

CENTRE DE RECERCA MATEMÀTICA
REPORT OF ACTIVITIES 2005



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The various activities carried out by the Centre de Recerca Matemàtica during 2005 are amply set out in the corresponding chapters of this Report, in which their scientific content is described. In this presentation, however, our aim is to highlight the consolidation of the volume of activity, both in terms of the number of researchers and the activities organised: 97 researchers invited, with a total of 260 months' stay, two congresses, two advanced courses and four workshops in the framework of an annual research programme and two specialised quarters are figures that consolidate those of previous years and allow us to look towards the immediate future with optimism.

Here however we would like to highlight various specific events of 2005, which range from strictly scientific aspects to more material questions, and which figure among the targets set out in the programme contract signed with the Government of Catalonia for the 2003-2006 period.

The organisation of annual Research Programmes –one in the 2004-2005 academic year and two in the 2005-2006 academic year– and of thematic quarters as well –two in the 2004-2005 academic year and one in the 2005-2006 academic year– have represented a more balanced distribution of the participation of the researchers from Catalan universities in the CRM's activities.

The CRM has also consolidated itself as a centre welcoming young researchers with post-doctoral grants or contracts obtained after highly competitive application submissions: three Marie Curie grant holders, one EPDI grant holder, six from the Spanish government's programme and one Ramón y Cajal contract confirm the CRM's standing as a centre for training young researchers.

The CRM's European dimension has also been reinforced over this period: in addition to the aforementioned Marie Curie grants, the CRM has organised an advanced course financed by the European Commission in the framework of the activities of the European Mathematical Society, and has obtained approval to organise a congress of the same characteristics in 2006. Moreover, a contract has been signed with the European Commission to carry out, over two years, the *Shaping New Directions in Mathematics for Science and Society* project, co-ordinated by the CRM, in which three other European centres participate.

This European outlook has also been evinced by the impulse given to the organisation of activities outside Catalo-

nia: in 2006 the CRM will organise a research thematic trimester partially at the Universidad Autónoma de Madrid, as well as an advanced course at Alcalá de Henares and a congress in the principality of Andorra, both as satellite activities of the ICM.

The publication of two new books in the series *Advanced Courses in Mathematics CRM Barcelona*, published by Birkhäuser, based on activities organised by the Centre, and a third book that is currently at print, mean that this series is advantageously positioned for the preparation of young researchers.

Finally, on a much more material note, we should draw attention to the expansion of our premises. Thanks to financial aid from the Government of Catalonia, the CRM now has at its disposal the space and equipment necessary to house up to 28 researchers and the organisation of any seminars, congresses and courses that might arise, as well as the management, technical and administrative services themselves.

Manuel Castellet
Director

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ACRONYMS

AGAUR	Agència de Gestió d'Ajuts Universitaris i de Recerca
CNRS	Centre National de la Recherche Scientifique
CRM	Centre de Recerca Matemàtica
CSIC	Consejo Superior de Investigaciones Científicas
DURSI	Departament d'Universitats, Recerca i Societat de la Informació
EMS	European Mathematical Society
EPDI	European Post-Doctoral Institute for the Mathematical Sciences
ERCOM	European Research Centres on Mathematics
EU	European Union
FFSB	Ferran Sunyer i Balaguer Foundation
ICM	International Congress of Mathematicians
ICREA	Institució Catalana de Recerca i Estudis Avançats
IEC	Institut d'Estudis Catalans
MATHFSS	Mathematics for Science and Society
MEC	Ministerio de Educación y Ciencia
NEST	New and Emerging Science and Technology
SCM	Societat Catalana de Matemàtiques
UAB	Universitat Autònoma de Barcelona
UAM	Universidad Autónoma de Madrid
UB	Universitat de Barcelona
UdG	Universitat de Girona
UPC	Universitat Politècnica de Catalunya
UPF	Universitat Pompeu Fabra

1. THE CENTRE DE RECERCA MATEMÀTICA

The Centre de Recerca Matemàtica (CRM) is a Consortium, with its own legal status, integrated by the Institut d'Estudis Catalans and the Catalan Government that takes part in it through its Department of Universities, Research and the Information Society (DURSI). The Centre de Recerca Matemàtica is a research institute associated with the Universitat Autònoma de Barcelona.

The CRM is, in essence, a horizontal infrastructure that gives support to all mathematical research groups in Catalonia, and encourages the pursuit of new emerging lines of research.

The CRM has the following goals:

- To consolidate its Research Programmes.
- To attract the best post-doctoral fellows on the basis of the competitive programmes of various administrations and agencies.
- To stimulate the best research programmes of the Catalan researchers.
- To establish mechanisms to guarantee a more efficient service for all the Catalan mathematicians.
- To enable the CRM to take a new step towards becoming as competitive as the best European research centres and those of the other scientifically developed countries of similar characteristics.

To achieve these goals the CRM invites outstanding scientists from around the world to do research visits, gives the opportunity to both the scientific institutions and young researchers to get in contact with them, carries out research programmes, organises conferences, seminars and other scientific meetings and spreads the results of the research.

The statutes of the CRM provide for the following governing bodies:

- The Governing Board, composed of the Minister of the DURSI, who acts as president, the President of the IEC, three members designated by the Government and three by the IEC.
- The Director, who is appointed by the Governing Board.
- The Scientific Advisory Board, whose members are proposed by the Director and approved by the Governing Board.
- Administrative support:
 - Technical and administrative support.
 - Computer system support.
 - Economic and personnel administrative support.

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1.1 THE INSTITUT D'ESTUDIS CATALANS



The Institut d'Estudis Catalans (Institute for Catalan Studies, IEC), founded in 1907, is an academic, scientific and cultural body whose sphere of activities includes all aspects of Catalan language and culture.

The aim of the IEC is to promote the scientific research, in particular the research related to all aspects of Catalan culture. It contributes to the planning, co-ordination and implementation of research in different fields of science, technology and humanities. Moreover, its own activities further the progress and development of society in general, and, when necessary, acts as an advisor to the government and other institutions.

The IEC is made up of five different sections defined by broad subject units in science, technology and humanities. Each section is formed by a maximum of twenty-eight

full members. There are 26 societies affiliated to the IEC, with more than 9,000 members. One of them is the Catalan Mathematical Society (SCM).

Web: www.iecat.net

1.2 THE GENERALITAT DE CATALUNYA



The Generalitat de Catalunya is the institution in which the self-government of Catalonia is politically organised through a Parliament and an Autonomous Government. It was created in the thirteenth century, bearing the same name, as an executive body, by the General Courts of the Confederation of the Catalan-Aragonese Crown.

The Generalitat de Catalunya participates in the CRM Consortium by means of its Department of Universities, Research and the Information Society (DURSI).

Web: www.gencat.es



2. GOVERNING BODY AND SECRETARIAT

2.1 THE GOVERNING BOARD

The CRM is governed by a Governing Board that this year 2005 has consisted of:

President:

The Minister of Universities, Research and the Information Society, Carles Solà

Members:

The President of the Institut d'Estudis Catalans, Salvador Giner

The Secretary General of the DURSI, Ramon-Jordi Moles

The Director General of Research, Francesc Xavier Hernández

The Advisor to the Minister for Research Centres, Carles Perelló

Salvador Alegret, member of the Institut d'Estudis Catalans

Joan Girbau, member of the Institut d'Estudis Catalans

Josep Enric Llebot, member of the Institut d'Estudis Catalans (until November)

Ricard Guerrero, member of the Institut d'Estudis Catalans (since November)

The Governing Board met twice during 2005. The first meeting was held on May 10. At this meeting the Board approved the CRM's plan for the expansion of its premises, as well as a financial agreement under which the Government of Catalonia undertook the responsibility for the return of the credit sum. At another meeting on July 20, the accounts for 2004 and the former Report of Activities were approved. A budget and the programme of activities for 2005 were also seen and approved.

The Board confirmed the nomination of Professor Consuelo Martínez, from the Universidad de Oviedo, as a new member of the CRM's Scientific Advisory Board, in substitution of Professor Juan Luis Vázquez.

2.2 THE DIRECTOR



The Governing Board elects a Director to serve for a period of four years. The current Director is Manuel Castellet, Professor of Geometry and Topology at the UAB, who was re-elected for the period 2002-2006 at the July 25, 2002 meeting of the Governing Board.



2.3 ASSOCIATE DIRECTORS



The Governing Board agreed at its meeting of June 22, 2004, to the Director's proposal, to nominate Carles Casacuberta (UB) and Jordi Quer (UPC) as Associate Directors of the CRM.



Thanks to these appointments, the CRM acquired a directorate that facilitates the management of the Centre as well as its interrelations with mathematicians working at Catalan universities.

2.4 THE SCIENTIFIC ADVISORY BOARD

The Governing Board, in its meeting of November 2002, nominated the first membership of the Scientific Advisory Board of the CRM. The current list of members is the following: Joan Bagaria, ICREA-UB; Àngel Calsina, UdG; Carles Casacuberta, UB and president of the SCM; Vicent Caselles, UPF; Alberto Facchini, Università degli Studi di Padova; Evarist Giné, University of Connecticut; Joan Girbau, UAB; Antoni Huerta, UPC; Jaume Llibre, UAB; Consuelo Martínez, Universidad de Oviedo; Xavier Massaneda, UB; M. Pilar Muñoz, UPC; Joan Carles Naranjo, UB; David Nualart, UB; Pere Pascual, UPC

and director of the FFSB; Joan Porti, UAB; Jordi Quer, UPC; Oriol Serra, UPC.

The Scientific Advisory Board met three times during 2005, on May 4, June 15, and November 4. The main points treated at these meetings were the following:

- Two Research Programmes were approved for the 2006-2007 period, namely *Enumerative Combinatorics and Random Structures*, and *Discrete and Continuous Methods in Ring Theory*.
- A thematic trimester was approved on *Nonsmooth Complex Systems*, to be started at the beginning of 2007.
- A call was launched for 2007-2008 Research Programmes.
- The possibility that the CRM starts hosting permanent researchers through the ICREA programme was discussed.
- The role of the CRM in the *Consolider-Ingenio 2010* programme was reported and debated.
- The NEST project *Shaping New Directions in Mathematics for Science and Society*, funded by the European Commis-



sion and co-ordinated by the CRM, was presented.

- Strategies were discussed for the participation of the CRM in the various programmes and calls of the European Union, Spain and Catalonia.

Professor Consuelo Martínez, from the Universidad de Oviedo, joined the Board on November 4. Professor Juan Luis Vázquez, from the Universidad Autónoma de Madrid, asked to be replaced as a Board member due to many commitments.

2.5 SECRETARIAT

The administrative staff of the CRM increased its number in 2005 thanks to a part-time employment of Mrs. María Paz Valero. Her post will become permanent in January 2006. This new contract has been possible through the collaboration of the CRM with the Aura Foundation. Therefore, the Secretarial Team of the CRM is currently the following:



Consol Roca
croca@crm.es
+34.935812953



Ana García-Donas
agarcia@crm.es
+34.935811081

They are in charge of the Director's office, activities and institutional relations.



Neus Portet
nportet@crm.es
+34.935814086



Núria Hernández
nhernandez@crm.es
+34.935811081

They are in charge of visitors and activities.



M. Paz Valero
mpvalero@crm.es
+34.935811081

She is in charge of maintenance and activities.



2.6 EXTERNAL SERVICES

In order to make the running of the CRM more flexible without increasing the number of work contracts, three companies offering external services perform the following tasks:

- Economic management and accounting: Consultors Rodao & associats
- Computer technical service: GetPut Software S.L.
- Support for the database management programme: Àgil Grup

3. FACILITIES

3.1 PREMISES

By the middle of 2004, the CRM's increase in activity as a result of the new Research Programmes made it necessary to expand in order to be able to accommodate more visiting researchers and to have an auditorium with enough capacity for the majority of the Centre's activities. For this reason, plans were drawn up for the construction of new facilities on UAB land next to the already existing CRM premises. Despite the fact that the UAB accepted the project immediately, work did not begin until the spring of 2005, soon after the DURSI agreed to guarantee financing. The architect Àngel Valdés designed the basic and building project for the premises.

After this expansion, the CRM now has facilities in the UAB Faculty of Sciences with a total floor space of 1,225 square metres, divided into seven individual offices, six double ones, three triple ones, a secretary's office with five work places, a management office, an office for deputy-management, a storeroom, an auditorium with capacity for one hundred people, a lecture room for twenty-five people, two work and meeting rooms and a common leisure area which includes computers and network connections for general use. The CRM's old large lecture room (which had places for up to fifty people) has



been converted into four double offices for the use of visiting researchers. All the premises have heating and air conditioning.

This expansion has allowed the CRM to increase the number of researchers that the Centre can accommodate simultaneously to a total of twenty-eight with the current space distribution. The Secretary's Office area has been substantially enlarged, now having room for five work places, and the area's new design means that visitors can make better use of the CRM's reprography and computer equipment, while at the same time having plenty of space for coffee breaks during scientific activities. The new auditorium has enough capacity for the majority of congresses and advanced courses that the CRM currently organises.

The new facilities were inaugurated on November 4, 2005 in a public ceremony aimed at all the Catalan mathematical community, and the event included a presentation of the CRM's Research Programmes for the 2005-2006 academic year, with the intention being for this act of dissemination to continue in future years. The programme on Arakelov Geometry and Shimura Varieties, co-ordinated by José Ignacio Burgos (UB) and Jörg Wildeshaus (Université de Paris XIII), and the programme on Hilbert's 16th Problem, co-ordinated by Armengol Gasull and Jaume Llibre (UAB) and Chengzi Li and Jiazong Yang (Peking Universi-



ty) were presented. The presentations consisted of a description of the scientific content of the main open problems, designed for non-specialist mathematicians, and were given by José Ignacio Burgos and Armengol Gasull, respectively. This was followed by addresses by the Catalan Minister for Universities, Research and Information Society, Carles Solà, the Secretary General of Scientific and Technological Policy for the MEC, Salvador Barberà, the Vice-Principal for Strategic Projects at the UAB, Francesc Gòdia, and the Director of the CRM, Manuel Castellet. These talks praised the work carried out by the CRM in its more than twenty years of service to mathematical research in Catalonia, and encouraged the Centre to continue playing a prominent role in the future.

3.2 COMPUTER EQUIPMENT

The CRM has a LAN Ethernet net of 100 Mbps. There are 43 working stations connected to the net and five printers. All workstations are part of a Windows Domain supplied by a central server (HP Netserver LC10) that at the same time works as a mail server and DNS server of the CRM's own domain (crm.es). A second server is used as a back-up and as an SQL server (data base for the CRM's management software). This LAN

net is connected to Internet through the UAB net. Wi-Fi connection is also available.

3.3 LIBRARY

CRM visitors have free access to all the scientific infrastructure of the UAB, consisting of essentially the Science and Engineering Library, which contains 446 paper journals, 400 electronic journals and 13,910 books devoted to Mathematics. The Library catalog is available online.

Web: www.bib.uab.es

3.4 HOUSING

The CRM has a few rented furnished apartments for the use of its visitors in Sant Cugat del Vallès (a small town connected by train to the UAB campus and to Barcelona) and in the *Vila Universitària* of the UAB campus. Most of the apartments consist of a dining room with kitchen, a bathroom and one bedroom with two single beds. A few of them have two or three bedrooms, and are suitable for families.

The rent, including utilities, ranges from 600 to 750 euros per month. Upon request, the apartments may be provided with a telephone connection at the visitors' expenses.



4. THE CONTRACT PROGRAMME WITH THE CATALAN GOVERNMENT

On June 18, 2003 the Minister of the Department of Universities, Research and the Information Society of the Catalan Government and the Director of the CRM signed a contract programme for the period 2003-2006, with the following goals:

- To establish a framework of relationship between the DURSI and the CRM.
- To provide the CRM with the necessary means to continue accomplishing its goals, according to the approved resolutions.
- To determine the participation of the DURSI in the definition and programming of the goals and of the funding of the CRM.
- To become an instrument of strategic planning, management of scientific research, and improvement of quality.

In the general framework of giving support to the Catalan research teams in all areas of Mathematics, the contract proposes as strategic goals of the CRM the following:

- To give support to the best research programmes of Catalan researchers and obtain their full participation in the programmes and activities offered by the CRM.
- To organise research-training activities and to promote the dissemination of the scientific results at the highest level in order to compete worldwide.
- To achieve the full integration of the Catalan mathematical community in the European research area and the acknowledgement of Catalonia as a mathematically developed country.
- To place the CRM among the best and more active mathematical research institutes in Europe.

Among the actions established in order to accomplish these goals, one must point out:

- The annual CRM Research Programmes.
- The visiting researchers and post-doctoral fellows.
- The organisation of conferences and advanced courses.
- The series *Advanced Courses in Mathematics CRM Barcelona*.
- The presence of Catalan mathematicians in the priority thematic areas of the 6th Framework Programme of the European Union.
- The Master's course in Mathematical Finance.
- The participation in ERCOM and in the EPDI.

4.1 MEETING OF THE CONTRACT PROGRAMME MONITORING COMMISSION

The contract programme between the DURSI and the CRM foresees, in its ninth clause, the creation of a Monitoring Commission, made up of two DURSI and two CRM representatives. The commission's main role is to evaluate the extent to which the objectives and commitments of the contract programme are met, and to propose the measures it considers necessary to achieve these objectives.

The Monitoring Commission met on October 4, 2005. The DURSI was represented by Mrs. Iolanda Font de Rubinat and the CRM was represented by the two Associate Directors, Carles Casacuberta and Jordi Quer. The meeting was also attended by the CRM's Director, Manuel Castellet, by Mr. Andreu Bote-

lla, from the AGAUR's Programme for Research Centres, and by Mrs. Gemma Morales, from the DURSI's Service for Research Structures.

The main aim of the meeting was to analyse the activity of the CRM in 2004 and the results obtained for the foreseen indicators for that year in the contract programme. On the basis of data in the CRM Report of Ac-

tivities for 2004, complemented and detailed with additional information supplied by the Centre, the Commission announced that the objectives proposed for 2004 had been achieved, in some cases more than substantially. The Commission's evaluation of the Centre's activity in 2004, and its compliance with commitments to the contract programme, was highly positive.



ACTIVITIES IN 2005

5. VISITING RESEARCHERS

5.1 LIST OF VISITORS

A. Martino	Algebra, 01.04.2003 – 31.08.2005 Centre de Recerca Matemàtica
J. Hirschorn	Logic and Foundations, 01.09.2003 – 28.02.2005 Centre de Recerca Matemàtica
O. Penacchio	Topology, 01.01.2004 – 09.02.2006 Centre de Recerca Matemàtica
U. Ray	Topology, 01.04.2004 – 31.03.2005 Université de Reims
J. Burillo	Discrete Mathematics, 01.09.2004 – 31.07.2005 Universitat Politècnica de Catalunya
E. Ventura	Algebra, 01.09.2004 – 31.07.2005 Universitat Politècnica de Catalunya
S. Tikhonov	Harmonic Analysis, 01.09.2004 – 31.08.2006 Centre de Recerca Matemàtica
A. Lewis	Differential Equations, 01.01.2005 – 30.03.2005 Queen's University
S. Cleary	Discrete Mathematics, 01.01.2005 – 30.06.2005 The City College of New York
N. Brady	Discrete Mathematics, 01.01.2005 – 31.07.2005 University of Oklahoma
C. Lecuire	Geometry, 01.01.2005 – 30.06.2006 Centre de Recerca Matemàtica
L. Ciobanu	Algebra, 01.01.2005 – 30.11.2005 Centre de Recerca Matemàtica
J.-Y. Briend	Dynamical Systems, 09.01.2005 – 22.01.2005 Université de Provence
K. St. John	Discrete Mathematics, 09.01.2005 – 30.06.2005 Lehman College
J. Taback	Discrete Mathematics, 10.01.2005 – 19.01.2005 Bowdoin College
H. Perdry	Dynamical Systems, 14.01.2005 – 22.01.2005 Università di Pisa
M. di Francesco	Differential Equations, 16.01.2005 – 30.01.2005 Università dell'Aquila

Yu. Fedorov	Geometric Mechanics, 20.01.2005 – 28.02.2005 Universitat Politècnica de Catalunya
B. Toën	Topology, 31.01.2005 – 04.02.2005 Université Paul Sabatier
J. Okninski	Algebra, 01.02.2005 – 11.02.2005 Uniwersytet Warszawski
R. McCann	Differential Equations, 01.02.2005 – 28.02.2005 University of Toronto
S. Friedman	Logic and Foundations, 01.02.2005 – 31.03.2005 Universität Wien
T. Brady	Discrete Mathematics, 01.02.2005 – 30.04.2005 Dublin City University
F. Dumortier	Dynamical Systems, 01.02.2005 – 30.04.2005 Limburgs Universitair Centrum
G. Olivar	Applied Mathematics, 05.02.2005 – 20.03.2005 Universitat Politècnica de Catalunya
B. Jovanovic	Geometry, 06.02.2005 – 13.02.2005 Serbian Academy of Sciences
S. Simanca	Differential Geometry, 07.02.2005 – 24.04.2005 University of New Mexico
A. Bloch	Differential Equations, 09.02.2005 – 13.02.2005 University of Michigan
D. Zenkov	Differential Equations, 09.02.2005 – 15.02.2005 North Carolina State University
B. Maschke	Differential Equations, 13.02.2005 – 17.02.2005 Université Claude Bernard
D. Martín	Differential Equations, 13.02.2005 – 18.02.2005 CSIC, Madrid
F. Bullo	Differential Equations, 13.02.2005 – 27.02.2005 University of Illinois at Urbana-Champaign
C. Martínez	Algebra, 14.02.2005 – 23.02.2005 Universidad de Oviedo
V. Mañosa	Geometry, 15.02.2005 – 14.06.2005 Universitat Politècnica de Catalunya
A. van der Schaft	Differential Equations, 20.02.2005 – 24.02.2005 Universiteit Twente
S. Stramigioli	Differential Equations, 20.02.2005 – 24.02.2005 Universiteit Twente
F. Angulo	Differential Equations, 21.02.2005 – 20.03.2005 Universidad Nacional de Colombia

L. A. Ibort	Differential Geometry, 23.02.2005 – 25.02.2005 Universidad Carlos III de Madrid
S. J. Hogan	Differential Equations, 26.02.2005 – 12.03.2005 University of Bristol
R. Ortega	Differential Equations, 28.02.2005 – 06.03.2005 Supélec
E. C. Turner	Discrete Mathematics, 01.03.2005 – 30.06.2005 University of Albany
E. H. Essaky	Probability and Statistics, 01.03.2005 – 31.08.2006 Université Cadi Ayyad
D. Pasca	Dynamical Systems, 01.03.2005 – 31.08.2006 Centre de Recerca Matemàtica
F. Torres	Differential Equations, 07.03.2005 – 13.03.2005 Universidad de Sevilla
T. Lange	Applied Mathematics, 08.03.2005 – 20.03.2005 Danmarks Tekniske Universitet
G. Frey	Number Theory, 08.03.2005 – 24.03.2005 Universität GHS Essen
M. Shelley	Differential Equations, 08.03.2005 – 24.03.2005 New York University
M. di Bernardo	Differential Equations, 09.03.2005 – 20.03.2005 University of Bristol
G.-A. Osorio	Differential Equations, 09.03.2005 – 21.03.2005 Università di Napoli Federico II
L. Tao	Differential Equations, 13.03.2005 – 19.03.2005 New Jersey Institute of Technology
W. S. Koon	Differential Equations, 20.03.2005 – 30.03.2005 California Institute of Technology
B. V. Simonov	Harmonic Analysis, 01.04.2005 – 25.04.2005 Volgograd State Technical University
J. C. Álvarez	Geometry, 01.04.2005 – 15.05.2005 Polytechnic University Brooklyn
J. L. Villar	Applied Mathematics, 01.04.2005 – 15.07.2005 Universitat Politècnica de Catalunya
R. Cramer	Applied Mathematics, 01.04.2005 – 24.07.2005 CWI Amsterdam
M. Fischlin	Applied Mathematics, 01.04.2005 – 31.07.2005 University of California, San Diego
C. Padró	Applied Mathematics, 01.04.2005 – 31.07.2005 Universitat Politècnica de Catalunya

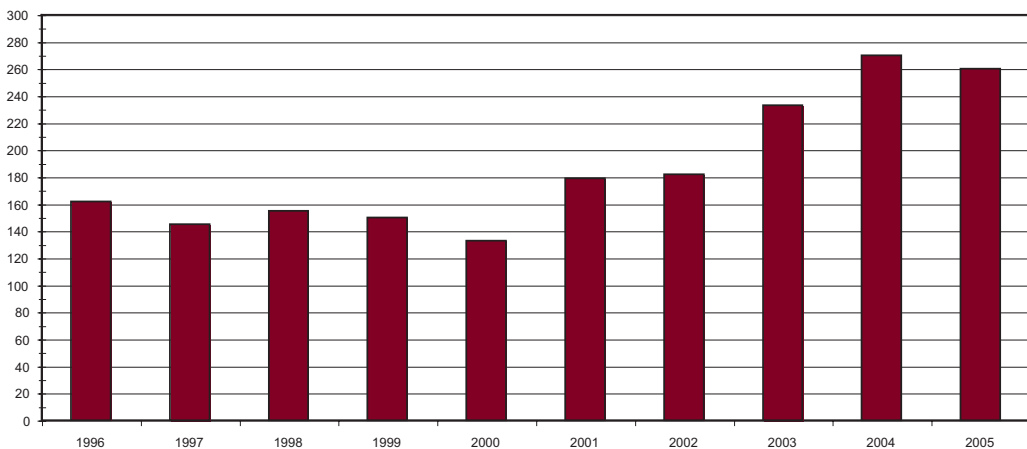
V. Shpilrain	Discrete Mathematics, 07.04.2005 – 22.04.2005 CUNY, Hunter College
C. Pittet	Discrete Mathematics, 10.04.2005 – 24.04.2005 Université de Provence
P. Weil	Discrete Mathematics, 15.04.2005 – 30.04.2005 Université de Bordeaux 1
S. Edixhoven	Number Theory, 01.05.2005 – 06.05.2005 Université de Rennes I
A. Toms	Algebra, 01.05.2005 – 31.05.2005 University of New Brunswick
T. Okamoto	Applied Mathematics, 01.05.2005 – 31.08.2005 NTT Information Sharing Platform Laboratories
E. Pardo	Algebra, 03.05.2005 – 28.05.2005 Universidad de Cádiz
J. A. Garay	Applied Mathematics, 09.05.2005 – 31.07.2005 Lucent Technologies
H. Iwaniec	Number Theory, 16.05.2005 – 16.06.2005 Rutgers University
T. Riley	Topology, 16.05.2005 – 15.07.2005 Yale University
C. Ritzenthaler	Number Theory, 16.05.2005 – 16.08.2005 Universitat Autònoma de Barcelona
D. Chataur	Algebraic Topology, 28.05.2005 – 12.06.2005 Université des Sciences et Technologies Lille 1
S. Fehr	Applied Mathematics, 01.06.2005 – 30.06.2005 CWI Amsterdam
E. Alibegovic	Discrete Mathematics, 01.06.2005 – 31.07.2005 University of Michigan
D. Karim	Algebra, 01.06.2005 – 15.08.2005 Université Cadi Ayyad
J. Meakin	Discrete Mathematics, 04.06.2005 – 04.07.2005 University of Nebraska-Lincoln
K. Reihani	Algebra, 08.06.2005 – 24.06.2005 Universitetet i Oslo
M. Stein	Discrete Mathematics, 08.06.2005 – 08.07.2005 Trinity College
R. de Haan	Applied Mathematics, 19.06.2005 – 29.06.2005 CWI Amsterdam
J. Bolte	Dynamical Systems, 21.06.2005 – 20.07.2005 Université de Paris VI

A. Miasnikov	Algebra, 25.06.2005 – 15.07.2005 McGill University
Y. Garcia	Applied Mathematics, 25.06.2005 – 24.07.2005 Université des Antilles et de la Guyane
I. Chatterji	Topology, 26.06.2005 – 06.07.2005 Columbia University
M. Forester	Topology, 27.06.2005 – 19.07.2005 University of Oklahoma
A. Boldyreva	Cryptography, 01.07.2005 – 31.07.2005 Georgia Institute of Technology
P. Paillier	Applied Mathematics, 02.07.2005 – 11.07.2005 Gemplus International
F. Rodriguez	Number Theory, 03.07.2005 – 17.07.2005 University of Texas at Austin
B. Boufoussi	Probability and Statistics, 04.07.2005 – 31.07.2005 Université Cadi Ayyad
H. Short	Discrete Mathematics, 05.07.2005 – 15.07.2005 Université de Provence
S. Friedman	Logic and Foundations, 29.08.2005 – 30.09.2005 Universität Wien
B. Deroin	Differential Geometry, 01.09.2005 – 31.12.2005 MPI Leipzig
J. Funke	Algebra, 01.09.2005 – 31.12.2005 New Mexico State University
J. Wildeshaus	Algebraic Geometry, 01.09.2005 – 31.07.2006 Université de Paris XIII
J. Yu	Dynamical Systems, 01.09.2005 – 28.02.2007 Centre de Recerca Matemàtica
A. Yaman	Algebra, 01.09.2005 – 30.05.2008 Centre de Recerca Matemàtica
D. Schritterser	Logic and Foundations, 05.09.2005 – 05.10.2005 Universität Wien
B. Bollobás	Discrete Mathematics, 10.09.2005 – 22.09.2005 University of Memphis
B. Thatte	Applied Mathematics, 13.09.2005 – 31.10.2005 Massey University
J. Nešetřil	Discrete Mathematics, 14.09.2005 – 30.09.2005 Univerzita Karlova
C. di Prisco	Logic and Foundations, 15.09.2005 – 29.11.2005 Instituto Venezolano de Investigaciones Cientificas

A. Gasull	Dynamical Systems, 15.09.2005 – 28.02.2006 Universitat Autònoma de Barcelona
H. Gillet	Algebraic Geometry, 19.09.2005 – 02.10.2005 University of Illinois at Chicago
J. I. Burgos	Algebra, 19.09.2005 – 31.07.2006 Universitat de Barcelona
K. Künnemann	Algebra, 20.09.2005 – 03.10.2005 Universität Regensburg
J. Kramer	Number Theory, 20.09.2005 – 15.10.2005 Humboldt Universität zu Berlin
U. Kühn	Algebra, 25.09.2005 – 14.10.2005 Humboldt Universität zu Berlin
H. Massold	Algebra, 01.10.2005 – 31.10.2005 ETH Zürich
Z. Zhang	Dynamical Systems, 01.10.2005 – 31.01.2006 Peking University
F.-A. Buica	Dynamical Systems, 01.10.2005 – 31.07.2006 Universitatea Babeş-Bolyai
M.-H. Nicole	Number Theory, 06.10.2005 – 06.11.2005 University of Tokyo
E. Gallardo	Analysis, 15.10.2005 – 15.12.2005 Universidad de Zaragoza
P. Fernández	Differential Geometry, 16.10.2005 – 06.11.2005 IMCA, Lima
R. J. Rosas	Differential Geometry, 16.10.2005 – 12.11.2005 IMPA, Rio de Janeiro
C. Valls	Dynamical Systems, 17.10.2005 – 22.10.2005 Universitat de Barcelona
V. Pilyugina	Differential Equations, 17.10.2005 – 17.12.2005 St. Petersburg State University
J.-P. Francoise	Complex Analysis, 18.10.2005 – 18.11.2005 Université de Paris VI
V. Jiménez	Dynamical Systems, 18.10.2005 – 18.11.2005 Universidad de Murcia
M. Y. Mazalov	Complex Analysis, 24.10.2005 – 20.11.2005 Military Academy
J. Yang	Dynamical Systems, 24.10.2005 – 19.03.2006 Peking University
D. U. Lee	Algebraic Geometry, 01.11.2005 – 31.07.2005 Centre de Recerca Matemàtica

H. Gillet	Algebraic Geometry, 01.11.2005 – 15.11.2005 University of Illinois at Chicago
E. M. Kalmoun	Applied Mathematics, 01.11.2005 – 30.11.2005 Université Cadi Ayyad
H. Wu	Dynamical Systems, 01.11.2005 – 19.08.2006 Centre de Recerca Matemàtica
Y. Ding	Dynamical Systems, 01.11.2005 – 31.10.2006 Centre de Recerca Matemàtica
G. Swirszcz	Dynamical Systems, 03.11.2005 – 30.11.2005 Uniwersytet Warszawski
C. Soulé	Algebraic Geometry, 04.11.2005 – 13.11.2005 Institut des Hautes Études Scientifiques
A.-A. Tarta	Dynamical Systems, 15.11.2005 – 14.11.2006 Universitatea Babes-Bolyai
I. D. Iliev	Dynamical Systems, 21.11.2005 – 17.12.2005 Bulgarian Academy of Science
A. R. D. Mathias	Logic and Foundations, 23.11.2005 – 20.12.2005 Université de la Réunion
M. Perling	Algebraic Geometry, 28.11.2005 – 03.12.2005 Université de Grenoble I
J. Parcet	Analysis, 01.12.2005 – 30.11.2010 Centre de Recerca Matemàtica

Visitor person-months



5.2 POST-DOCTORAL FELLOWS

Among the visiting researchers at the CRM during the year 2005 there were eleven post-doctoral fellows who visited for more than nine months, thereby fulfilling one

of the foundational aims of the CRM, namely to facilitate the work of young researchers and their contact with leading scientists. They were:

Armando Martino	01.04.2003 – 31.08.2005
Olivier Penacchio	01.01.2004 – 31.12.2005
Sergey Yu. Tikhonov	01.09.2004 – 31.08.2006
Laura Ciobanu	01.01.2005 – 30.11.2005
Cyril Lecuire	01.01.2005 – 30.06.2006
El Hassan Essaky	01.03.2005 – 31.08.2006
Daniel Pasca	01.03.2005 – 31.08.2006
Bertrand Deroin	01.09.2005 – 31.08.2006
Asli Yaman	01.09.2005 – 28.02.2007
Jiang Yu	01.09.2005 – 28.02.2007
Yiming Ding	01.11.2005 – 31.10.2006

5.3 THE RAMÓN Y CAJAL PROGRAMME

The Ramón y Cajal programme of the Spanish Ministry for Education and Science (MEC) provides funding for five-year contracts offered to doctoral degree holders in any knowledge area, in order to work at Spanish centres. It is open to candidates from any nationality meeting the following requirements: holding a doctoral degree no older than ten years before the call's deadline and having stayed at other centres during at least two years after receipt of their doctoral

degree. Ramón y Cajal contracts are financed jointly by the MEC and the hosting institution. In the case of contracts offered for stays at the CRM, the Generalitat de Catalunya assumes the CRM's share of the salary.

The first Ramón y Cajal contract signed by the CRM was awarded to Javier Parcet, a specialist in Analysis. He started working at the CRM on December 1, 2005. With this contract, the CRM opens an important new way of hosting top-level young researchers.

6. SCIENTIFIC ACTIVITIES

6.1 RESEARCH PROGRAMMES

6.1.1 STRUCTURE

On November 22, 2002 the CRM Governing Board passed a resolution consisting on a quadrennial strategic plan that includes two Research Programmes per year, together with other complementary activities.

Goal

To foster, during a year, the work of two outstanding research groups from Catalan institutions, by hosting visitors and post-doctoral fellows.

Scientific research staff

- One full time local researcher; eventually, two one semester each.
- One full time visiting researcher; eventually, two one semester each.
- Two post-doctoral fellows.
- 24 months of visiting researchers for periods of one to three months.
- Other local or visiting researchers.

Activities

- Research.
- Seminars.
- A conference or workshop.
- An advanced intensive course at a doctoral or recent post-doctoral level.

The annual Research Programmes started in the academic year 2003-2004. An open call is made public at least a year and a half before the expected start of the programme. Each programme has to be approved by the CRM Governing Board, at the proposal of the Director, who is counselled by

the Scientific Advisory Board, which evaluates the applications received.

6.1.2 RESEARCH PROGRAMME ON GEOMETRY OF THE WORD PROBLEM

Period

From September 1, 2004 to July 31, 2005.

Scientists in charge

Locals Josep Burillo (UPC)
Enric Ventura (UPC)

Visitor Noel Brady (University of Oklahoma)

Main research topic

Geometry of the Word Problem

Other research topics

• Free Groups and Automorphisms of Free Groups

- Hyperbolic Groups
- Amenability
- Current Topics in Geometric Group Theory

Visiting researchers

Emina Alibegovic
University of Michigan

Goulnara Arjantseva
Université de Genève

Oleg Bogopolski
Institute of Mathematics, Novosibirsk

Noel Brady
University of Oklahoma

Tom Brady
Dublin City University

Martin Bridson
Imperial College

Jean Yves Briend
Université de Provence

Peter Brinkmann
Technische Universität Berlin

Indira Chatterji
Columbia University

Laura Ciobanu
Rutgers University

Sean Cleary
City College of New York

Daryl Cooper
University of California at Santa Barbara

Max Forester
University of Oklahoma

Victor Guba
Vologda State University

Peter Haissinsky
Université de Provence

Ilya Kapovich
University of Illinois at Urbana-Champaign

Jérôme Los
CNRS, Marseille

Martin Lustig
Université d'Aix-Marseille III

Consuelo Martínez
Universidad de Oviedo

Armando Martino
Centre de Recerca Matemàtica

John Meakin
University of Nebraska-Lincoln

Christophe Pittet
Université de Provence

Jean-Philippe Preaux
CMI, Marseille

Urmie Ray
Université de Reims

Lawrence Reeves
Université d'Aix-Marseille III

Tim Riley
Yale University

Hamish Short
Université de Provence

Vladimir Shpilrain
City College of New York

Tatiana Smirnova
Université de Genève

Melanie Stein
Trinity College, Hartford

Jennifer Taback
University at Albany and Bowdoin College

Ted Turner
University at Albany

Pascal Weil
CNRS, Bordeaux

Activities

Seminar

A weekly seminar on the Geometry of the Word Problem, co-ordinated by J. Burillo and E. Ventura.

Conference

Barcelona Conference on Geometric Group Theory, June 28 to July 2, 2005, co-ordinated by J. Burillo.

Advanced course

Advanced Course on the Geometry of the Word Problem for Finitely Generated Groups, July 5 to 15, 2005, co-ordinated by J. Burillo.

Final report

The research programme on the Geometry of the Word Problem was held during the 2004–2005 academic year at the CRM, co-ordinated by Josep Burillo and Enric Ventura from the Universitat Politècnica de Catalunya, together with Noel Brady from Oklahoma University. The main body of this programme

Name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul
J. Burillo											
E. Ventura											
A. Martino											
U. Ray											
J. Los											
O. Bogopolski											
D. Cooper											
V. Guba											
M. Bridson											
L. Reeves											
G. Arjantzeva											
P. Haissinsky											
I. Kapovich											
H. Short											
P. Weil											
M. Lustig											
J.P. Preux											
T. Smirnova											
P. Brinkmann											
N. Brady											
S. Cleary											
L. Ciobanu											
J. Taback											
J.-Y. Briend											
T. Brady											
C. Martínez											
T. Turner											
V. Shpilrain											
Ch. Pittet											
T. Riley											
E. Alibegovic											
J. Meakin											
M. Stein											
I. Chatterji											
A. Miasnikov											
M. Forester											

consisted of the visits of 32 foreign researchers, who came to the CRM for stays of various lengths, spread over the whole year, with the specific aim of researching into the field of Geometric Group Theory. At the end of the year the programme was closed by holding a congress, the *Barcelona Conference on Geometric Group Theory* (from June 28 to July 2) and a course entitled *Advanced Course on the Geometry of the Word Problem for Finitely Generated Groups* (July 5 to 15).

The scientific evaluation of the programme was excellent. The organisers were fortunate to receive visits from some top ranking researchers worldwide, such as M. Bridson (Imperial College, London), I. Kapovich (University of Illinois at Urbana-Champaign), G. Arzhantseva (Université de Genève), E. C. Turner (University at Albany) and H. Short (Université de Marseille). These academics brought to Catalonia their expertise in a subject that is very poorly

represented in the Catalan and Spanish mathematical community. Holding the programme in Barcelona has given our country an important prominence within the field of Group Theory, and has contributed considerably to the increased visibility of Catalonia and of its mathematical community in this research area as well.

One of the central activities of the programme was the seminar's weekly talks. Throughout the year we kept to a rhythm of two talks per week, and these became the week's star activities. Many of the informal conversations between visiting researchers took place in the hallways after the talks, and were sparked off by the seminar papers. Enjoying the presence of enough experts to be able to keep up this rhythm of talks has been one of the main successes of the programme, and has provided us with exposure to the most up to date and leading topics in our field. The level of the talks was very high.

The moment of maximum visitor influx was during November 2004. The visit by Ilya Kapovich from Urbana-Champaign (Illinois, EUA) during the month of November attracted the participation of various European academics interested in talking to him, and we were able to take advantage of this by having them participate in the seminar. The weeks in November were very busy, with three talks being held every week.

Nonetheless, apart from the seminar papers and the numerous and fruitful informal conversations, the real research work was carried out in the offices, where different collaborations materialised, both between visitors and local researchers and between visitors and others. Overall, both the volume and the quantity of research done in the framework of the programme were quite considerable. This is reflected in the number of contributions to the CRM's collection of preprints generated

directly or indirectly by this programme. By the end of 2005 there were a total of 21 preprints collected, and we estimate that there are between 5 and 10 more still to arrive. All of these are in the process of being published in international journals.

Overall therefore, we value very positively the development of this research programme, both on an objective level in terms of results obtained, and in an indirect way, with regard to the magnificent image that it has helped to give to our country and the local community working in Group Theory.

6.1.3 RESEARCH PROGRAMME ON HILBERT'S 16TH PROBLEM

Period

From September 1, 2005 to July 31, 2006



Scientists in charge

Locals Jaume Llibre (UAB)
Armengol Gasull (UAB)

Visitors Chengzhi Li (Peking University)
Jiazhong Yang (Peking University)

Main research topic

Hilbert's 16th Problem for certain families of polynomial vector fields

Other research topics

- Limit Cycles
- Darboux Integrability
- Centres
- Period Functions

Visiting researchers

Jürgen Appell
University of Würzburg

Florina-Adriana Buica
Universitatea Babeş-Bolyai

Colin Christopher
Plymouth University

Jean-Pierre Francoise
Université de Paris VI

Hector Giacomini
Université François Rabelais

Vladimir S. Gonchenko
Institute Appl. Math. Cybernetics
Nizhny Novgorod

Antoni Guillamon
Universitat Politècnica de Catalunya

Iliya Dimov Iliev
Bulgarian Academy of Sciences

Víctor Jiménez
Universidad de Murcia

José Tomás Lázaro
Universitat Politècnica de Catalunya

Jinming Li
Beijing Agricultural University

Weigu Li
Peking University

Pavao Mardesic
Université de Bourgogne

Linping Peng
Peking University

Violetta Pilyugina
St. Petersburg State University

Douglas Shafer
University of North Carolina at Charlotte

Gregorz Swirszcz
Uniwersytet Warszawski

Alexandrina-Alina Tarta
Universitatea Babeş-Bolyai

Clàudia Valls
Universitat de Barcelona

Jordi Villadelprat
Universitat Rovira i Virgili

Sebastian Walcher
RWTH Aachen

Hao Wu
Peking University

Jiang Yu
Peking University

Zhifen Zhang
Peking University

Activities*Seminar*

A weekly seminar on Hilbert's 16th Problem, co-ordinated by A. Gasull and J. Llibre.

Conference

Barcelona Conference on Planar Vector Fields, February 13 to 17, 2006, co-ordinated by A. Gasull and J. Llibre.

Advanced course

Advanced Course on Limit Cycles of Differential Equations, June 26 to July 8, 2006, co-ordinated by A. Gasull and J. Llibre.



6.1.4 RESEARCH PROGRAMME ON ARAKELOV GEOMETRY AND SHIMURA VARIETIES

Period

From September 1, 2005 to July 31,
2006

Scientists in charge

Local José Ignacio Burgos (UB)
Visitor Jörg Wildeshaus (Université de Paris
XIII)

Main research topic

Arakelov Geometry and Shimura Varieties

Other research topics

• Modular Forms and Values of
 L -Functions

- The Arithmetic Riemann-Roch Theorem
- Integral Models of Shimura Varieties
- Motivic Theory
- Intersection Theory of Algebraic Stacks

Visiting researchers

Ching-Li Chai
Penn State University

Henri Darmon
McGill University

Jens Funke
New Mexico State University

Carlo Gasbarri
Università di Roma «Tor Vergata»

Henri Gillet
University of Illinois at Chicago

Benedict H. Gross
Harvard University

Walter Gubler
Universität Dortmund

Dihua Jiang
University of Minnesota-Minneapolis

Shu Kawaguchi
Kyoto University

Kai Köhler
Universität Düsseldorf

Jürg Kramer
Humboldt Universität zu Berlin

Ulf Kühn
Humboldt Universität zu Berlin

Klaus Künnemann
Universität Regensburg

Dong Uk Lee
University of Pennsylvania

Francesco Lemma
Université de Paris XIII

Razvan Litcanu
Universitatea Al. I. Cuza

Xiaonan Ma
École Polytechnique, Palaiseau

Vincent Maillot
Institut de Mathématiques de Jussieu

Heinrich Massold
ETH Zürich

Christophe Mourougane
Université de Paris VI

Bao Chau Ngo
Université de Paris XI

Marc-Hubert Nicole
University of Tokyo

Damian Roessler
Université de Paris VII

Pierre Schapira
Université Pierre et Marie Curie



Martín Sombra
Universitat de Barcelona

Christophe Soulé
IHÉS

Yuichiro Takeda
Kyushu University

Activities

Seminar

A weekly seminar on Arakelov Geometry and Shimura Varieties, co-ordinated by J. I. Burgos.

Introductory course

Introduction to Shimura Varieties, September 20 to 23, 2005, co-ordinated by J. I. Burgos and taught by Víctor Rotger (UPC).

Advanced course

Advanced Course on Arakelov Geometry and Shimura Varieties, February 20 to 25, 2006, co-ordinated by J. I. Burgos.

Conference

Recent Developments in the Arithmetic of Shimura Varieties and Arakelov Geometry, July 10 to 15, 2006, co-ordinated by J. I. Burgos.

This was an EMS Conference financed by the European Commission.

6.2 SPECIALISED QUARTERS

6.2.1 CONTROL, GEOMETRY AND ENGINEERING

From February 7 to March 30, 2005, a themed term was organised at the CRM on Control, Geometry and Engineering by Miguel C. Muñoz, from the Universitat Politècnica de Catalunya.

The main goal of this activity was to gather together a number of specialists in these three areas with the purpose of exchanging techniques, problems, solutions and diverse viewpoints on Control Systems in Engineering and related problems, bringing up ideas and geometric methods for their modelisation, their study and possible solutions. To this aim, three specialised post-graduate courses were organised, as well as three round tables about several topics and a dozen of different seminars.

Researchers from more than twenty European and American universities participated at these activities. The audience (more than 60 people altogether) came from four Catalan institutions, nine from the rest of Spain, five from other European countries, and four from America.

The topics treated at the seminars ranged from the study of quantum control of coupled oscillators to a presentation of open problems and future goals in Geometric Control Theory. The marks given by the participants on a CRM questionnaire showed that this activity was positively assessed by the participating researchers and by the students as well.

Lists of courses, round tables and participants follow:

Post-graduate courses

Geometric Control of Mechanical Systems, February 14 to 20, 2005, taught by F. Bullo (University of California).

Port Controlled Hamiltonian Systems, February 21 to 27, 2005, taught by S. Stramigioli and A. van der Schaft (Universiteit Twente).

Modeling Large-Scale Dynamics of the Visual Cortex, March 7 to 13, 2005, taught by M. Shelley (Courant Institute, New York University).

Round tables

Open Problems in Geometric Control

Participants: A. Lewis, F. Bullo, A. van der Schaft.

Mathematical Engineering

Participants: J. Solà-Morales, R. Ortega, S. J. Hogan.

Research in Applied Mathematics

Participants: M. Shelley, M. Castellet, M. di Bernardo.

Visiting researchers

Fabiola Angulo

Universidad Nacional de Colombia

Mario di Bernardo

University of Bristol

Anthony Bloch

University of Michigan

Francesco Bullo

University of California

Yu. Fedorov

Universitat Politècnica de Catalunya

S. J. Hogan

University of Bristol

Alberto Ibort

Universidad Carlos III de Madrid

Bozidar Jovanovic

Serbian Academy of Sciences

Wang Sang Koon

California Institute of Technology

Andrew Lewis

Queen's University

David Martín de Diego

CSIC, Madrid

Bernhard Maschke

Université Claude Bernard Lyon 1

Gerard Olivar

Universitat Politècnica de Catalunya

Romeo Ortega

LSS/CNRS/Supélec, Plateau de Moulon

Gustavo-Adolfo Osorio

Università di Napoli Federico II

Arjan van der Schaft

Universiteit Twente

Michael Shelley

Courant Institute, New York University

Stefano Stramigioli

Universiteit Twente

Louis Tao

New Jersey Institute of Technology

Francisco Torres

Universidad de Sevilla

Dmitry Zenkov

North Carolina State University

CONTROL, GEOMETRY AND ENGINEERING

Centre de Recerca Matemàtica
Campus of the Universitat Autònoma de Barcelona
January – March, 2005

Main Topics:
 Geometric control
 Control of mechanical systems
 Control of nonholonomic systems
 Non-controlled systems
 Piecewise control systems
 Morse theory
 Engineering applications

Courses:
 Geometric control of mechanical systems
 Francesco Bullo
 February 14 to 18, 2005

Port controlled Hamiltonian systems
 Stefano Stramigioli
 Arjan van der Schaft
 February 21 to 25, 2005

Modeling Dynamics of the Visual Cortex
 Michael Shelley
 March 7 to 11, 2005

ROUND TABLES:
 Open problems in geometric control
 Mathematical engineering
 Research in applied mathematics

Visiting Researchers:
 F. Angulo, Universidad Nacional de Colombia
 A. Bloch, University of Michigan
 F. Bullo, University of California
 M. di Bernardo, University of Bristol
 Yu. Fedorov, Universitat Politècnica de Catalunya
 S.J. Hogan, University of Bristol
 A. Ibort, Universidad Carlos III, Madrid
 B. Jovanovic, Serbian Academy of Sciences and Arts
 A. Lewis, Queen's University, Kingston
 D. Martín de Diego, CSIC, Madrid
 S. Martinez, University of Illinois
 B. Maschke, Université Claude Bernard, Lyon
 G. Olivar, Universitat Politècnica de Catalunya
 R. Ortega, CNRS-Supélec, Gif sur Yvette
 W. Sang Koon, California Institute of Technology
 M. Shelley, Courant Institute, New York
 S. Stramigioli, University of Twente
 L. Tao, New Jersey Institute of Technology
 F. Torres, Universidad de Sevilla
 A. van der Schaft, University of Twente
 D. Zenkov, North Carolina State University

Control2005@crm.es
<http://www.crm.es/Control2005>

The CRM can offer a reduced number of accommodation slots for Ph.D. students interested in the courses

Co-ordinators:
 Miguel C. Muñoz, CRM-UPC
 Eric Fassin, IMCS-UPC
 Andrew Datcham, CRM-UPC

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6.2.2 CONTEMPORARY CRYPTOLOGY

From February to July 2005, a thematic semester took place at the CRM on Contemporary Cryptology, organised by Jorge Villar and Carles Padró, from the Universitat Politècnica de Catalunya. Ronald Cramer and Tatsuaki Okamoto were keynote visitors and collaborated with the organisation of activities.

A diversity of specialists in Mathematics Applied to Cryptography met together with the aim of bringing mathematical tools, such as Combinatorial Group Theory, the theory of Elliptic and Hyperelliptic Curves, Matroid Theory or Coding Theory, into the context of Contemporary Cryptology, where security issues and formal methods for the analysis of distributed crypto-

graphic protocols become increasingly demanding. Computational Theory (basically algorithmic complexity) and Information Theory (classical and quantum) are also of great importance. In many recent proposals of new cryptosystems there is a lack of a mathematical analysis of their security. In this direction, the organisers aim to consolidate an annual scientific meeting, jointly with Professor Ronald Cramer. The second event in this series was the *Workshop on Mathematical Problems and Techniques in Cryptology*, which was organised by the CRM within this semester. The main goal of this series of meetings is to provide a link between Theoretical Computer Science and Applied Mathematics for the development of research in Cryptology.

A weekly seminar was run during the whole semester. All the invited researchers



presented their recent work at this seminar. This allowed local researchers and especially graduate students working in this area to grasp the state of the art in current topics of research in Cryptology.

Taking advantage of the stay of Professor Gerhard Frey on March 10 and 11, a seminar entitled *Seminar on Geometric Methods in Cryptography* was organised, consisting of a short course taught by Frey and several presentations offered by Tanja Lange and local researchers. A large number of people from Catalan universities attended the course. The seminar was devoted to the various applications of elliptic and hyperelliptic curves to Cryptology.

The main activity of the semester was the *Workshop on Mathematical Problems and Techniques in Cryptology*, which was held from June 20 to 22. Seven first-rank speakers were invited and many students and researchers from several countries attended the workshop.

Many collaborative works were begun during the semester between invited researchers and members of the research group on Mathematics Applied to Cryptography of the UPC. The activities of this semester have greatly contributed to improve the level of research in Cryptology in Catalonia. The fruits will be seen in the very near future. One of the most important consequences of these activities has been the start of several collaborations between different research groups at the Catalan universities that are in some way related to Cryptology.

Activities

Workshop

Mathematical Problems and Techniques in Cryptology, June 20 to 22, 2005, co-ordinated by C. Padró and J. Villar.

Seminars

Seminar on Geometric Methods in Cryptography, March 10 and 11, 2005.

Weekly Seminar on Public-Key and Distributed Cryptography, March 30 to July 20, 2005.

Visiting researchers

Alexandra Boldyreva
Georgia Institute of Technology

Ronald Cramer
CWI Amsterdam

Sebastian Edixhoven
Université de Rennes I

Serge Fehr
CWI Amsterdam

Marc Fischlin
University of California, San Diego

Gerhard Frey
Universität GHS Essen

Juan Garay
Lucent Technologies

Robbert de Haan
CWI Amsterdam

Tanja Lange
Danmarks Tekniske Universitet

Tatsuaki Okamoto
NTT Information Sharing Platform Laboratories

Pascal Paillier
Gemplus International

Christopher Ritzenthaler
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6.3 CONFERENCES

6.3.1 FOURTH CONGRESS OF THE EUROPEAN SOCIETY FOR RESEARCH IN MATHEMATICS EDUCATION

From February 17 to 21, the *Fourth Congress of the European Society for Research in Mathematics Education* (CERME 4), the administrative organisation for which fell to the CRM, took place in Sant Feliu de Guíxols. The organising committee, chaired by M. Bosch (Universitat Ramon Llull), was made up of J. Deulofeu (Universitat Autònoma de Barcelona and Societat Catalana de Matemàtiques), M. Edo, L. Figueiras and J. Gascón (Universitat Autònoma de Barcelona), V. Font and J. Giménez (Universitat de Barcelona), J. Callís (Universitat de Girona), M. Moreno (Universitat de Lleida and Sociedad Española de Investigación en Educación Matemática), J. Gómez Urgellés (Universitat Politècnica de Catalunya and FEEMCAT), J. Miralles (Universitat Pompeu Fabra), L. Gironde (Universitat Rovira i Virgili) and E. Barrabés and C. Gallego (Universitat Ramon Llull). An audience of 320 researchers and doctoral students attended the congress.

CERME 4 has been important as a consolidation of the European Society for Research into Mathematics Education (ERME), set up in 1998, legally registered in the autumn of 2004, and with regulations approved during this fourth congress. With the high attendance achieved in this fourth congress (over 300 participants, 194 articles and 24 posters), CERME is becoming the most important scientific meeting in Mathematics Teaching on a European level.

The participating researchers, all of them Mathematics teachers or teacher trainers, were able to decide on a common approach with regard to the main European research lines in the teaching of Mathematics,

dealing with problems such as the teaching of mathematical modelling, the introduction of new technologies, teachers training or multiculturalism. The impact of research on educational policy was also debated, as well as the need to open up avenues leading to a new school teaching approach, more in line with the needs of our times.

The congress included plenary activities, poster presentations and a programme of social activities. However its main aim was to encourage the exchange of projects and results among researchers into Mathematics Education in diverse geographical, social and cultural contexts. To this end, it focused less on the presentation of individual studies than on the joint discussion of topics within work groups. In this way, progress was able to be made, within each subject group, towards the realisation of what was considered to be the main research lines and problems that should guide the efforts of European research into Didactics over the coming years.

In addition, holding the congress in Catalonia provided a good occasion for giving more visibility and dissemination to research into Mathematics Teaching, as well as offering the possibility of work exchange and of sharing problems with prominent European researchers. And furthermore, to involve us, as a local community, in the wider project of reinforcing a scientific society that proposes to build a point of reference in all areas related to the management and development





of Mathematics Education in the European Union.

The congress was organised around 14 themed work groups, and included three plenary activities (two lectures and a round table), the Society's general assembly and a session designed to tie together all the work carried out in each group.

Lectures

Yves Chevallard, Towards a new epistemology in Didactics of Mathematics

Margaret Brown, The role of Mathematics Education research in influencing educational policy

Round table

History and Theory of Mathematics Education, Juan D. Godino (co-ordinator), Michèle Artigue, Paul Ernest, Fulvia Furinghetti

Working groups and co-ordinators

- | | |
|---------|--|
| Group 1 | Bernard Parzysz
The role of metaphors and images in the learning and understanding of Mathematics |
| Group 2 | Markku Hannula
Affect and mathematical thinking |
| Group 3 | Milan Hejny
Building structures in mathematical knowledge |
| Group 4 | Maria Marriotti
Argumentation and proof |
| Group 5 | Dave Pratt
Stochastic thinking |
| Group 6 | Jean-Philippe Drouhard
Algebraic thinking |
| Group 7 | Rudolf Straesser
Geometrical thinking |
| Group 8 | Candia Morgan
Mathematics and language |

- Group 9 Paul Drijvers
Tools and technologies in mathematical didactics
- Group 10 Núria Gorgorió
Mathematics education in multi-cultural settings
- Group 11 Tommy Dreyfus
Different theoretical perspectives/approaches in research in Mathematics Education
- Group 12 José Carrillo
From a study of teaching practices to issues in teacher education
- Group 13 Gabriele Kaiser
Applications and modelling
- Group 14 Joanna Mamona Downs
Advanced mathematical thinking

Sponsors and collaborators

Ministerio de Educación y Ciencia, Departament d'Educació de la Generalitat de Catalunya, Departament d'Universitats, Recerca i Societat de la Informació de la Generalitat de Catalunya, Diputació de Girona, Universitat de Girona, Caixa Girona, Caixa Sabadell, Societat Catalana de Matemàtiques, Universitat Autònoma de Barcelona, Maths for More, Casio, and especially the City Hall of Sant Feliu de Guíxols, without whose help this conference would not have been possible.

6.3.2 BARCELONA CONFERENCE ON GEOMETRIC GROUP THEORY

From June 28 to July 2, 2005, the CRM organised a conference entitled *Barcelona Conference on Geometric Group Theory*. The organising committee consisted of Josep Burillo and Enric Ventura (UPC), and Noel Brady (University of Oklahoma). Sixty-two researchers and doctoral students participated at the conference. Funding was obtained from the Universitat Autònoma de

Barcelona and the Universitat Politècnica de Catalunya.

The five main speakers were prestigious mathematicians working in this specialty, and their lectures on cutting-edge topics achieved a high level and attracted a numerous audience. The lecture titles were the following: *Groups acting on trees and profinite trees*, given by Luis Ribes (Carleton University); *Tethers and homology stability*, given by Karen Vogtmann (Cornell University); *Fundamental groups of Kähler manifolds*, given by Thomas Delzant (Université de Strasbourg); *On the QI-rigidity of right-angled Artin groups*, given by Mladen Bestvina (University

BCN - GGT

Centre de Recerca Matemàtica
Campus of the Universitat Autònoma de Barcelona
June 28 to July 2, 2005

**Barcelona
Conference
on Geometric
Group Theory**

Speakers:
Mladen Bestvina
Universitat of Utah
Thomas Delzant
Université de Strasbourg
Gilbert Levitt
Université de Caen
Karen Vogtmann
Cornell University

Programme Committee:
Noel Brady
Universitat of Oklahoma
Josep Burillo
Universitat Politècnica de Catalunya
Enric Ventura
Universitat Politècnica de Catalunya

Co-ordinator:
Josep Burillo

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of Utah) and *A general construction of JSJ splittings*, given by Gilbert Levitt (Université de Caen).

The other lectures, each lasting 30 minutes, were also of a very high level. They were distributed into three talks every morning after the plenary talk and a coffee break, and three talks in average every afternoon (with some free afternoons).

A list of speakers and titles of talks follows:

Brita Nucinkis, Groups acting on contractible spaces with stabilizers of prime power order

Vincent Guirardel, Core and intersection number for actions on trees

Martin Dunwoody, Groups acting on real trees

Andrzej Bis, Lattice actions on Menger manifolds

Ian Leary, Finite subgroups of VF groups

Oleg Bogopolski, On a generalized Whitehead problem for hyperbolic groups

Emina Alibegovic, Limit groups and CAT(0)

Andrew Duncan, Centralizers in partially commutative groups

Sean Cleary, Alternate generating sets for Thompson's group

Swiatoslaw Gal, Multivariable growth series on Coxeter groups and their specializations

Henry Glover, $\mathbb{Z}/p\mathbb{Z}$ acting on surfaces and the cohomology of mapping class groups

Jodie Humphreys, A finiteness property of co-compact lattices in semi-simple Lie groups

Tim Riley, Diameters of Cayley graphs of $SL(n, \mathbb{Z}/k\mathbb{Z})$

Ilya Kazatchkov, A gathering process in braid groups

John Meakin, One-relator groups and one-relator monoids

Dimitri Sonkin, On simple groups of large exponent

Armando Martino, Conjugacy separability for Seifert-fibered groups

Ping Zhang, Automorphisms of surface braid groups

Arnaud Illion, Dynamics of automorphisms on the boundary of the free group

Peter Kropholler, Generalizing the Lyndon-Hochschild-Serre spectral sequence

Yves Stalder, Baumslag-Solitar groups and their limits

Murray Elder, Zimin words, Schreier graphs and Grigorchuk's group

Daniel Groves, Bounded area bicombings for relatively hyperbolic groups

Hamish Short, Solving conjugacy problems in hyperbolic groups

Eric Swenson, Cut pairs in CAT(0) boundaries

Damian Osajda, Boundaries of systolic groups

Martin Lustig, Trees, currents and folding paths

Denis Serbin, Groups with regular free length functions in \mathbb{Z}^n

Ramón Flores, From classical to proper classifying spaces

Arye Juhász, On equations over groups which have solutions of finite order

Olga Kharlampovich, Algorithmic problems for fully residually free groups

Alexei Miasnikov, Equations over groups

The assessment of the conference by participants and local researchers was very positive, both scientifically and with regard to organisational and administrative aspects. It should be emphasised that the organisation of the conference would have been painful

without the efficiency and experience of the administrative staff of the CRM.

6.3.3 CONGRESO INTERNACIONAL MEDITERRÁNEO DE MATEMÁTICAS

The International Mediterranean Congress of Mathematics (CIMMA 2005) took place in Almería from June 6 to 10, 2005. It was organised by the Universidad de Almería, with the purpose that activities of this kind achieve continuity, namely activities that facilitate contact between members of the mathematical community of all countries around the Mediterranean Sea. The CRM shares this objective and hence collaborated gladly with the congress.

The organising committee consisted of the following people: J. C. Navarro, J. L. Rodríguez, M. A. Sánchez, E. de Amo, J. Escoriza, A. García, F. Gil, E. A. Kaidi, B. Lafuerza, P. López, A. M. Finkelshtein, J. J. Moreno, and B. Torrecillas. Scientific sessions were organised on the following topics: Algebras and their Representations; Geometry and Topology; Functional Analysis and its Applications; Approximation, Special Functions and Numerical Analysis; General Topology and its Applications; Probabilistic Spaces, Copulae and t -Norms; Random Models and Design of Experiments; Financial Mathematics and Mathematical Economy; Mathematics Education. More than 300 participants attended the congress. A number of contributed articles will be collected in a special issue of the *Mediterranean Journal of Mathematics*.

6.4 ADVANCED COURSES

This year for the eleventh time, the CRM organised a series of advanced courses on specific subjects of Mathematics that have

seen recent development. These intensive courses are addressed to advanced PhD students and recent doctors and taught by well known specialists in each area.

6.4.1 THE GEOMETRY OF THE WORD PROBLEM FOR FINITELY GENERATED GROUPS

The course took place at the CRM from July 5 to 15, 2005, co-ordinated by J. Burillo (UPC) and with the following programme:

- Hamish Short (Université d'Aix-Marseille), Introduction to the Geometry of the Word Problem

The three sessions of the course had a common topic, namely the Geometry of the Word Problem. The Word Problem aims to discuss the existence of an algorithm allowing to decide if a given word in a finite set of generators of a group is equal to the identity element under the group relations. This research topic has received much attention during the past 25 years, thanks to the development of geometrical methods towards its solution. Each session of the course lasted eight hours. The first session was devoted to the introduction of the main methods used in this field. These methods include Cayley graphs, their associated 2-complexes, combinatorial area and small cancellation. The excellent exposition of Professor Short, who has a long experience in this topic, and the introductory character of this session made it the most accessible part of the course and most welcome by the students.

- Noel Brady (Oklahoma University), Negatively Curved Groups

As its title indicates, this part was devoted to groups with a negative curvature. This is the speciality of Professor Brady. The

classical notion of curvature (especially negative curvature), which is due to Gauss in the case of surfaces, was recently translated into Combinatorics after the work of Gromov and Bridson, among others. The combinatorial version consists of assigning an angle value to each vertex of a cell and considering the total angle value around each vertex. If this angle exceeds the Euclidean value 2π at a vertex, then the complex is negatively curved at this vertex. This concept has proved to be extremely fruitful for the study of infinite groups. The eight lectures given by Professor Brady addressed these methods, using for instance cubical complexes, where cells are cubes (that is, with right angles) of the appropriate dimension. These lectures were largely technical and addressed to a more specialised audience.

- Tim Riley (Yale University), Filling Functions and Their Applications

One of the most frequently used concepts in the field of Geometry of Infinite Groups is that of filling functions. Such functions measure the number of objects that are needed in order to fill a closed path in a complex. It applies for instance to 2-cells in order to obtain their area, to the radius of a circle (intrinsic or extrinsic), or to the length of closed paths homotopic to a given main path. These functions are important since their values give estimations about the complexity of the Word Problem, by determining the time and space needed to solve it. Professor Riley offered an extensive survey of the various types of filling functions, including a study of their relationship, and discussed theorems that link them with different aspects of the Word Problem. It was a very nice series of talks where very accessible topological methods were used. It was enthusiastically followed by the participants, especially by the youngest ones.

In addition to the eight hours taught by each of the three main lecturers,

other talks were given by course participants. These were delivered by Arye Juhasz (Technion, Haifa, Israel), Alexei Myasnikov (McGill University, Montréal, Canada), Max Forester (Oklahoma University, Norman, USA), Armando Martino (CRM), and Juan González-Meneses (Universidad de Sevilla). The course was attended by 33 participants. Funding was received from DURSI, UAB, and UPC.

6.4.2 RECENT TRENDS OF COMBINATORICS IN THE MATHEMATICAL CONTEXT

The course ran from September 13 to 23, 2005, co-ordinated by Oriol Serra (UPC). Its goal was to display the increasing number of connections between Combinatorics and other areas of Mathematics. On this occasion, two of the most renowned world specialists participated, namely Béla Bollobás in the area of Combinatorial Probability and Jaroslav Nešetřil in the area of Algebraic Combinatorics.

In the Combinatorial Probability part, fundamental inequalities were discussed (the Harris Lemma, the inequalities of Azuma and Tallagrand, and the Ahlswede-Daykin Theorem), as well as a description of the basic models of random graphs and an introduction to random models for large-scale networks. The Algebraic Combinatorics part included the universality of the category of graphs, reconstruction problems, the Nešetřil-Shelah theorem for antichains, and the constructibility of chromatic classes of graphs.

This course was integrated into the *Summer Schools* series of the European Mathematical Society, that was supported by the European Commission in 2005 within the *Marie Curie Conferences and Training Courses* programme. Funding from the Spanish Ministry for Education and Science was



also obtained. The course was attended by 60 students from 14 countries. Course lectures were complemented with problem sessions conducted by Robert Morris and Amites Sarkar (Trinity College, Cambridge), and by Jan Foniok and Robert Samal (Univerzita Karlova).

Course lecture notes were edited. Two books will appear, collecting and expanding the course lecture notes, one of them in the *Advanced Courses in Mathematics CRM Barcelona* series.

The programme of the course was the following:

- Béla Bollobás (Trinity College, Cambridge and University of Memphis), Random Graphs

The theory of random graphs, founded by Erdős and Rényi in the late 1950s, has grown into a large and very active area. In this course, several classical results of

the theory were presented, together with numerous recent developments that illustrate the use of great many tools. In particular, the fundamental inequalities of Combinatorial Probability were proved: the Harris Lemma, the Four Functions Inequality, the Lovász Local Lemma, and the inequalities of Azuma, Janson, and Talagrand. These inequalities were applied to the study of the basic models of random graphs: $G(n, p)$ and $G(n, m)$, the space of random graph processes, and threshold functions of monotone properties; in particular, those of connectedness, 1-factors, Hamilton cycles, the diameter and the chromatic number. The phase transition in the component structure was also examined, and some as yet unpublished results were proved about the chromatic number and the random assignment problem. Finally, several models were presented of large-scale real-life networks and some very recent results about them were proved.

- Jaroslav Nešetřil (Univerzita Karlova and ITI, Praga), Combinatorics of Morphisms

In many instances of combinatorial problems one studies special maps and correspondences which are tailored to capture a variety of discrete phenomena. Structural Combinatorics studies such situations and stresses their relationship to the mainstream Mathematics (Model Theory, Algebra and Probability in particular). This was a self-contained course based on a forthcoming book. The course covered Mappings and Categories (Freyd-Vinarek Theorem), Existence versus Counting Reconstruction (Lovász and Muller Theorems), Homomorphisms, Tensions and Flows (continuous and matroid setting, rich quasiorders), Constructions (product classes, dimension, LA method, product conjecture), Coloring Order (density, independence, countable universality, bounds for minor closed families), Homomorphism Dualities (algorithmic and extremal aspects, Gallai-Roy type theorems), Amalgamation and Combinatorial Sieve (density, sparse graphs, Ramsey theory).

6.4.3 STATISTICAL MODELS IN FINANCIAL SERIES

The course took place from July 17 to 22, 2005, in Barcelona. It was organised by the Statistics and Operations Research Department of the UPC and the Business Economics Department of the UAB, with the support of the CRM and the Computer Science Faculty of Barcelona. The organising committee was chaired by Pilar Muñoz, from the Universitat Politècnica de Catalunya, and made up of professors Pia Margarit (UPC), M. Dolores Márquez (UAB), Manuel Martí-Recober (UPC), Josep Anton Sánchez (UPC), and Cèsar Villazón (UAB).

The goal of the course was to review recent advances in methodological and com-

putational aspects of statistical models applied to financial time series. The lecturers were specialists in these topics. Although the course was addressed to young researchers, it was also open to the staff of the universities and to researchers from public or private institutions. A maximum number of 30 participants were admitted. The daily programme of activities included a three-hour session of lectures in the morning, one hour for discussions, a two-hour practical session in the afternoon, and two additional hours of personal work using the CRM's computer equipment. A round table was held at the end of the course, moderated by Cèsar Villazón (UAB).

6.4.4 INTRODUCTION TO SHIMURA VARIETIES

As an opening activity for the Research Programme on Arakelov Geometry and Shimura Varieties, an introductory course took place at the UAB from September 20 to 23, 2005, especially addressed to students. It was co-ordinated by José Ignacio Burgos (UB) and taught by Víctor Rotger (UPC). About 30 people, including local researchers and visitors, attended this course.

The goal of the course was to offer an introduction to Shimura varieties associated to a reductive algebraic group, with emphasis on moduli spaces of abelian varieties with an additional structure. The programme was the following:

- Hermitian Symmetric Domains
- Arithmetic Groups and Locally Symmetric Varieties
- Shimura Data and Shimura Varieties
- Classical Examples
- Canonical Models of Shimura Varieties

6.5 WORKSHOPS

6.5.1 MATHEMATICAL PROBLEMS AND TECHNIQUES IN CRYPTOLOGY

The MAPTIC 2005 workshop took place from June 20 to 22 at the CRM, co-ordinated by Carles Padró and Jorge Villar (UPC), with the scientific collaboration of Ronald Cramer and Tatsuaki Okamoto. The workshop was attended by 47 researchers.

The following main lectures were given:

Steven Galbraith, The eta pairing

Ronald Cramer, Black-box secret sharing from primitive sets in algebraic number fields

Yehuda Lindell, The security of protocols in modern network settings

Tatsuaki Okamoto, Security of Computational Cryptography and computational lower bounds

Rainer Steinwandt, Non-abelian groups in Cryptography: constructions and attacks

Renato Renner, Information-theoretical security proof for QKD protocols

Phong Nguyen, Lattices in Cryptology: the good, the bad and the ugly

The workshop also included the following talks:

David Galindo, An instantiation of the Cramer-Shoup encryption paradigm using bilinear map groups

Paula Valença, Ordinary abelian varieties having small embedding degree

Jordi Pujolàs, Distortion maps for genus two curves

Àlex Tamarit, Weighted list decoding of Chinese Remainder Theorem codes

The poster for the MAPTIC 2005 workshop features a dark background with a pattern of mathematical symbols and letters. The title 'MAPTIC' is prominently displayed at the top in large, white, serif font. Below it, the text reads: 'Centre de Recerca Matemàtica, Campus of the Universitat Autònoma de Barcelona, June 20 to June 22, 2005'. The main title of the workshop, 'Workshop on Mathematical Problems and Techniques in Cryptology', is written in a large, white, serif font. The poster lists the following speakers: Rijen Lensstra (Eindhoven University of Technology), Ronald Cramer (Leiden University), Tatsuaki Okamoto (NTT Laboratories), Hugo Braziarzug (Technion University), and Steven Galbraith (Royal Holloway University of London). It also lists the programme co-chairs: Ronald Cramer, Tatsuaki Okamoto, and Yehuda Lindell, and the co-ordinators: Jorge L. Villar, Carles Padró, and Carles Padró. The website <http://www.crm.es/maptic> is provided. At the bottom, there are logos for the Centre de Recerca Matemàtica and the Universitat Autònoma de Barcelona, along with contact information for the centre.

Jesús Almansa, A full abstract encoding of the UC framework

María Isabel González, On the security of a group based public key cryptosystem

Jeff Hoffstein, Performance improvements and a baseline parameter generation algorithm for NTRU sign

An additional working session was held including six short talks.

This *Workshop on Mathematical Problems and Techniques in Cryptology* (MAPTIC) is the second one in a series whose expectation is to become a yearly series of

events. The first workshop of this kind was entitled *Mathematics of Cryptology*. It was organised by Professor Ronald Cramer at the Universiteit Leiden (The Netherlands) in 2003. The common goal of these workshops is to keep in contact the international community of researchers in Mathematics Applied to Cryptology. This community keeps increasing in size, if one takes into account the appearance of new cryptographic techniques, such as the ones related with Quantum Cryptography, Cryptography based on nonabelian groups or applications to Cryptography of certain bilinear mappings defined on elliptic and hyperelliptic curves.

MAPTIC 2005 gathered seven invited speakers from various countries, whose lectures covered the main parts of research in Mathematics Applied to Cryptology. The event was attended by 45 people, including graduate students and advanced researchers. As a complement to the main lectures, seven participants selected by the organisers offered contributed talks. An informal working session was also organised, during which six research works in progress were presented.

These three activities offered the participants a high-level training on mathematical problems closely related with advances in Cryptography and mathematical tools used to treat these problems. Additionally, the goal of fostering scientific communication between participants was achieved, as an added value to the lectures. Finally, links between research groups working at Catalan universities were strengthened in topics related with Cryptology, such as Number Theory, Telematic Systems and Data Protection. The participation of researchers from UPC, UAB, Universitat Oberta de Catalunya and Universitat de Lleida was acknowledged.

6.5.2 GRAPHS, MORPHISMS AND APPLICATIONS

This workshop took place from September 27 to 30, 2005, at the CRM, co-ordinated by Oriol Serra (UPC). It was attended by 36 researchers and was partially funded by the Spanish Ministry for Education and Science.

This was the third event of the same series, after the workshops held at the CRM in 2001 and in Dagstuhl in 2003. This series aims to gather together a community that studies algorithmic and structural aspects of chromatic problems in graphs and other combinatorial structures. The list of participants included some of the most distinguished world researchers in this area. The contributions to this workshop will be the basis of a special issue of the *European Journal of Combinatorics*.

The following lectures were given:

- Pavol Hell, From graph colourings to constraint satisfaction: there and back again
- Jan Arne Telle, Locally constrained graph homomorphisms and degree refinement matrices
- Jan Kratochvíl, On the complexity of local constrained graph homomorphisms
- David Wood, On the oriented chromatic number of the hypercube
- André Raspaud, On the maximum average degree and the circular chromatic number
- Andrei Krokhin, The maximum B -colorable substructure problem
- Patrice Ossona de Mendez, Classes with bounded expansion
- Dimitrios Thilikos, Fast FPT-algorithms for detecting grids in graphs

- Jan Foniok, Dualities and maximal antichains in the homomorphism order of relational structures
- Csaba Szabó, Applications of graph homomorphisms in algebraic problems
- Miklos Ruzsinko, Using the Szemerédi Regularity Lemma in Ramsey Theory
- Gabor Kun, The complexity of constraints: dichotomy vs $CSP = NP$
- Dwight Duffus, Chromatic numbers and homomorphisms of large girth hypergraphs
- Hanno Lefmann, Distributions of points in d dimensions and large k -point simplices
- Manuel Bodirsky, Maximal infinite-valued constraint languages
- Hosseini Hajiabolhassan, Graph homomorphisms and spectral conditions
- Bojan Mohar, Coloring locally planar graphs
- Wilfried Imrich, Finite and infinite median graphs

6.5.3 SECOND WORKSHOP ON TUTTE POLYNOMIALS AND APPLICATIONS

This workshop was held at the CRM from October 4 to 7, 2005, co-ordinated by Marc Noy (UPC) and Joseph E. Bonin (George Washington University). It was attended by 29 researchers and partially funded by the Spanish Ministry for Education and Science.

The workshop gathered together a number of European researchers (coming from Spain, France, UK, Israel, Portugal, and the Czech Republic), American researchers (coming from Canada, USA, and Mexico), and researchers from Australia. Twenty-two talks were given, most of them about topics of Combinatorics and Graph Theory. There were

also lectures related with Algebra, Statistical Physics, Theoretical Computer Science and Topology. The workshop was attended by high-level specialists and young doctoral and post-doctoral researchers.

In addition to the lectures, a session about open problems was organised. Remarkably, one of the most interesting open problems in the area was recently solved as a result of discussions held during this workshop. The solution has been written down by Gordon Royle in a paper entitled *Planar triangulations with real chromatic roots arbitrarily close to four*.

A special issue of *Annals of Combinatorics* is being prepared with some contributions to the workshop, following the usual reviewing procedures of the journal. It will be edited by Joseph Bonin (The George Washington University), Joseph Kung (University of North Texas), Marc Noy (UPC), and Dominic Welsh (Oxford University).

The following talks were given at the workshop:

- Bill Jackson, Chromatic roots of graphs
- Iain Moffatt, Knot homologies and graph polynomials
- Graham Farr, On the symmetric Ashkin-Teller model and Tutte-Whitney functions
- David Wagner, Negatively correlated Bernoulli variables and Mason's conjecture
- Michel Las Vergnas, On certain evaluations of the 2- and 3-variable Tutte polynomials
- Thomas Zaslavsky, Polynomial Tutte invariants of rooted integral gain graphs
- Joseph E. Bonin, Several families of matroids related to lattice paths
- Alan Sokal, The multivariate Tutte polynomial for graphs and matroids
- Gordon Royle, The Brown-Cobourn property



Johann Makowsky, Recurrence relations for graph polynomials on recursive families of graphs

Jesús Salas, Chromatic roots for a family of 3-connected planar graphs

Joanna A. Ellis-Monaghan, Weak Tutte functions

Petr Hlineny, Computing the Tutte polynomial with restricted «width»

Raul Cordovil, An Orlik-Solomon type algebra for matroids with a fixed linear class of circuits

Mireille Bousquet-Mélou, The Ising and hard-particle models on planar maps

Anna de Mier, A solution to the tennis ball problem

Criel Merino, On the number of tilings of rectangles with T -tetraminoes

Omer Giménez, The complexity of computing the Tutte polynomial of bicircular matroids

Joseph Kung, The Tutte polynomial turned upside down

Emeric Gioan, Cycle-cocycle reversing systems in graphs and matroids

Martin LoebI, On q -chromatic function

6.6 MASTER'S COURSE IN MATHEMATICAL FINANCE

The Master's course *Matemàtiques per als Instruments Financers* was developed for the eighth time in 2005 thanks to the collaboration of the Mathematics Department of the UAB, the CRM, and several financial companies such as the Barcelona Stock Exchange, which is the sponsoring institution. Other collaborating institutions are the departments of Economics and Economics History, Applied Economics, and Business Economics of the UAB, the Statistics Department of the UB and several outstanding spe-

cialists who work in direct contact with the markets.

The collaborating companies offer practical training opportunities to the students by offering them grants. This allows a direct contact between the academic community and the professional world, allowing to develop and teach innovative techniques about valuation of derived financial products, calculation of coverage strategies, risk assessment and risk control.

The goal of the Master's course is to train specialists capable of developing new financial products, according to the current needs, and prepare them to understand and critically discuss the hypotheses and limitations of the existing models. The Master's course was designed for young students with a mathematical talent, regardless of their previous training. Thus it is open to students with a degree in Mathematics, Physics, Economy, Engineering or similar disciplines. Job opportunities after the course are excellent at present.

In the 2004-2005 academic year, 17 students were enrolled. Of these, seven were from the Universitat Autònoma de Barcelona, five from the Universitat de Barcelona, one from the Universitat Politècnica de Catalunya, one from the Universitat de Lleida, one from the Universitat Oberta de Catalunya, one from the Universidad Autónoma de Madrid, and one from the Université Abdelmalek Es-saadi, Tetouan.

The Master's course is structured in three terms, two theoretical, each with 120 hours of teaching, and a third practical in a financial company. The Master's responsibility lies on the Academic Commission, consisting of professors Joan del Castillo, Jaume Llibre, Frederic Utzet, Xavier Xarles, and Josep Vives (who has been the co-ordinator), and the Advisory Council, consisting of Xavier Auguets (Caixa Catalunya), Antoni Giralt (Barcelona Stock Exchange), Pere Guinjoan (Caixa d'Estalvis i Pensions de Barcelona), Al-

bert Cortés (Banc Sabadell), and Victòria Castellot (Caifor). The Executive Committee consists of Manuel Castellet (CRM Director), Jaume Agudé (Chairman of the UAB Mathematics Department), and Josep Vives (Master's Co-ordinator).

Every year a maximum of twenty students are admitted to the course, and they have access at the premises of the CRM to the most advanced technology in order to follow the financial markets.

6.7 SEMINARS AND TALKS

The CRM promotes the seminars and talks that are the result of the work undertaken by visiting researchers at the Centre, and gives both support and welcome to various periodical seminars organised by research groups from the Barcelona universities. Diffusion of these activities is made through the weekly Newsheet distributed by e-mail and published on the CRM website.

A good many of these lectures take place on the CRM premises; others are held in the Mathematics Departments at the UAB, UB and UPC. In 2005, there were 246 talks, of which 200 were given in the following seminars:

ANALYSIS SEMINAR

Organised by the Universitat Autònoma de Barcelona and the Universitat de Barcelona.

Co-ordinated by Joan Orobitg and Xavier Tolsa.

SEMINAR ON EDPS AND APLICACIONS

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Albert Avinyó.

Web: www-ma2.upc.es/~edps

GEOMETRY SEMINAR

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Marcel Nicolau.

UAB DYNAMICAL SYSTEMS GROUP SEMINAR

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Armengol Gasull.

Web: www.gsd.uab.es

PROBABILITY AND STATISTICS SEMINAR

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Josep Lluís Solé.

Web: orfeu.mat.ub.es/~gaesto/welcome.htm

STATISTICS SERVICE SEMINAR

Organised by the Statistics Service of the UAB.

Co-ordinated by Pere Puig.

Web: www.uab.es/s-estadistica

RING THEORY SEMINAR

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Francesc Perera.

NUMBER THEORY SEMINAR

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Francesc Bars.



TOPOLOGY SEMINAR

Organised by the Universitat Autònoma de Barcelona and the University of Barcelona.

Co-ordinated by C. Broto, W. Pitsch and J. Scherer.

Web: mat.uab.es/~topalg

GEOMETRY OF THE WORD PROBLEM SEMINAR

Organised by the Centre de Recerca Matemàtica.

Co-ordinated by J. Burillo and E. Ventura

WORKSHOP OF THE WORKING COMMUNITY OF THE PYRENEES

The second workshop of the Working Community of the Pyrenees (CTP) on Par-

tial Derivative Equations and their Applications was held at the CRM on November 3 and 4, 2005. It was financed by a CTP project co-ordinated by J. A. Carrillo (ICREA-UAB). Talks were devoted to applications to Biology and to interaction of particles in kinetic theories, entropy methods and numerical methods. Professor J. J. Velázquez was invited as an external speaker. He offered two seminars about the Keller-Segel model for cellular aggregation and the Lifshitz-Slyozov model in molecular aggregation. Other participants were K. Fellner, from the Universität Wien, and the CTP network members from Toulouse and Bilbao: J. P. Bougarde, M. Escobedo, F. Filbet, P. Laurençot and M. Lemou, besides several participants from the PDE team of Barcelona.

7. PUBLICATIONS

During the year 2005 the CRM has continued the series *Advanced Courses in Mathematics CRM Barcelona, Quaderns and Preprints*.

7.1 ADVANCED COURSES IN MATHEMATICS CRM BARCELONA

The volumes of this series, published by the Swiss publishing company Birkhäuser, cover the content of some of the advanced courses taught by distinguished specialists at the CRM, based on the notes handed out to the students at the beginning of the course, which are later reworked by the authors. They are especially addressed to advanced doctoral and young post-doctoral students, and completely elucidate their content, with the necessary preliminaries, definitions and detailed proofs.

The following two volumes were published in 2005:

Ramsey Methods in Analysis, by S. A. Argyros and S. Todorčević, from the advanced course with the same title given in January 2004.

Contemporary Cryptology, by D. Catalano, R. Cramer, I. Damgård, G. Di Crescenzo, D. Pointcheval and T. Takagi, from the advanced course with the same title given in February 2004.

7.2 QUADERNS

They compile the content of specialised activities. The following issues have been published in 2005:

Workshop on Mathematical Problems and Techniques in Cryptology

Editors: C. Padró and J. Villar (no. 31)

Advanced Course on the Geometry of the Word Problem for Finitely Generated Groups

Editors: J. Burillo and E. Ventura (no. 32)

Statistical Models in Financial Series. 8th ERS-IASC International Summer School

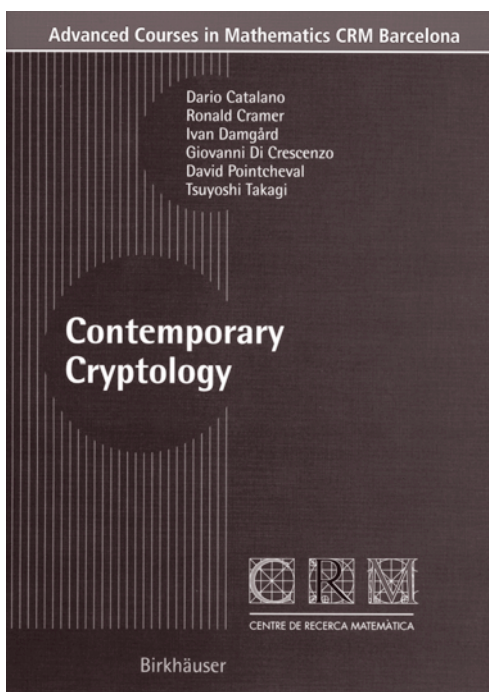
Editor: P. Muñoz (no. 33)

Advanced Course on Recent Trends of Combinatorics in the Mathematical Context

Editor: O. Serra (no. 34)

Shimura Varieties and their Canonical Models

Editor: V. Rotger (no. 35)



7.3 PREPRINTS

The following 49 issues have been published in the CRM preprint series in 2005:

Distortion of wreath products in some finitely presented groups

S. Cleary (no. 612)

Infinite index subgroups and finiteness properties of intersections of geometrically finite groups

B. Apanasov (no. 613)

Weak systems of Gandy, Jensen and Devlin

A. R. D. Mathias (no. 614)

On moduli of smoothness of fractional order

S. Tikhonov (no. 615)

CAT(0) and CAT(-1) dimensions of torsion free groups

N. Brady and J. Crisp (no. 616)

On Boas-type problem

S. Tikhonov (no. 617)

Reduction, linearization and stability of relative equilibria for mechanical systems on riemannian manifolds

F. Bullo and A. Lewis (no. 618)

Shellability of noncrossing partition lattice
C. Athanasiadis, T. Brady and C. Watt (no. 619)

Contractions in the 2-Wasserstein length space and thermalization of granular media

A. Carrillo, R. McCann and C. Villani (no. 620)

Combinatorial and metric properties of Thompson's group

J. Burillo, S. Cleary, M. Stein and J. Taback (no. 621)

The Patterson-Sullivan embedding and minimal volume entropy for outer space

I. Kapovich and T. Nagnibeda (no. 622)

Contractive metrics for a Boltzmann equation for granular gases: diffusive equilibria.

The Patterson-Sullivan embedding and minimal volume entropy for outer space

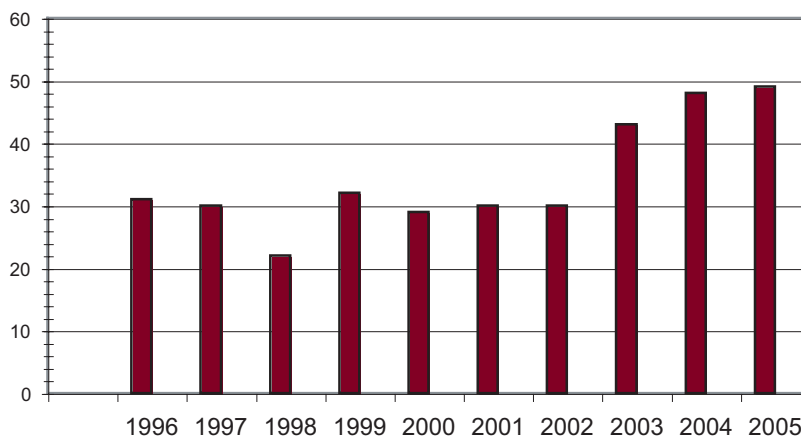
M. Bisi, J. A. Carrillo and G. Toscani (no. 623)

Intermediate asymptotics beyond homogeneity and self-similarity: long time behavior for $u_t = \varphi A(u)$

J. Carrillo, M. di Francesco and G. Toscani (no. 624)

Semidiscretization and long-time asymptotics of nonlinear diffusion equations

Number of preprints



- J. Carrillo, M. di Francesco and M. P. Gualdani (no. 625)
The Zariski-Lefschetz principle for higher homotopy groups of nongeneric pencils
 M. Tibar (no. 626)
A proof that all Seifert 3-manifold groups and all virtual surface groups are conjugacy separable
 A. Martino (no. 627)
Metrics on diagram groups and uniform embeddings in a Hilbert space
 G. Arzhantseva (no. 628)
Stability and asymptotic analysis of a fluid-particle interaction model
 J. Carrillo (no. 629)
The complexity of random ordered structures
 K. St. John and J. H. Spencer (no. 630)
Embedding theorems of function classes I
 B. Simonov and S. Tikhonov (no. 631)
The period function of the generalized Lotka-Volterra centers
 J. Villadelprat (no. 632)
On hyperbolic once-punctured-torus bundles II. Fractal tessellations of the plane
 W. Dicks and J. W. Cannon (no. 633)
A topological proof that surface relators are test words
 E. Turner (no. 634)
Computational explorations in Thompson's group F
 J. Burillo, S. Cleary and B. Wiest (no. 635)
Embedding theorems of function classes II
 S. Tikhonov (no. 636)
Bounding right-arm rotation distances
 S. Cleary and J. Taback (no. 637)
Clarke critical values of subanalytic Lipschitz continuous functions
 J. Bolte, A. Daniilidis, A. Lewis and M. Shiota (no. 638)
Linear stochastic differential-algebraic equations with constant coefficients
 A. Alabert and M. Ferrante (no. 639)
The automorphism group of a free-by-cyclic group in rank 2
 O. Bogopolski, A. Martino and E. Ventura (no. 640)
In search of mathematical primitives for deriving universal projective hash families
 M. I. González and J. L. Villar (no. 641)
Some remarks on the class of continuous (semi-)strictly quasiconvex functions
 Y. García and A. Daniilidis (no. 642)
Periodic orbits of the planar collision restricted 3-body problem
 J. Llibre and D. Pasca (no. 643)
On the set of subrings which are directed unions of Artinian subrings
 D. Karim and S. Zarzuela (no. 644)
Examples of retracts in a free group that are not the fixed subgroup of any group of automorphisms
 L. Ciobanu and W. Dicks (no. 645)
The unbounded dead-end depth property is not a group invariant
 T. Riley and A. Warshall (no. 646)
Non-completeness of the Arakelov-induced metric on moduli space of curves
 J. Jorgenson and J. Kramer (no. 647)
Large cardinals and L -like universes
 S. Friedman (no. 648)
Embedding theorems of function classes III
 B. Simonov and S. Tikhonov (no. 649)
Global ergodicity and complete integrability of discrete dynamical systems
 A. Cima, A. Gasull and V. Mañosa (no. 650)
The orthogonal subcategory problem in homotopy theory
 C. Casacuberta and B. Chorny (no. 651)
Periodic solutions of second-order differential inclusions systems with p -laplacian
 D. Pasca (no. 652)
Growth of positive words and lower bounds of the growth rate for Thompson's groups $F(p)$
 J. Burillo and V. Guba (no. 653)

Mixed Hodge structures and vector bundles on the projective plane I

O. Penacchio (no. 654)

Polynomial-time complexity for instances of the endomorphism problem in free groups

L. Ciobanu (no. 655)

On an upper bound for the arithmetic self-intersection number of the dualizing sheaf on arithmetic surfaces

U. Kühn (no. 656)

Distortion of surface groups in CAT(0) free-by-cyclic groups

N. Brady and J. Barnard (no. 657)

Embedding theorems of function classes IV
S. Tikhonov (no. 658)

On the number of limit cycles bifurcating from a non-global degenerated center

A. Gasull, C. Li and C. Liu (no. 659)

Free and fragmenting filling length

M. R. Bridson and T. R. Riley (no. 660)

Handwritten mathematical notes and formulas:

- $h_{\text{top}}(F) = \sup_{\lambda} h_{\lambda}(F)$
- $\pi(x) \approx \frac{x}{\log(x)}$
- $\sum_{n=2}^{\infty} f(n) = \sum_{n=2}^{\infty} \hat{f}(n)$
- $\text{Cat}(n) = \frac{1}{n+1} \binom{2n}{n}$
- $\int_S K dA = 2\pi \chi(S)$
- $\text{ind}(F) = (-1)^n \{ \text{ch}(c(F)) \cdot \text{td}(c_1(F) \circ c) \} [M]^1$
- $e^{n_i} + 1 = 0$
- $F(B_i) = \int F(B_i) dA + \frac{1}{2} \int F(B_i) d\theta + F(0)$
- $\frac{\partial u}{\partial t} = \Delta u$
- $\lim_{s \rightarrow 1} (s-1) \zeta_K(s) = \frac{2^{r_1} (2\pi)^{r_2}}{w_K |d_K|^{1/2}} h_K R_K$

8. THE EUROPEAN FRAMEWORK

8.1 ERCOM

ERCOM (European Research Centres on Mathematics) is a committee under the European Mathematical Society (EMS) consisting of the scientific directors of European research centres in the Mathematical Sciences. Only centres for which the number of visiting staff substantially exceeds the number of permanent and long-term staff, and which cover mathematical sciences broadly, are eligible for representation in ERCOM.

The purposes of ERCOM are:

- to constitute a forum for communication and exchange of information and to foster collaboration and co-ordination among the centres themselves and between the centres and the EMS;
- to promote advanced research training on a European level;

- to advise the Executive Committee of the EMS on matters related to activities of the centres;

- to contribute to make the EMS more visible;

- to cultivate contacts with similar research centres within and outside Europe.

The CRM is a member of ERCOM from its foundation.

The Chair of ERCOM is proposed by the Committee and appointed by the Executive Committee of the EMS for a period of 4 years (to be renewed for 2 more years). The Director of the CRM, Manuel Castellet, has been Chair of ERCOM during the period 2002-2005.

The annual ERCOM meeting took place in 2005 at the Centro di Ricerca Matematica Ennio De Giorgi, in Pisa, on March 11 and 12. Information was given about the



preparation of the 7th Framework Programme of the European Commission and the creation of the European Research Council (ERC). The European Mathematical Society issued a document addressing the contribution of the European Commission to research. A wide diffusion of this document is sought. Among other initiatives, the Chair of ERCOM is in charge to visit the responsible director of the *Human Factor, Mobility and Marie Curie Activities* programme of the European Commission.

Resolutions were adopted about financial support to certain developing countries; about the requirements for centres that wish to become ERCOM members (European centres, mainly research oriented, with a wide international visiting programme and covering a broad area of Mathematics); about possible steps to be taken in order to reinforce the presence of Mathematics in the INTAS programme; and about the election of the next Chair for the period 2006-2009. Professor Jan Karel Lenstra, the current Director of CWI in Amsterdam, was elected for this position in December 2005.

The next ERCOM meeting will take place at the IHÉS, in Bures-sur-Yvette, on March 24 and 25, 2006.

Web: www.ercom.org

8.2 EPDI



The CRM is a member of EPDI (European Post-doctoral Institute for the Mathematical Sciences) since December 2000. The EPDI is a network of nine European research institutes, which are: the Institut des Hautes Études Scientifiques (IHÉS) in Bures-sur-Yvette (which was the promoter and whose Director J.-P. Bourguignon co-ordinates it), the Max-Planck-Institut für Mathematik in Bonn, the Isaac Newton Institute for the Mathematical Sciences in Cambridge, the Max-Planck-In-

stitut für Mathematik in den Naturwissenschaften in Leipzig, the Institut Mittag-Leffler in Djursholm, the Banach Center in Warsaw, the Erwin Schrödinger Institut in Vienna, the Forschungsinstitut für Mathematik (FIM) in Zürich, and the CRM.

Every year, the EPDI offers two-year post-doctoral fellowships in Mathematics (pure and applied) and in Mathematical Physics to young Europeans.

In 2004 a grant was awarded to Bertrand Deroin, who will be at the CRM from September 2005 to August 2006 working on Geometry, specifically on holomorphic immersions in projective spaces of laminations in Riemann surfaces, deformations of laminations in Riemann surfaces and limit sets of holomorphic foliations, with Professor Marcel Nicolau, of the Universitat Autònoma de Barcelona, acting as tutor.

This year's application procedure, for which there were 48 candidates, was resolved at the meeting of the Scientific Committee in January 2005 at the CRM. Several candidates applied for stays at the CRM. Carlo Marinelli, a researcher in Stochastic Analysis, is expected to start his stay in September 2006, after having completed stays at other EPDI centres. His supervisor in Barcelona is Professor Marta Sanz, from the Universitat de Barcelona. Other candidates who were selected for stays at the CRM obtained jobs before the date foreseen for their start at the CRM.

Web: seven.ihes.fr/EPDI/index.html

8.3 MARIE CURIE ACTIONS

During 2005, the CRM received funds from the *Human Resources and Mobility* programme of the European Commission through the following Marie Curie Actions:

- An Intra-European Marie Curie

grant for Jérôme Dubois, for a two-year stay at the CRM since September 2006.

- An Intra-European Marie Curie grant for Asli Yaman, for a two-year stay at the CRM since December 2006.

- The conference *Recent Developments in the Arithmetic of Shimura Varieties and Arakelov Geometry*, which will take place at the CRM from July 10 to 15, 2006.

8.4 THEMATIC PRIORITIES OF THE 6TH FRAMEWORK PROGRAMME

In 2003, the CRM produced reports on the state-of-the-art of four of the seven priority thematic areas, the aim being to detect young researchers with an interest in these areas and to help them produce a doctoral thesis. They were as follows:

- Life Sciences, Genomics, and Biotechnology for Health (A. Guillamon, UPC).

- Nanotechnologies and Nanosciences (J.A. Carrillo, ICREA-UAB).

- Information Society Technologies (O. Serra and J. Villar, UPC).

- Sustainable Development, Global Change and Ecosystems (J. Saldaña, UdG).

The actions initiated in 2004 dealt with the first three of these areas. These actions materialised during 2005 as follows, and will continue in the coming years.

- A doctoral course at the UPC on *Modelling Large-Scale Dynamics of the Visual Cortex*, in March 2005, by Michael Shelley (Courant Institute, New York).

- A thematic term on *Contemporary Cryptology* from March to June 2005 and a workshop on *Mathematical Problems and Techniques in Cryptology* in June 2005, co-ordinated by Jorge Villar (UPC) and Carles Padró (UPC).

- An advanced course on *Recent Trends on Combinatorics in the Mathematical Context*, in September 2005, co-ordinated by Oriol Serra (UPC).

- The participation of the CRM, as a co-ordinating institution, in a project entitled *Shaping New Directions in Mathematics for Science and Society* from the NEST programme of the European Commission.

- A conference on *Mathematical Neuroscience*, co-organised with the Universitat d'Andorra, in September 2006, co-ordinated by Antoni Guillamon (UPC).

8.5 SHAPING NEW DIRECTIONS IN MATHEMATICS FOR SCIENCE AND SOCIETY

The NEST programme (*New and Emerging Science and Technology*) is an activity of the 6th Framework Programme of the European Commission, whose aim is to promote highly innovative research, possibly opening new directions for science and technology. Besides stimulating research aimed to the development of new techniques and supporting multidisciplinary scientific knowledge, the NEST programme aims to consoli-

Noves direccions en matemàtiques per a la ciència i la societat

Shaping New Directions in Mathematics for Science and Society

PROJECTE
MATHFSS
(2005 - 2007)

Per a més informació:
www.mathfss.org
mathfss@upc.es

CRM
Centre de Recerca Matemàtica, Bellaterra (coordinador)

INM
Emmy Noether Research Institute for Mathematics, Ramat Gan, Israel

EURANDOM
European Institute for Statistics, Probability and Operations Research, Eindhoven, Holanda

IRES
Institut des Hautes Études Scientifiques, Bures-sur-Yvette, France

date efforts made in emerging research fields. It also aims to help planning support activities for the European Research Area. The programme includes several complementary lines of action and also foresees support actions. These can be methodological studies or activities that promote links within the research community about important scientific and technological advances.

The project entitled *Shaping New Directions in Mathematics for Science and Society* (MATHFSS) is one of the Support Actions that were approved in 2005 within the NEST programme. It will last two years since December 1, 2005. It has been made possible by the collaboration of the following ERCOM centres:

- Centre de Recerca Matemàtica, project co-ordinator
- Emmy Noether Research Institute for Mathematics, Israel
- European Institute for Statistics,

Probability and Operations Research (EURANDOM), The Netherlands

- Institut des Hautes Études Scientifiques (IHÉS), France

The goal of the project is to foster international contacts and draw training contents in Mathematics around the following emerging research topics:

- Systems Biology
- Risk Assessment
- Mathematical Neuroscience
- Digital Content Security

Eight workshops have been planned on these topics. Two of them will be organised by the CRM (one on Mathematical Neuroscience in September 2006 and the other one on Cryptography and Data Security in June 2007). Several round tables have been planned, one of which as a part of the scientific programme of the International Congress of Mathematicians (ICM 2006) in August 2006 in Madrid.

9. SOCIAL ACTIVITIES

From its beginnings, the CRM has not only aimed at offering its visiting researchers the very best conditions in which to work, but it has also provided them with the opportunity to become aware of the social and cultural reality of Catalonia, their temporary host country. In this sense, there are a number of social activities programmed each year such as visits to museums, excursions to the nearby mountains, participation in local festivities, and so on, all of which play their part in stimulating contact and communication between CRM visitors and the local population

During 2005, various social gatherings and informal activities were carried out, including particularly the following:

- A visit to the live nativity scene in Torres de Fals on January 23.
- A visit to the Cistercian monasteries of Poblet and Santes Creus, with a typical *calçotada* outdoor barbecue in Valls on March 5.
- Celebration of Easter Sunday, with the typical *mona* Easter cake, on March 28.
- Celebration of new arrivals:
 - Daniel (son of Katherine St. John and Sean Cleary, both CRM visitors), born on April 5.
 - Guillem (son of Olivier Penacchio, a Marie Curie grant holder), born on November 10.
- Christmas refreshments, with traditional *torró* nougat, on December 23.



10. PRIZE OF THE FERRAN SUNYER I BALAGUER FOUNDATION

In 2005 the Institut d'Estudis Catalans and the Ferran Sunyer i Balaguer Foundation announced the International Ferran Sunyer i Balaguer Prize for the fourteenth time. The prize is awarded to a monograph which updates the progress in research in a mathematical area that has recently been developed. The prize consists of 12,000 euros and the winning monograph is published by Birkhäuser in the *Progress in Mathematics* series.

In the call of the year 2004, the Scientific Committee consisting of Hyman Bass (University of Michigan), Antonio Córdoba (UAM), Oriol Serra (UPC), Paul Malliavin (Université de Paris VI), and Joseph Oesterlé (Institut de Mathématiques de Jussieu) recommended that the Foundation should award the prize *ex aequo* to the following two monographs:

On the Topology of Isolated Singularities in Analytic Space

by José Seade, Universidad Nacional Autónoma de México

Perturbation Methods and Semilinear Elliptic Problems on \mathbb{R}^n

by Antonio Ambrosetti and Andrea Malchiodi, SISSA, Itàlia

Since 2003 the Director of the Ferran Sunyer i Balaguer Foundation is Pere Pascual, professor of the Universitat Politècnica de Catalunya.

Web: www.crm.es/info/ffsb.htm

Winners from previous editions

- 1993 Alexander Lubotzky
Discrete Groups, Expanding Graphs and Invariant Measures (PM 125)
- 1994 Klaus Schmidt
Dynamical Systems of Algebraic Origin (PM 128)
- 1995 The scientific committee decided not to award the prize

- 1996 Vijaya Kumar Murty and Ram Murty
Non-Vanishing of L-Functions and Applications (PM 157)
- 1997 Albrecht Böttcher and Yuri I. Karlovich
Carleson Curves, Muckenhoupt Weights, and Toeplitz Operators (PM 154)
- 1998 Juan J. Morales-Ruiz
Differential Galois Theory and Non-Integrability of Hamiltonian Systems (PM 179)
- 1999 Patrick Dehornoy
Braids and Self-Distributivity (PM 192)
- 2000 Juan-Pablo Ortega and Tudor Ratiu
Hamiltonian Singular Reduction (PM 222)
- 2001 Martin Golubitsky and Ian Stewart
The Symmetry Perspective (PM 200)
- 2002 Alexander Lubotzky and Dan Segal
Subgroup Growth (PM 212)
André Unterberger
Automorphic Pseudodifferential Analysis and Higher-Level Weyl Calculi (PM 209)
- 2003 Fuensanta Andreu-Vaillo, Vicent Caselles and José M. Mazón
Parabolic Quasilinear Equations Minimizing Linear Growth Functionals (PM 223)
- 2004 Guy David
Singular Sets of Minimizers for the Mumford-Shah Functional (PM 233)
- 2005 José Seade
On the Topology of Isolated Singularities in Analytic Space
Antonio Ambrosetti and Andrea Malchiodi
Perturbation Methods and Semilinear Elliptic Problems on \mathbb{R}^n

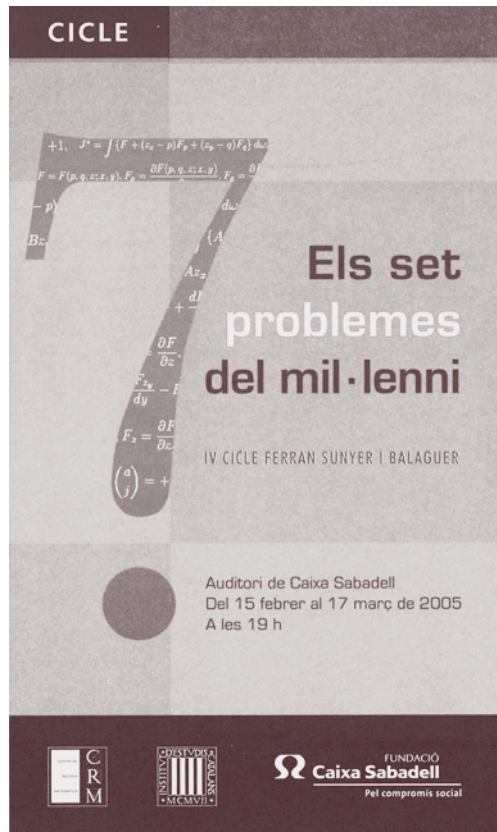
11. CYCLE OF FERRAN SUNYER I BALAGUER LECTURES

The fourth cycle of Ferran Sunyer i Balaguer lectures was held between February 15 and March 17, 2005. The aim of this cycle, organised jointly by the CRM and the Caixa Sabadell Foundation, and held biannually, is to offer university Mathematics students a range of both academic and research and professional perspectives that gives them guidance for the future and at the same time improves the presence of Mathematics in society.

In this year's event, the topic chosen was open problems in Mathematics. In a series of ten lectures, different specialists presented, in a way understandable to university level students, the so called «problems of the millennium», a list of open problems drawn up by the Clay Institute of Mathematics, and each of which carries a prize of a million dollars for anyone solving them. The cycle was co-ordinated by Jordi Quer, and the following lectures were given:

- Dels problemes de Hilbert als problemes del mil·lenni, J. Pla (UB)
- La conjectura de Birch i Swinnerton-Dyer, J. Quer (UPC)

- La conjectura de Hodge, J. I. Burgos (UB)
- Les equacions de Navier-Stokes, X. Mora (UAB)
- P versus NP , A. Atserias (UPC)
- Criptografia, complexitat i geometria, A. Rio (UPC)
- La conjectura de Poincaré, M. T. Lozano (Universidad de Zaragoza)
- La teoria quàntica de Yang-Mills, I. Mundet (UB)
- La hipòtesi de Riemann, P. Bayer (UB)
- Els problemes de Vitushkin i de Painlevé, X. Tolsa (ICREA-UAB)



12. INSTITUTIONAL FUNDING

12.1 VISITING PROFESSORS (MEC, DURSI, UAB)

U. Ray	01.04.2004 – 31.03.2005
A. Millet	01.10.2004 – 31.01.2005
A. Lewis	01.01.2005 – 30.03.2005
N. Brady	01.01.2005 – 31.07.2005
F. Dumortier	01.02.2005 – 30.04.2005
E. Turner	01.03.2005 – 30.06.2005
R. Cramer	01.04.2005 – 24.07.2005
T. Okamoto	01.05.2005 – 31.08.2005
D. Karim	01.06.2005 – 15.08.2005
J. Wildeshaus	01.09.2005 – 31.07.2006
Z. Zhang	01.10.2005 – 31.01.2006

12.2 POST-DOCTORAL FELLOWSHIPS (MEC, DURSI)

J. Hirschorn	01.09.2003 – 28.02.2005
C. Lecuire	01.01.2005 – 30.06.2006
E. H. Essaky	01.03.2005 – 31.08.2006
D. Pasca	01.03.2005 – 31.08.2006
B. Deroin	01.09.2005 – 31.12.2005
J. Yu	01.09.2005 – 28.02.2007
A. Yaman	01.09.2005 – 30.05.2008
Y. Ding	01.11.2005 – 31.10.2006

12.3 MARIE CURIE FELLOWSHIPS (EU)

O. Penacchio	01.10.2003 – 31.01.2006
S. Tikhonov	01.09.2004 – 31.08.2006
L. Ciobanu	01.01.2005 – 31.12.2006

12.4 CONFERENCES AND ADVANCED COURSES

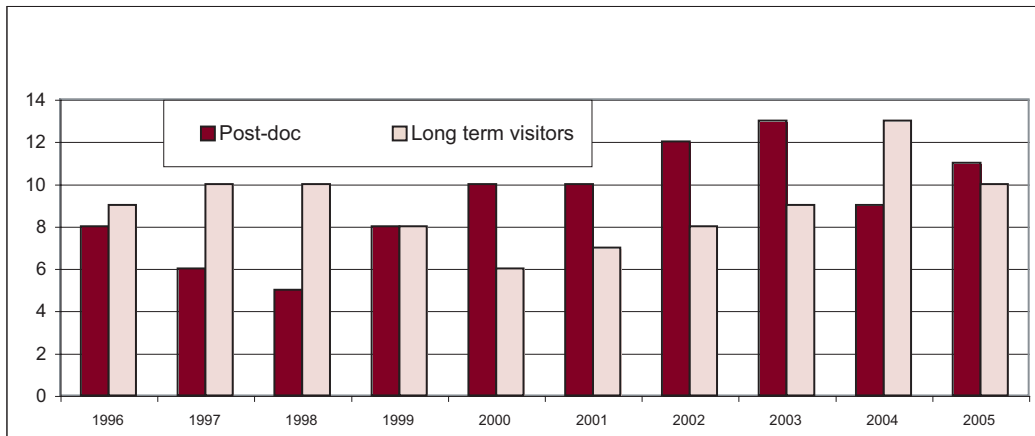
- CERME (DURSI, Caixa Girona, Caixa Sabadell, Casio, Diputació de Girona, Departament d'Educació, Maths for More, MEC, SCM, UAB, Universitat de Girona)
 - *Barcelona Conference on Geometric Group Theory* (UAB, UPC)
 - *Advanced Course on the Geometry of the Word Problem for Finitely Generated Groups* (DURSI, UAB, UPC)
 - *Advanced Course on Recent Trends on Combinatorics in the Mathematical Context* (MEC, EU)
 - *Workshop on Graphs, Morphisms and Applications* (MEC)
 - *Second Workshop on Tutte Polynomials and Applications* (MEC)

12.5 SCIENTIFIC POLICY ACTIONS (MEC)

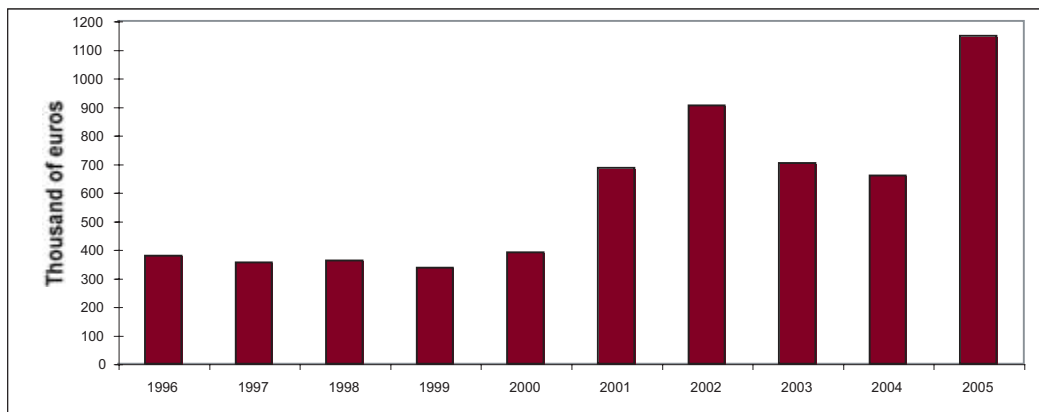
- Research Programme in Geometry of the Word Problem

12.6 OTHER FUNDS

- Spanish Topology Network (MEC)
- Participation in ERCOM (MEC)
- *Shaping New Directions in Mathematics for Science and Society* (EU)



Institutional funding



CRM's budget

13. FINANCIAL ACTIVITY

13.1 REVENUE

DURSI (subsidy)	339.000 €
DURSI (calls)	31.314 €
MEC	254.050 €
UE	244.393 €
UAB (facilities)	77.779 €
UAB (activities)	1.878 €
Other institutions	8.535 €
Registration fees	117.649 €
Remainder year 2003	70.036 €
Other income	3.597 €
Total	1.148.231 €

13.2 EXPENDITURE

Visitors	262.742 €
Post-doctoral fellows	209.065 €
Graduate students	1.800 €
Conferences and courses	185.678 €
UAB facilities	77.779 €
Long-term material	48.058 €
Day-to-day material	43.555 €
Administration	121.689 €
Directorate	14.884 €
External services	18.574 €
Publications	19.575 €
Miscellaneous	32.126 €
Applied provision	40.447 €
Remainder	72.259 €
Total	1.148.231 €

FUTURE ACTIVITIES

14. SCHEDULED SCIENTIFIC ACTIVITIES

14.1 RESEARCH PROGRAMMES

14.1.1 RESEARCH PROGRAMME ON DISCRETE AND CONTINUOUS METHODS IN RING THEORY

Period

From September 1, 2006, to July 31, 2007

Scientists in charge

Locals Dolores Herbera (UAB)
Francesc Perera (UAB)

Visitors Silvana Bazzoni (Università degli Studi di Padova)
Ken Goodearl (University of California at Santa Barbara)

Main research topic

Noncommutative Algebra: Ring Theory, Module Theory and Operator Algebras

Other research topics

- Monoid Theory
- Noncommutative Geometry

Visiting researchers

Lidia Angeleri-Hügel
Università degli Studi dell'Insubria

Gonzalo Aranda
Universidad de Málaga

Ana I. Cárceles
Universidad de Murcia

George Elliott
University of Toronto

Pedro A. Guil
Universidad de Murcia

Ivo Herzog
Ohio State University

Birge Huisgen-Zimmermann
University of California at Santa Barbara

Dan Kucerovsky
University of New Brunswick

Jan Okninski
Uniwersytet Warszawski

Enric Pardo
Universidad de Cádiz

Pavel Prihoda
Univerzita Karlova

Gena Puninski
University of Manchester

Iain Raeburn
University of Newcastle

Mikael Rordam
Syddansk Universitet

Mercedes Siles
Universidad de Málaga

Andrew S. Toms
University of New Brunswick

Jan Trlifaj
Univerzita Karlova

Friedrich Wehrung
CNRS, Université de Caen

Planned activities

Seminars

- A weekly seminar on Discrete and Continuous Methods in Ring Theory
- A seminar on specific problems and development of research techniques
- A bimonthly colloquium

Advanced course

Quasideterminants and Their Applications
February 2007

Conference

C^* -Algebras and Their Invariants
June 2007

14.1.2 RESEARCH PROGRAMME ON ENUMERATIVE COMBINATORICS AND RANDOM STRUCTURES

Period

From September 1, 2006, to July 31,
2007

Scientists in charge

Local Marc Noy (UPC)
Visitor Dominic Welsh (University of Oxford)

Main research topic

Use of algebraic, analytic and probabilistic tools in the study of combinatorial structures. In particular: random graphs, maps in surfaces, knots and links, exact models from Statistical Physics, boolean formulas, and others.

Visiting researchers

Mireille Bousquet-Mélou
CNRS, Bordeaux
Pierre Colson
Universität Rostock
Enrica Ducci
Université Paris VII
Sergi Elizalde
Dartmouth College
Stephanie Gerke
ETH Zürich

Geoffrey Grimmett
University of Cambridge

Graeme Kemkes
University of Waterloo

Joseph Kung
University of North Texas

Martin Loeb
Univerzita Karlova

Colin McDiarmid
University of Oxford

Jean-François Marckert
CNRS, Bordeaux

Simone Rinaldi
Università di Siena

Gilles Schaeffer
École Polytechnique

Alan Sokal
New York University

Angelika Steger
ETH Zürich

Nicholas Wormald
University of Waterloo

Planned activities*Seminar*

A weekly seminar on Combinatorics and Probability

Advanced course

Analytical and Probabilistic Techniques in
Combinatorics
January 2007

Conference

Enumerative Combinatorics and Random
Structures
June 2007

14.2 SPECIALISED QUARTERS

14.2.1 FOURIER ANALYSIS, GEOMETRIC MEASURE THEORY AND APPLICATIONS

Period

From April 20 to June 3, 2006,
Universidad Autónoma de Madrid

Co-ordinators

Xavier Tolsa (ICREA-UAB)
Joan Mateu (UAB)
Ana Vargas (UAM)
José M. Martell (UAM)
Alberto Ruiz (UAM)
Joan Verdera (UAB)

Main research topics

- Calderón-Zygmund Operators and Rectifiability
- Analytical Capacity
- Avoidable Singularities for Elliptic PDES
- Restriction Problems for Fourier Transforms
- The Kakeya Problem and related questions

Visiting researchers

Kari Astala
Helsingfors Universitet
Pascal Auscher
Université de Paris XI
Jonathan Bennett
University of Birmingham
Russell Brown
University of Kentucky
Tony Carbery
University of Edinburgh
Marianna Csoranyi
University College London

Galia Dafni
Concordia University
Guy David
Université de Paris Sud
John B. Garnett
University of California, Los Angeles
Loukas Grafakos
University of Missouri-Columbia
Steve Hofmann
University of Missouri-Columbia
Peter Jones
Yale University
Pekka Koskela
Jyväskylä Universitet
Slava Kurylev
Loughborough University
Sanghyuk Lee
University of Wisconsin-Madison
Pertti Mattila
Jyväskylä Universitet
Hervé Pajot
Université de Grenoble I
Carlos Pérez
Universidad de Sevilla
Raanan Schul
University of California, Los Angeles
Ignacio Uriarte
Helsingfors Universitet
Sergei Treil
Brown University
Luis Vega
Universidad del País Vasco
Alexander Volberg
Michigan State University

Planned activities

Seminars

Two weekly seminars will be organised on Fourier Analysis, Geometric Measure Theory and Applications

Workshop

Workshop on Fourier Analysis, Geometric
Measure Theory and Applications

June 5 to 9, 2006, co-ordinated by Xavier
Tolsa (UAB) and Ana Vargas (UAM)

14.3 OTHER VISITING RESEARCHERS DURING 2006

M. Bridgeman	Boston College	Geometry
L. Ciobanu	Centre de Recerca Matemàtica	Algebra
S. Cleary	City College of New York	Discrete Mathematics
A. del Río	Universidad de Murcia	Algebra
B. Deroin	Max-Planck-Institut, Leipzig	Differential Geometry
Y. Ding	Centre de Recerca Matemàtica	Dynamical Systems
Z. Ditzian	University of Alberta	Analysis
E. H. Essaki	Université Cadi Ayyad	Probability and Statistics
M. Ferrante	Università degli Studi di Padova	Probability and Statistics
S. Friedman	Universität Wien	Logic and Foundations
S. Fuchino	Chubu University	Logic and Foundations
T. Goudon	Université de Lille 1	Differential Equations
D. Herbera	Universitat Autònoma de Barcelona	Algebra
E. Jespers	Vrije Universiteit Brussel	Algebra
P. Lafitte-Godillon	Université de Lille 1	Applied Mathematics
C. Lecuire	Centre de Recerca Matemàtica	Geometry
C. Marinelli	Universität Bonn	Stochastic Analysis
F. Otto	Universität Bonn	Differential Equations
J. Parcet	Centre de Recerca Matemàtica	Analysis
D. Pasca	University of Oradea	Dynamical Systems
O. Penacchio	Centre de Recerca Matemàtica	Topology
A. Poltoratski	Texas A&M University	Complex Analysis
M. Scharleman	University of California	Topology
K. St. John	Lehman College	Discrete Mathematics
A.-A. Tarta	Universitatea Babeş-Bolyai	Dynamical Systems
S. Tikhonov	Moscow State University	Harmonic Analysis
S. Tindel	Institut Élie Cartan	Probability and Statistics
D. Wright	Oklahoma State University	Dynamical Systems
A. Yaman	IHÉS	Algebra

14.4 OTHER CONFERENCES AND ADVANCED COURSES

Advanced Course on Combinatorial and Computational Geometry: Trends and Topics for the Future

Co-ordinator: Ferran Hurtado

Alcalá de Henares, August 31 to September 5, 2006 (an ICM 2006 satellite activity).

Conference on Mathematical Neuroscience

Co-ordinator: Antoni Guillamon

Sant Julià de Lòria, Andorra, September 1 to 5, 2006 (an ICM 2006 satellite activity).

This is an activity of the MATHFSS project.

Cryptography and Digital Content Security

Co-ordinator: Enric Nart

CRM, Bellaterra, June 2007

This is an activity of the MATHFSS project.

- A round table at ICM 2006 about the scientific topics of the MATHFSS project.

- A thematic trimester on Fourier Analysis, Geometric Measure Theory and Applications, from April 20 to June 3, 2006, at the Universidad Autónoma de Madrid.

- An advanced course on Combinatorial and Computational Geometry at the Universidad de Alcalá de Henares, from August 31 to September 5, 2006 (an ICM 2006 satellite activity).

- A conference on Mathematical Neuroscience in Sant Julià de Lòria (Andorra), co-organised by the CRM and the Universitat d'Andorra, from September 1 to 5, 2006 (an ICM 2006 satellite activity).

14.5 AROUND THE ICM 2006

From August 22 to 30, 2006, the International Congress of Mathematicians (ICM 2006) will be held in Madrid. As a contribution to this event and to its scientific environment, the CRM will organise the following activities:

