Switzerland  
Thomas Mikosch, University of Copenhagen, Denmark  
Stefan Mittnik, Universität München, Germany  
Per A. Mykland, University of Chicago, USA  
Wolfgang Polasek, Institut für Höhere Studien (IHS), Austria  
Eric Renault, University of North Carolina at Chapel Hill, USA  
Jürgen Schmieg, Aarhus University, Denmark  
Robert Stresing, Universität Oldenburg, Germany  
Jeanette Woerner, Universität Göttingen, Germany  
Nakahiro Yoshida, University of Tokyo, Japan

## **Workpackages 1 to 4:**

### *Preparation of a Round Table at the ICM 2006*

The International Congress of Mathematicians (ICM) is held every four years since 1897. It is the most important mathematical event in the world. Among other features, the Fields Medals are traditionally awarded at the opening ceremony of each ICM.

The ICM 2006 will take place in Madrid, Spain, from August 22 to 30, 2006. On this occasion, a Round Table will be held on August 24, as a part of the scientific programme of the ICM 2006. The title of the Round Table is the same title as the MATHFSS project: *Shaping New Directions in Mathematics for Science and Society*. The list of panelists is the following:

- Touradj Ebrahimi, École Polytechnique Fédérale de Lausanne, Switzerland
- Francisco Marcellán, Ministry of Education and Science, Spain
- Mina Teicher, Emmy Noether Research Institute, Bar-Ilan, Israel
- David Terman, Ohio State University, USA
- Henry Wynn, London School of Economics, UK

*Coordinator:*

Carles Casacuberta, Centre de Recerca Matemàtica, Barcelona, Spain

## **Section 2 – Consortium management**

### ***Meeting of the Advisory Committee***

A first meeting of the MATHFSS Advisory Committee was held on February 4, 2006, at the CRM Barcelona, organized by the project coordinator. The meeting was attended by Jean-Pierre Bourguignon, Carles Casacuberta (Secretary), Manuel Castellet, Enric Nart, Mina Teicher (Chair), and Henry Wynn. The agenda was the following:

1. Welcoming words
2. Calendar of events for the project
3. Priority mathematical topics in each of the four main subjects
4. Membership of expert groups
5. Preparation of a round table at ICM 2006
6. Other actions to be organised within the project
7. Other issues

After this meeting, the coordinator has remained in contact with the members of the Advisory Committee in order to discuss and fix the membership of an expert group for each project subject.

### ***Website***

Although the project website was initially planned to be designed and stored at IHÉS, it was agreed at the Advisory Committee meeting on February 3, 2006 that the design and allocation of the website would be undertaken by the CRM, due to the fact that the whole computer system at IHÉS is being modified. Accordingly, the budgetary amount that was previously assigned to the IHÉS under the title “Database maintenance” has been moved to the CRM for the purposes of design, installation and updating of the project website.

The MATHFSS website is fully operative since February 2006 at the address

[www.mathfss.org](http://www.mathfss.org)

This Internet domain was reserved and paid by the CRM to Nominalia (Barcelona) and will remain active at least until January 25, 2009.

### ***Leaflet***

The coordinator also produced a leaflet for the promotion of the project in two versions: Catalan and English. A sufficient number of copies were printed for the use of all partners and for distribution during the ICM 2006 in Madrid and at other project events. An updated version of the leaflet will be printed at the end of 2006.

### ***Change of Coordinator***

The current coordinator, Manuel Castellet, will finish his term as CRM Director in the Summer of 2006. He therefore wishes to step down as MATHFSS Coordinator. This role will be undertaken by Carles Casacuberta, currently CRM Associate Director, upon obtaining the agreement of the other project partners and the conformity of the European Commission.

### Section 3 – Dissemination and use

The main actions undertaken for dissemination were the following to the present date:

- Launching of a website containing a description of the project, the list of participating centres, membership of the Advisory Committee, expert groups, events and activities, and non-confidential reports, at the Internet address

<http://www.mathfss.org>

- A promotional leaflet was printed in Catalan and English. Copies of the English version were sent to all partners. A pdf version of the leaflet is available at the project website and is also attached to this report.

- The project is advertised on the websites of the events held or fully planned so far, namely at the workshop that took place in March 2006 at EURANDOM, Eindhoven,

[http://www.eurandom.nl/workshops/2006/Risk%20Measures/RiskMeasures\\_main.htm](http://www.eurandom.nl/workshops/2006/Risk%20Measures/RiskMeasures_main.htm)

and at the conference that will be held in September 2006 in Andorra, organised by the CRM Barcelona,

<http://www.crm.es/CMathNeuroscience>

- Professional e-mail lists were used in order to announce ongoing activities at EURANDOM, like *stoch-ned* (The Netherlands), *random* (Italy), *allstat* (UK and broader), *st net* (Germany), etc.

- As already reported, a round table is planned on August 24, 2006, in Madrid, Spain, on the occasion of the International Congress of Mathematicians (ICM 2006). This round table has two purposes:

- To advertise the MATHFSS project in an unparalleled environment of high-level experts in Mathematics and their applications.
- To obtain written reports by panelists on each of the project topics as well as input from round table attendants. The following points will be addressed: How is Mathematics influenced by each of the project subjects? What is the impact of Mathematics on each of the project subjects? How can mathematicians benefit more effectively from public or private collaborative research programmes?