CENTRE DE RECERCA MATEMÀTICA

MEMÒRIA D'ACTIVITATS 2010

REPORT OF ACTIVITIES 2010

CENTRE DE RECERCA MATEMÀTICA

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Presentació

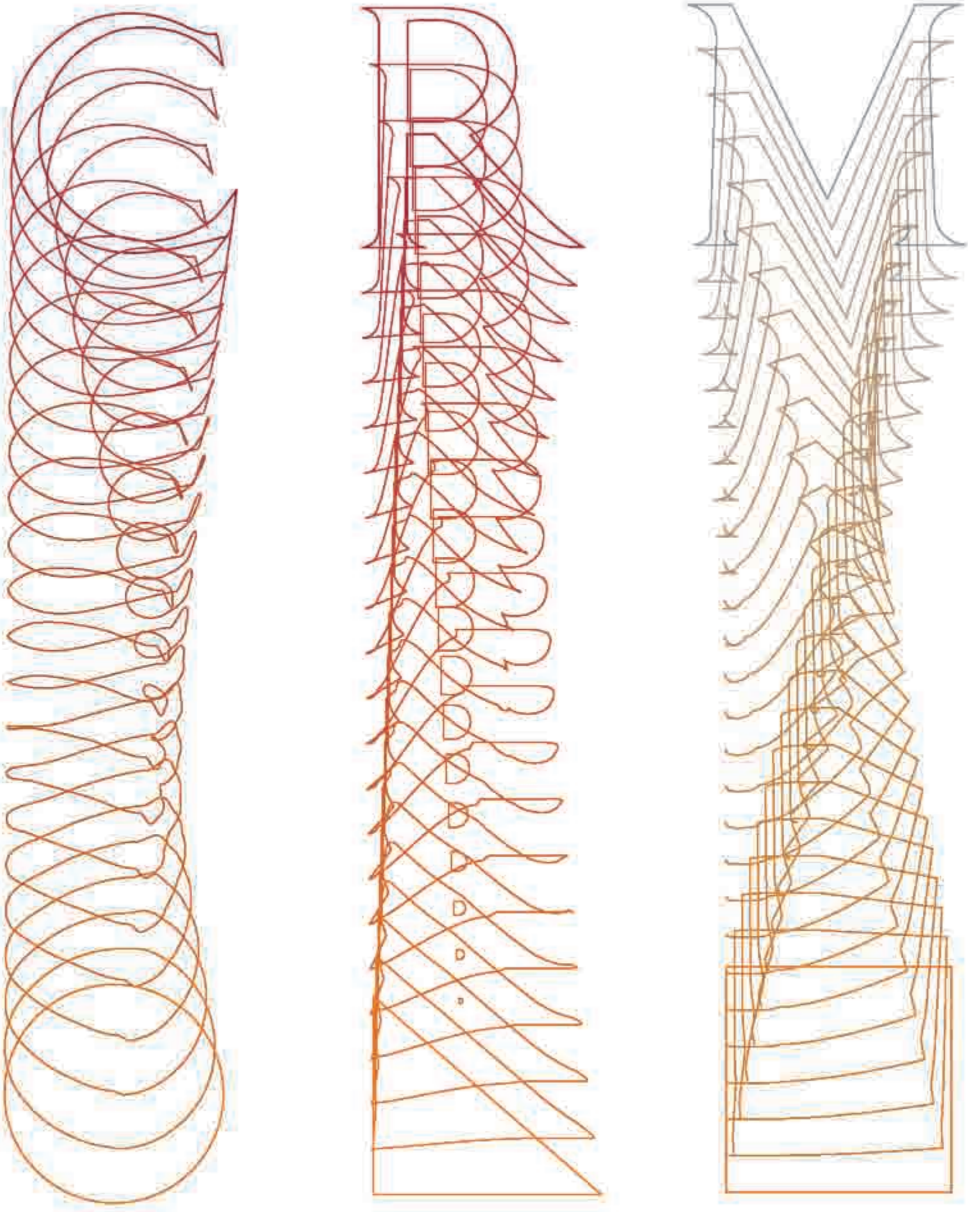
Durant l'any 2010 quelcom que ha marcat l'activitat del CRM ha estat la continuació de les obres d'ampliació del centre i el seu acabament pel Octubre del 2010. L'ala nova del CRM, que totalitza uns 900 m^2 útils, fou inaugurada per l'Honorable Conseller Josep Maria Huguet durant una visita al centre.

Els nous espais s'han destinat a l'ubicació del personal de plantilla del centre i han permès així visualitzar explícitament l'acompliment de l'objectiu prioritari del pla estratègic vigent, la consolidació d'una plantilla pròpia d'investigadors contractats en àrees interdisciplinars. Aquest ha estat, des del punt de vista científic, el fet més rellevant de l'activitat del CRM durant el 2010. Els grups de recerca en 'Matemàtica Industrial', 'Sistemes Complexos' i 'Biologia Computacional i Matemàtica' han començat a donar fruits i assolir una mínima massa crítica per a captar projectes competitius. Els grups de 'Matemàtica Financera', 'Anàlisi Harmònica i Aproximació' i 'Anàlisi Numèrica i Computació Científica' es troben en una fase més embrionària.

Pel que fa a les activitats científiques organitzades pel CRM, el 2010 ha estat un any veritablement intens i fructífer, amb un total de 31 activitats de diferent format acollides pel CRM. El centre ha acollit investigadors visitants d'arreu del món per un total de 382 mesos, tots ells o bé participants del programes de recerca del CRM o bé col·laboradors de matemàtics d'institucions catalanes. Ambdós factors-activitats i visitants- conformen aquest altre aspecte del CRM, l'històric, que es fa amb esperit de servei a la comunitat matemàtica en general i que és possible gràcies, en gran part, a la iniciativa i a la implicació de matemàtics de les universitats catalanes.

En aquesta memòria trobareu informació sobre tot plegat, informació que a la plana web del centre (http://www.crm.cat) es troba més detallada en alguns aspectes.

Joaquim Bruna
Director



Presentation

During 2010, something that has marked the CRM activity was the continuation of works to expand the center and its completion by October 2010. The new wing of the CRM, which totals about 900 m^2, was inaugurated by the Honourable Minister Josep Maria Huguet during a visit to the center.

The new spaces have been allocated to the research staff of the center and thus bring visualization of the accomplishment of the main aim of the current strategic plan, namely the consolidation of its own staff of researchers engaged in interdisciplinary areas. This has been, from the scientific point of view, the most important fact of the CRM in 2010. The research groups in Industrial Mathematics, Complex Systems and Computational and Mathematical Biology have begun to bear fruit and achieve a minimum critical mass to attract competitive projects. The groups of 'Financial Mathematics', 'Harmonic Analysis and Approximation' and 'Numerical Analysis and Scientific Computation' are at an embrionary stage.

Regarding the scientific activities organized by the CRM, 2010 was a truly intense and fruitful year, with a total of 31 activities of different formats organized by the CRM. The center has hosted visiting researchers from around the world for a total of 382 months, all being participants of CRM research programmes or else collaborators of mathematicians at Catalan institutions. Both things- activities and visitors- define the other aspect of CRM activity, the historical one, that the center carries over as a service center to the mathematical communit, and which is possible thanks to the initiative and implication of local mathematicians.

You will find information about all this in this report; for more detailed information, please see the CRM web page: http://www.crm.cat

Joaquim Bruna
Director

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Descripció Institucional

Institutional Description

1

1.1. Missió i objectius

L'objectiu definit als estatuts del CRM és la recerca i la formació avançada en l'àmbit de les matemàtiques, mitjançant la col·laboració i les sinergies amb les universitats i les institucions de recerca de Catalunya, amb l'objectiu d'ésser un referent científic internacional en aquest àmbit.

El CRM és un centre amb implantació interuniversitària en el sentit que de la seva activitat se'n beneficia el conjunt de la recerca en matemàtiques del país. La política científica del CRM per a l'assoliment de la seva missió té dos eixos d'actuació, recollits en el seu pla estratègic i dins el marc del Contracte-Programa amb la Generalitat de Catalunya pel període 2008-2013:

- ☐ Donar suport als grups d'investigació catalans, organitzant tipus d'activitats que depassen la capacitat dels mateixos, amb projecció internacional i acollint visitants amb qui treballen conjuntament.

- ☐ Des d'un punt de vista més proactiu, dissenyar i executar polítiques estratègiques que incideixin en debilitats de la recerca matemàtica a Catalunya entesa globalment, incentivant el desenvolupament d'àrees estratègiques i creant els seus propis grups de recerca en les mateixes.

1.1. Mission and objectives

As stated in its statutes, the CRM's aim is to foster research and advanced training in mathematics, by collaborating with the universities and research institutions in Catalonia, in order to continue to be an international reference center.

The CRM is transversal in the sense that its activities benefit the whole community of mathematical researchers of our country. The scientific policy of the CRM towards fulfilling its mission is structured around two main axes, quoted in the strategic plan within the contract-programme with the Generalitat de Catalunya for the period 2008-2013:

- ☐ *To give support to research groups, by organising activities whose size or nature goes beyond the capabilities of the teams, achieving broad visibility and hosting visitors for joint work.*

- ☐ *To design and execute strategies aimed at repairing weaknesses of the mathematical research activity in Catalonia as a whole, encouraging emergent areas and the creating its own research groups in these.*

1.2. Estructura jurídica

El CRM va ser creat l'any 1984 per l'Institut d'Estudis Catalans (IEC) com a centre de recerca propi. El mateix any, l'IEC signà un conveni de col·laboració amb la Universitat Autònoma de Barcelona (UAB), en virtut del qual el Centre quedà ubicat físicament en uns espais d'aquesta universitat. L'any 1993 s'adequaren uns espais propis per al CRM a la Facultat de Ciències de la UAB amb finançament de la CIRIT. Per aquest motiu, es reformulà el conveni entre l'IEC i la UAB i se sol·licità l'adscripció del CRM a la UAB com a institut universitari.

L'acord del Govern de la Generalitat de 9 de juliol de 2002 (DOGC núm. 3693, de 6 d'agost de 2002) aprovà la constitució del Consorci Centre de Recerca Matemàtica, integrat per la Generalitat de Catalunya i l'IEC. El Consorci és una entitat pública amb personalitat jurídica pròpia. El 2010 s'ha iniciat el procés, encara no completat, per incorporar la Universitat Autònoma al Consorci.

El CRM està regit pel Consell de Direcció i pel director, i compta amb un Consell Científic Assessor.

El CRM està integrat dins la xarxa CERCA de centres de recerca participats majoritàriament per la Generalitat de Catalunya i forma part de l'Associació Catalana d'Entitats de Recerca (ACER). També forma part d'ERCOM, dins l'European Mathematical Society, i de la xarxa EPDI (European Postdoctoral Institute).

1.2. *Legal Status*

The CRM was founded in 1984 by the Institut d'Estudis Catalans (IEC), the Catalan Academy. In the same year, an agreement was signed with the Universitat Autònoma de Barcelona (UAB), by virtue of which the CRM became established in the UAB Campus. In 1993 the CRM inaugurated its own premises at the UAB's Science Faculty, thanks to financial support from CIRIT. On that occasion, the CRM became associated with the UAB as one of its research institutes.

The Government of Catalonia approved on July 9, 2002 (DOGC no. 3693, August 6, 2002) the creation of the CRM Consortium, formed by the Government and the IEC. The CRM Consortium is a public body with its own legal status. In 2010 started the process to join Universitat Autònoma to the Consortium.

The CRM is conducted by its Governing Board and the Director, and has a Scientific Advisory Board.

The CRM is one of the centers in the CERCA network of research institutions participated by the Generalitat de Catalunya, and of the Associació Catalana d'Entitats de Recerca (ACER). CRM is also in ERCOM, a committee of the European Mathematical Society (EMS) and of the European Postdoctoral Institute (EPDI).

1.3. Consell de Direcció

El Consell de Direcció, òrgan superior de decisió i d'administració del CRM, està format per:

☐ El president, que és el conseller d'Innovació, Universitats i Empresa, o persona en qui delegui.

☐ El vicepresident, que és el president de l'IEC o persona en qui delegui.

1.3. *Governing Board*

The Governing Board is the steering body of the CRM. Its members are the following:

☐ *The Minister of Innovation, Universities and Enterprise of the Catalan Government, or a delegated person, acting as Chair.*

☐ *The IEC President or a delegated person, acting as Vice Chair.*

☐ Tres vocals en representació de la Generalitat de Catalunya.

☐ Tres vocals en representació de l'IEC.

☐ El director del CRM, que hi participa amb veu però sense vot.

Durant l'any 2010, la Generalitat de Catalunya hi va estar representada pel Comissionat de Recerca i Universitats, Joan Majó, presidint el Consell, el director general de Recerca, Joan Roca, la subdirectora general de Recerca, Iolanda Font, i el director d'i-CERCA, Ramón Moreno. L'IEC hi va estar representat pel seu president, Salvador Giner, el vicepresident, Joandomènech Ros, el secretari científic, Ricard Guerrero, i per Joan Girbau. Carles Jaime, vice-rector de projectes estratègics de la UAB, ha assistit com a convidat a totes les sessions.

El Consell de Direcció es va reunir el 26 d'abril de 2010, el 13 d'Octubre de 2010 i el 10 de Desembre de 2010.

☐ *Three representatives of the Catalan Government.*

☐ *Three representatives of the IEC.*

☐ *The CRM Director, without vote.*

During 2010, the Catalan Government has been represented by the Commissioner for Universities and Research, Joan Majó, the General Director of Research, Joan Roca, the Vice Director of Research, Iolanda Font de Rubinat, and the Director of i-CERCA, Ramón Moreno. The IEC was represented by its President, Salvador Giner, its Vice President, Joandomènech Ros, its Scientific Secretary, Ricard Guerrero, and by Joan Girbau. Carles Jaime, vicerector of strategical projects of UAB, attended all meetings as a guest.

The Governing Board met on April 26, 2010, October 13, 2010 and December 10, 2010.

1.4. Consell Científic Assessor

El Consell Científic Assessor està integrat per personalitats de prestigi científic en l'àmbit d'actuació del Centre, nomenats pel Consell de Direcció a proposta del director.

El Consell Científic Assesor va tenir la seva reunió anual presencial el 15 de gener de 2010. Al llarg de l'any es fan diverses reunions no presencials. La llista actual de membres del Consell Científic Assessor s'especifica a continuació:

1.4. Scientific Advisory Board

The CRM's Scientific Advisory Board is formed by established mathematicians, nominated by the Governing Board on the Director's proposal.

The Scientific Advisory Board has its annual in person meeting on January 15, 2010. A number of online meetings are organized over the year. The current list of members of the Scientific Advisory Board is given below:

Jaume Aguadé, Universitat Autònoma de Barcelona

Alfredo Bermúdez de Castro, Universidade de Santiago de Compostela

Michel Boileau, Université de Toulouse

Aline Bonami, Université d'Orléans

Bodil Branner, Danmarks Tekniske Universitet, Lyngby

Luis Caffarelli, University of Texas at Austin

Eduard Casas-Alvero, Universitat de Barcelona

José Luis Fernández, Universidad Autónoma de Madrid

Oscar García Prada, Consejo Superior de Investigaciones Científicas, Madrid

Antonio Huerta, Universitat Politècnica de Catalunya, Barcelona

Dominique Picard, Université Paris VII

Kristian Seip, Norges Teknisk-Naturvitenskapelige Universitet, Trondheim

Maria Eulalia Vares, Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro

Dominic Welsh, University of Oxford

1.5. Contracte programa

El primer contracte programa del CRM amb la Generalitat de Catalunya es va signar el 18 de juny de 2003. Es va mantenir vigent fins a 2006 i es va prorrogar durant l'any 2007. El 14 de febrer de 2009 es va signar un segon contracte programa que cobreix el període de 2008 a 2013.

Aquest contracte programa emana del pla estratègic del Centre, que va ser aprovat pel Consell de Direcció, i és la concreció dels eixos de desplegament continguts en el pla. L'objecte del contracte programa és: establir un nou marc de relacions i mecanismes de coordinació entre la Generalitat de Catalunya i el CRM; dotar el CRM dels mitjans necessaris per seguir complint els seus objectius; determinar la participació de la Generalitat de Catalunya en la definició i la programació dels objectius i del finançament del CRM; i configurar-se com un instrument de planificació estratègica, de gestió de la recerca, la formació, la difusió del coneixement i la millora de la qualitat.

El desenvolupament del contracte programa s'analitza en una reunió anual d'una comissió mixta de seguiment.

1.5. Contract Programme

The first contract programme of the CRM with the Catalan Government was signed on June 18, 2003. It remained into force until 2006 and was extended over 2007. On February 14, 2009, a new contract programme was signed for the period 2008-2013.

This contract programme stems from the CRM's strategic plan, which was approved by the Governing Board, and specificies the main axes of the strategic plan. The goal of the contract programme is the following: to set up a new framework for relations and coordination mechanisms with the Catalan Government; to provide the CRM with the necessary resources to achieve its foundational aims; to specify the participation of the Catalan Government in the definition of the CRM's goals and financing; and to become an instrument for strategic planning, management of research, training, knowledge dissemination, and quality improvement.

The development of the contract programme is analysed and discussed in an annual meeting of a Monitoring Commission.

1.6. ERCOM

ERCOM és l'acrònim del comitè European Research Centres on Mathematics de la Societat Matemàtica Europea (EMS), format pels directors científics de diversos centres de recerca europeus. Els centres representats a ERCOM són aquells el nombre de visitants dels quals supera essencialment el nombre d'investigadors permanents o de llarga durada i que cobreixen un espectre ampli de les matemàtiques. El CRM és membre d'ERCOM des de la seva fundació l'any 1997.

El president d'ERCOM és nomenat per un període de quatre anys pel comitè executiu de l'EMS. Des de 2006, ERCOM és presidit per Jan Karel Lenstra, director del Centrum voor Wiskunde en Informatica d'Amsterdam (Holanda). A finals de

1.6. ERCOM

ERCOM is the acronym of the European Research Centres on Mathematics committee of 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 CRM has been a member of ERCOM since the committee's creation in 1997.

The Chairman of ERCOM is appointed for a period of four years by the EMS Executive Committee. From 2006 to 2009, ERCOM has been chaired by Jan Karel Lenstra, director of l'any 2009 va ser escollit president Gert-Martin Greuel, director del Mathematisches Forschungsinstitut Oberwolfach.

La reunió anual d'ERCOM de 2010 tingué lloc els dies 12 i 13 de març al International Centre for Mathematical Sciences, Edinburgh (Regne Unit).

Per a més informació: www.ercom.org

the Centrum voor Wiskunde en Informatica, Amsterdam. A new chair, Gert-Martin Greuel, director of the Mathematisches Forschungsinstitut Oberwolfach, was elected in 2009.

The annual meeting of ERCOM took place at the International Centre for Mathematical Sciences, Edinburgh (United Kingdom) on March 12 and 13, 2010.

For more information: www.ercom.org

1.7. Ingenio Mathematica

El CRM és un dels promotors i un node d'un projecte anomenat Ingenio Mathematica, finançat pel Ministeri de Ciència i Innovació durant cinc anys dins del programa Consolider-Ingenio 2010. La data d'inici d'aquest projecte va ser el 3 d'octubre de 2006.

L'investigador coordinador del projecte és Marco Antonio López Cerdá, de la Universitat d'Alacant, i l'entitat gestora és la Universitat de Cantàbria. La direcció científica del projecte correspon a un consell de direcció format per investigadors de diverses institucions de l'estat espanyol. Els nodes del projecte són: CRM, CESGA (Centro de Supercomputación de Galicia), CIEM (Centro Internacional de Encuentros Matemáticos, Castro Urdiales), ICMAT (Instituto de Ciencias Matemáticas, Madrid) i IMUB (Institut de Matemàtiques de la Universitat de Barcelona). Les activitats del projecte s'emmarquen en diverses plataformes, anomenades *Future, Consulting, Computing, EDU, PMII, SARE, SAIRT i MIGS.*

Moltes de les activitats del CRM desenvolupades durant l'any 2010 (programes de recerca, congressos, cursos avançats, etc.) varen ser finançades parcialment per Ingenio Mathematica.

1.7. Ingenio Mathematica

The CRM is one of the promoters, and a node, of a project called Ingenio Mathematica, which is being funded by the Spanish Ministry of Science and Innovation for five years, from October 3, 2006 to October 3, 2011, within the Ministry's Consolider-Ingenio 2010 programme.

The coordinator of the project is Marco Antonio López Cerdá, from Universitat d'Alacant, and the management center is located at Universidad de Cantabria. The scientific direction of the project lies under the responsibility of a Board of Directors formed by researchers from several Spanish institutions. The nodes of the project are: CRM, CESGA (Centro de Supercomputación de Galicia), CIEM (Centro Internacional de Encuentros Matemáticos, Castro Urdiales), ICMAT (Instituto de Ciencias Matemáticas, Madrid), and IMUB (Institut de Matemàtiques de la Universitat de Barcelona). Several platforms, named Future, Consulting, Computing, EDU, PMII, SARE, SAIRT, and MIGS, provide a framework for the actions of Ingenio Mathematica.

Many CRM activities, including research programmes, conferences, advanced courses, etc., were partially funded by Ingenio Mathematica in 2010.

1.8. Beques EPDI

Des de desembre de 2000, el CRM és membre de l'EPDI (European Post-Doctoral Institute for the Mathematical Sciences), que agrupa deu prestigiosos instituts d'investigació europeus: Institut des Hautes Études Scientifiques, Bures-sur-Yvette (el director del qual n'és el coordinador); Max-Planck-Institut für Mathematik, Bonn; Isaac Newton Institute for the Mathematical Sciences, Cambridge; Max-Planck-Institut für Mathematik in den Naturwissenschaften, Leipzig; Institute Mittag-Leffler, Djursholm; Banach Center, Varsòvia; Erwin Schrödinger Institut, Vienna; Forschungs-institut für Mathematik, Zuric; Mathematisches Forschungsinstitut Oberwolfach; Centre de Recerca Matemàtica, Bellaterra.

1.8. EPDI Fellowships

Since December 2000, the CRM has been a member of the EPDI (European Post-Doctoral Institute for the Mathematical Sciences), which currently groups ten European research institutes: the Institut des Hautes Études Scientifiques (IHÉS) in Bures-sur-Yvette (the Director of which is the coordinator), the Max-Planck-Institut für Mathematik in Bonn, the Isaac Newton Institute for the Mathematical Sciences in Cambridge, the Max-Planck-Institut für Mathematik in den Naturwissenschaften in Leipzig, the Institute Mittag-Leffler in Djursholm, the Banach Center in Warsaw, the Erwin Schrödinger Institut in Vienna, the Forschungsinstitut für Mathematik (FIM) in Zürich, the Mathematisches Forschungsinstitut Oberwolfach, and the CRM.

L'EPDI convoca anualment beques postdoctorals de dos anys de durada en l'àmbit de les matemàtiques i de la física matemàtica, ofertes a joves investigadors de països europeus.

The EPDI annually awards post-doctoral grants in mathematics (pure and applied) and mathematical physics, which are offered to young researchers in European countries.

1.9. Direcció i Administració

1.9.1. Equip de Direcció

El director del CRM és nomenat pel Consell de Direcció, a proposta del president, per a un període de quatre anys. El director actual és Joaquim Bruna, que va ser nomenat per al període de 2007 a 2011.

A proposta del director, el Consell de Direcció va nomenar el 2007 un equip format per Carles Casacuberta (fins juny), Marta Sanz (fins juliol) i Joan Solà-Morales (fins juliol). Aquest equip assessora i ajuda el director en les tasques de gestió del Centre. El Setembre del 2010, aquestes tres persones deixaren els seus càrrecs al CRM per haver estat nomenats presidents, respectivament, del Institut de Matemàtiques de la Universitat de Barcelona, de l'European Mathematical Society, i de la Societat Catalana de Matemàtiques.

Manuel Castellet, que va ser director del CRM des de la seva creació l'any 1984, va ser nomenat director honorari pel Consell de Direcció l'any 2007.

1.9.2. Gerent

El Sr. Oriol Fernández ocupa el carrec de gerent des de l'any 2008.

ofernandez@crm.cat telèfon 93 586 8424

1.9. Direction and Administration

1.9.1. Team of Directors

The Governing Board elects a Director, proposed by the Chair, to serve for a period of four years. The current Director is Joaquim Bruna, who was elected for the period from 2007 to 2011.

On the Director's proposal, in 2007 the Governing Board also nominated a team consisting of Carles Casacuberta (until June), Marta Sanz-Solé (until July), and Joan Solà-Morales (until July), whose goal is to advise and assist the Director in the management of the Centre. On September 2010, they resigned their position at CRM to become presidents, respectively, of the Institut de Matemàtiques de la Universitat de Barcelona, the European Mathematical Society and the Societat Catalana de Matemàtiques.

Manuel Castellet, who had been the CRM Director since its creation in 1984, was nominated Honorary Director by the Governing Board at its 2007 meeting.

1.9.2. Manager

The CRM's Manager is Mr. Oriol Fernández since 2008.

ofernandez@crm.cat telèfon 93 586 8424

1.9.3. Equip de secretaria

Les persones següents formen l'equip de secretaria del CRM.

1.9.3. Secretarial Team

The following people made up the team in 2010.

Ana García-Donas	agarcia@crm.cat	Tel: 93 581 2953
Lara González	lgonzalez@crm.cat	Tel: 93 586 8423
Núria Hernández	nhernandez@crm.cat	Tel: 93 586 8192
Raquel Hernández	rhernandez@crm.cat	Tel: 93 581 2953
Maria Àngels Huertos	mahuertos@crm.cat	Tel: 93 586 8496
Moisés Oliver (fins abril)	moliver@crm.cat	Tel: 93 581 1081
Carles Parres	cparres@crm.cat	Tel: 93 586 8496
Neus Portet	nportet@crm.cat	Tel: 93 581 4086
Consol Roca	croca@crm.cat	Tel: 93 581 1081
Mari Paz Valero	mpvalero@crm.cat	Tel: 93 581 1081

1.10. Equipament

Els espais que actualment ocupa el CRM estan situats en una ala de l'edifici de la Facultat de Ciències de la UAB, amb una superfície total de 2.125 m2, després de la darrera ampliació finalitzada l'Octubre del 2010, amb el finançament del govern i del fons FEDER. Permeten la ubicació de la secretaria, la direcció, un màxim de 60 investigadors, tres sales de reunions, tres aules amb capacitat per a 40 persones i un auditori amb capacitat per 100 persones.

Per a l'allotjament dels investigadors visitants, el CRM utilitza la oferta d'apartaments de la Vila Universitària de Bellaterra.

Durant l'any 2010, l'equipament informàtic del CRM constava d'una xarxa LAN Ethernet de 1.000/100 Mbps. A la xarxa hi ha connectades 87 estacions de treball, cinc impressores. Totes les estacions formen part d'un domini Windows controlat des d'un servidor central (Dell) que fa, a més, tasques de servidor de correu electrònic i DNS del domini propi del CRM. Aquesta xarxa LAN és connectada a Internet a través de la xarxa de la UAB mitjançant un enllaç de 1.000 Mbps, amb un NetScreen 5 que actua com a encaminador, tallafocs i VPN. El centre disposa també de connexió a Internet sense cables i de set canons de projecció.

1.10. Venues

The CRM has facilities in the UAB Faculty of Sciences with a total floor space of 2.125 m2, after completion on October 2010 of the enlargement of CRM premises, made possible through Generalitat and UE-FEDER funding. The facilities include secretarial offices, the Directors's desk, up to 60 researcher places, three meeting rooms, three lecture rooms with capacity for 40 people and an auditorium with capacity for 100 people.

To host visiting researchers, CRM uses the facilities provided by Vila Universitària at Bellaterra.

During 2010, the CRM computer equipment was based on a LAN Ethernet net of 1.000/100 Mbps. There were 47 working stations connected to the net, together with five printers. All workstations are part of a Windows domain supplied by one Dell server, which works as a mail server and DNS of the CRM domain (crm.cat). This LAN net is connected to Internet through the UAB net by means of a 1.000 Mbps connection, with a Netscreen 5 acting as a router, firewall and VPN. Wi-Fi connection is also available. The Centre has three projectors, two of them installed in the lecture rooms.

1.11. Serveis externs

El CRM té contractats els serveis de les empreses externes següents:

1.11. External Services

The following companies had service contracts:

Gestió laboral: 3F Consultors

2 La recerca al CRM

Research at CRM

2.1. Els grups de recerca del CRM

Tal i com s'ha dit al paràgraf 1.1., la política científica del CRM es concreta mitjançant dos eixos d'actuació, el segon dels quals contempla la creació de grups de recerca propis en àrees poc desenvolupades a Catalunya. Durant el 2010 han anant prenent forma els següents grups de recerca del CRM:

2.1. CRM Research Groups

As mentioned in section 1.1., the scientific policy of CRM has two main axes, the second one aiming at building its own research groups in underdeveloped areas in Catalunya. During 2010 the following CRM research groups began their consolidation:

- *Harmonic Analysis and Approximation Theory,* coordinated by Sergey Yu Tikhonov
- *Numerical Analysis and Scientific Computing,* coordinated by Blanca Ayuso
- *Computational & Mathematical Biology,* coordinated by Tomás Alarcón
- *Financial Mathematics and Risk Control,* coordinated by Salvador Ortiz
- *Industrial Mathematics,* coordinated by Timothy Myers
- *Complex Systems,* coordinated by Álvaro Corral

2.1.1. Grup de Recerca en Anàlisi Harmònica i Teoria d'Aproximació

Àmbit de Recerca. L'anàlisi harmònica estudia la representació de funcions o senyals com a superposició d'ones elementals. Avui, és un dels camps amb més aplicacions en matemàtiques, entre les quals hi ha el processament del senyal, la transmissió d'imatges, diversos camps en enginyeria, electrònica, probabilitat, física i molts altres camps de les matemàtiques.

La teoria de l'aproximació considera el problema d'aproximar de la forma més senzilla i acurada possible senyals complicats per altres més senzills i més manipulables. El significat de "senzill", "acurada" i "manipulable" depèn de l'aplicació que es consideri. La teoria d'aproximació és un àrea establerta de les matemàtiques en fase de creixement per la varietat de les seves aplicacions, no solament en matemàtiques (anàlisi numèrica, anàlisi en ondetes) sinó també en ciències de la computació, tractament del senyal, biomedicina, geomàtica, etc. Els avenços recents en aproximació no lineal que són de naturalesa teòrica, han permès incrementar la capacitat de manipular i extraure informació de grans conjunts de dades.

2.1.1. Research Group in Harmonic Analysis and Approximation

Research Interests. *Harmonic analysis studies the representation of functions or signals as the superposition of basic waves. Now it is one of the most applicable fields of modern mathematics. Among its many applications are signal processing/image transmission, various electrical and computer engineering applications, probability theory, physics, and many fields of pure and applied mathematics.*

Approximation theory considers the problems of best approximating general and possibly complicated functions by simpler and more easily calculated ones. Concepts ''best'', ''simpler'' and ''easily calculated'' will depend on the applications. Approximation theory is an established and developed area of mathematics. On the other hand, this area currently experiences a significant rise due to its wide applications not only in mathematics (e.g., numerical, wavelet analysis) but also in computer science, signal processing, biomedical optics, and geographic information systems. Recent developments in nonlinear approximation theory are aimed at carrying out fundamental mathematical (compress, denoise, etc.) and algorithmic study to significantly increase our ability to process large data sets.

Projectes vigents *Current Projects*	☐ MTM 2008-05561-C02-02, Diversos aspectos de la teoría de funciones y aplicaciones, Ministerio de Ciencia e Innovación ☐ 2009 SGR 1303 Grup de teoria de funcions de la UB/UAB, Generalitat de Catalunya
Membres del grup *Research Team*	Sergey Tikhonov (team leader), Andriy Bondarenko (postdoctoral researcher), Polina Glazyrina (postdoctoral researcher), Ainur Jumabayeva (Ph.D. student)
Activitats relacionades *Related Activities*	☐ Barcelona Analysis Seminar (every Monday, CRM or UB) ☐ CRM Research Program "Approximation Theory and Fourier Analysis" (September 2011 to February 2012 - Centre de Recerca Barcelona)

Col·laboradors
Related Activities

M. Ash	DePaul University, USA
H. Mhaskar	California State University, USA
E. Nursultanov	L. N. Gumilev Eurasian National University, Kazakhstan
V. Stepanov	Peoples' Friendship University, Moscow, Russia
W. Trebels	Technische Universität Darmstadt, Germany

2.1.2. Grup de Recerca en Anàlisi Numèrica i Computació Científica

Àmbit de Recerca. Els interessos científics es concentren en l'àmbit dels mètodes numèrics per a equacions en derivades parcials. En particular, ens centrem en els mètodes d'elements finits (de diferents tipus). Un dels principals interessos de recerca és el disseny i anàlisi dels mètodes de solució eficient dels sistemes algebraics discrets resultants. Les aplicacions de les tècniques que estudiem són en diversos models matemàtics en Mecànica de Fluids, Mecànica Estructural i més recentment, en les equacions cinètiques en Mecànica Estadística. En particular, treballem en els següents temes:

☐ Post-processament de tècniques per a les equacions de Navier-Stokes en mecànica de fluids.

☐ Tècniques d'estabilització en problemes d'advecció-difusió.

☐ Mètodes d'elements finits (conforme, disconforme i mixt).

☐ Mètodes de Galerkin discontinus.

2.1.2. Research Group in Numerical Analysis and Scientific Computing

Research Interests. *The primary scientific interests are concentrated in the field of Numerical Methods for Partial Differential Equations. In particular, my work is focused on Finite Element Methods (of different types). One of my main research interests is the design and analysis of efficient solution methods for the resulting discrete algebraic systems. The applications of the techniques that I study arise in various mathematical models in Fluid Mechanics, Structural Mechanics, and more recently Kinetic equations in Statistical Mechanics. In particular, I work (or have worked) in the following topics:*

☐ *Post processing techniques for Navier-Stokes equations.*

☐ *Stabilization techniques for steady/unsteady advection-diffusion problems.*

☐ *Finite Element Methods (conforming, non-conforming and mixed).*

☐ *Discontinuous Galerkin Methods.*

- Domini dels mètodes de descomposició.
- Solucionadors iteratius multinivell i multigrau
- Aproximació numèrica d'equacions cinètiques.

- *Domain decomposition Methods*
- *Multilevel and Multigrid Iterative Solvers*
- *Numerical Approximation of Kinetic Equations*

Projectes vigents
Current Projects

- MTM2008 - 03541, PI: Enrique Zuazua
- HI2008-0173 (Accion integrada España-Italia) PI español: Blanca Ayuso. PI (italiano): L. D. Marini

Membres del grup
Research Team

Blanca Ayuso (Ramón y Cajal fellow)

Activitats relacionades
Related Activities

- B. Ayuso de Dios has been a member of the Scientific Comitee of the SIMAI 2010 Biannual Congress to be held at Cagliari (Italy), in June 2010.
- Advances in Domain Decomposition, Multilevel and Multigrid Methods, at joint SIAM/RSME-SCM-SEMA Meeting, Barcelona, Spain, May-June 2010. (12 speakers), Co-organizer: L.T. Zikatanov.
- Discontinuous Galerkin Methods for Partial Differential Equations, at joint SIAM/RSME-SCM-SEMA Meeting, Barcelona, Spain, May-June 2010. (24 speakers), Co-organizers: L.D. Marini & C.W. Shu.
- Domain Decomposition Methods, Iterative Solvers and Adaptive Methods, at SIMAI 2010 Biannual Congress, Cagliari (Italy) June 2010. (12 speakers). Co-organizers: S.Schacchi, S. Perotto, M. Verani.

Col·laboradors *Collaborators*	L.Donatella Marini	Universita degli Studi di Pavia, Italy
	F. Brezzi	Istituto di Matematica Applicata e Tecnologie Informatiche (IMATI)-CNR & Istituto Universitario di Studi Superiori (IUSS), Pavia, Italy
	Ludmil T. Zikatanov	Penn State University , USA
	Paola F. Antonietti	MOX & Politecnico de Milano, Italy
	Chi-Wang Shu	Brown University, USA
	Jose Antonio Carrillo	ICREA & UAB, Spain
	Yunrong Zhu	University of California at San Diego, UCSD, USA
	Michael Holst	University of California at San Diego, UCSD, USA
	Johannes Kraus	Johann Radon Institute for Computational and Applied Mathematics , RICAM, Linz, Austria

2.1.3. Grup de Recerca en Biologia Computacional i Matemática

Àmbit de Recerca. La majoria dels fenòmens estudiats per les Ciències Naturals, des de Ciència de Materials a Astrofísica, són processos d'escales múltiples, és a dir, són fenòmens que impliquen l'acoblament de processos que tenen escales espacials i temporals característiques molt diferents, de manera que el comportament global emergeix d'aquesta interacció. Mentre que en el camp de les Ciències Físiques s'ha fet un progrés considerable en el tractament d'aquest tipus de fenomen, els resultats obtinguts per sistemes biològics són bastant més modestos. Aquest estat de coses es deu a que la unitat fonamental en sistemes vius (la cèl·lula) és molt més complexa que les corresponents unitats en sistemes inerts. Per tant, es necessiten tant models com mètodes nous per analitzar els processos d'escales múltiples en Biologia. Aquest és el camp de recerca del grup de Biologia Computacional i Matemàtica al CRM: La formulació de nous models que sigui rellevants tant per biòlegs experimentals com per investigadors clínics, i el desenvolupament de les eines computacionals i analítiques necessàries pel seu estudi. Ens centrem en problemes de rellevància clínica, en particular en problemes relacionats amb càncer.

L'activitat del nostre grup s'articula al voltant de les següents línies de recerca:

2.1.3. Research Group in Computational and Mathematical Biology

Research Interests. *Most phenomena studied by the Natural Sciences, from Material Sciences to Astrophysics, are multi-scale processes, i.e. they involve the coupling of multiple different processes characterised by widely-ranging time and length scales, with the macroscopic behaviour emerging from the complex interactions between them. Whilst considerable progress has been done in dealing with such problems in the Physical Sciences, the success achieved so far in the Biological Sciences is rather more limited. This is partly due to the fact that the individual components of biological systems (e.g. cells) are much more complex than their counterparts in physical systems and, therefore, new methods and models are needed to analyse multi-scale processes in Biology. Such is the remit of the Computational & Mathematical Biology group at CRM: To propose new models relevant to experimental biologists and clinicians and develop the analytical and computational tools necessary for their analysis. We pay special attention to problems with clinical relevance, in particular those related to cancer.*

The research activity of our group is developed along the following lines:

☐ Modelització d'escales múltiples de creixement tumoral i angiogènesi

☐ Dinàmica evolutiva de poblacions amb estructura complexa, en particular, poblacions de cèl·lules amb estructura jeràrquica i mapa entre genotip i fenotip

☐ Modelització del cicle cel·lular

☐ Modelització estocàstica de receptors tirosina-quinasa

☐ Tumors latents

☐ *Multiscale modelling of tumour growth and tumour-induced angiogenesis*

☐ *Evolutionary dynamics of populations with complex structure, in particular cell populations with hierarchical structure and genotype-phenotype map*

☐ *Mathematical modelling of the cell-cycle*

☐ *Stochastic modelling of receptor tyrosine kynases*

☐ *Tumour dormancy*

Projectes vigents
Current Projects

☐ Angiogenesis in Diabetic Retinopathy: Integrating Experiment into Modelling Dynamics. Principal Investigator: Rui Travasso, Department of Physics, Universiy of Coimbra, Portugal. Funded by the Portuguese government

☐ Grup de Recerca Consolidat en Equacions en Derivades Parcials i Applicacions de la UAB-UPC-UdG. Principal Investigator: José Antonio Carrillo de la Plata, Departament de Matemàtiques, Universitat Autònoma de Barcelona, Barcelona, Spain. Funded by the Catalan government.

Membres del grup
Research Team

Tomás Alarcón	(team leader)
Pilar Guerrero	(post-doctoral researcher)
Esther Ibáñez	(Ph.D. student)
Daniel Sánchez	(Ph.D. student)

Activitats relacionades
Related Activities

☐ Computational & Mathematical Biology Seminar

Col·laboradors *Collaborators*	Helen M. Byrne	Centre for Mathematical Medicine University of Nottingham
	Aurora Hernandez-Machado	Universitat de Barcelona
	Henrik Jeldtoft	Jenesen Imperial College London
	Philip K. Maini	Centre for Mathematical Biology
	Markus R. Owen	Centre for Mathematical Medicine
	Pablo Padilla	Universidad Nacional Autónoma de México
	Karen M. Page	University College London
	Juan Soler	Universidad de Granada
	Rui Travasso	Universidade de Coimbra

2.1.4. Grup de Recerca en Sistemes Complexos

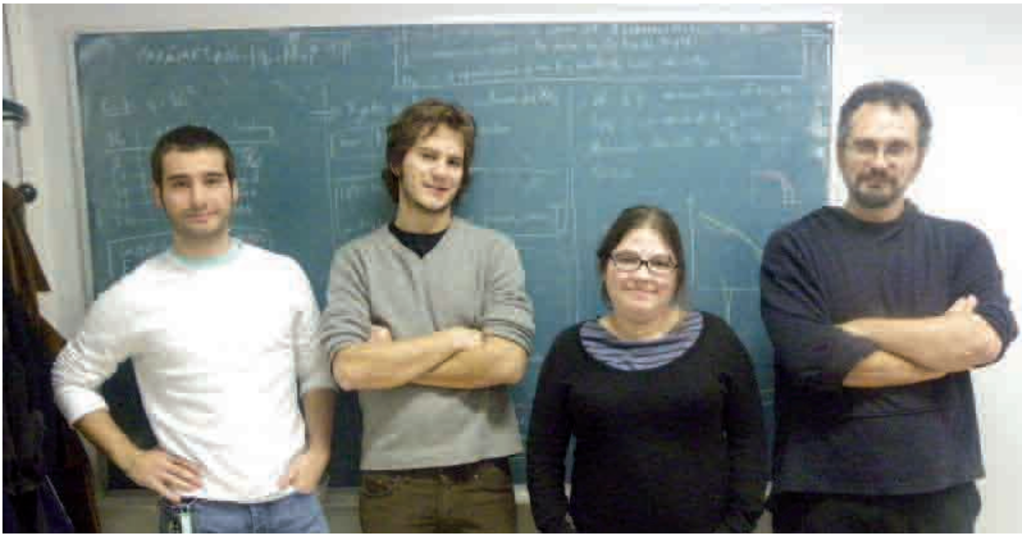
Àmbit de Recerca. Podem considerar com a sistemes complexos aquells formats per un nombre molt gran de components que interactuen intensament. Molts dels reptes actuals de la humanitat estan en comprendre el comportament de sistemes complexos, com és ara el clima, la economia, la societat, el cervell humà, la biologia, etc. En oposició a aquest concepte, l'àtom d'hidrogen, el sistema solar o un gas ideal serien sistemes simples, malgrat que per descriure'ls necessitem conceptes profunds de la física i matemàtiques sofisticades. Tanmateix, si tot allò que és complex és un sistema complex, que aporta de nou el nou paradigma de la complexitat? Tots aquests sistemes d'àmbits tan diversos, poden ser tractats des d'una única perspectiva? Una de les idees clau en els estudis de complexitat es que les estructures apareixen en aquest tipus de sistemes a tots els nivells, incloent nivells molt distants dels propis de la interacció entre les components, i a més mostren regularitats estadístiques sorprenents.

En el grup de Sistemes Complexos del CRM ens concentrem en dues línies de recerca: el primer, desastres naturals i fenòmens meteorològics, resultat de l'activitat complexa de la Terra, i el segon, l'estructura de la informació en les comunicacions entre humans, resultat de l'activitat complexa de les zones del cervell que les controlen i de les relacions socials entre els comunicadors.

2.1.4. Research Group in Complex Systems

Research Interests. *We can consider complex systems to be ones formed by a large number of heavily interacting elements. As a result, many of mankind's greatest challenges come from trying to unravel the behaviour of these systems, such as the climate, the economy, society, the brain, biological development, etc. However, contrary to this, the hydrogen atom, solar system or an ideal gas would be simple systems, despite the fact that in order to study them we need to use in-depth physics concepts and sophisticated mathematics. However, if everything that is complex is a complex system, what does the new science of complexity bring to the table? Can such wide-ranging systems be tackled with a single perspective? One of the key ideas in complexity studies is that structures appear in these types of systems at all levels, including levels far in excess of those achieved by the interaction between components; as well as this, the structures also show surprising statistical regularities.*

At the Complex Systems Group, we focus on two major lines of research: one, natural disasters and meteorological phenomena, resulting from the complex activity of the Earth's system, and the other, the structure of the information in human communication, produced by the areas of the brain responsible for this and the relationship between the speakers.



Projectes vigents
Current Projects

- FIS2009-09508 Complejidad y leyes de escala en fenómenos meteorológicos, desastres naturales y lenguaje humano, coordinated by Alvaro Corral
- 2009SGR-164 Grup de recerca consolidat de física estadística, coordinated by David Jou

Membres del grup
Research Team

Álvaro Corral	(team leader)
Ana Deluca	(Ph.D. student)

Activitats relacionades
Related Activities

- Beyond physics: Multidisciplinary challenges Seminar
- Seminar of the network complexitat.cat

Col·laboradors
Related Activities

Ole Peters	Imperial College
Josep Enric Llebot	Universitat Autònoma de Barcelona
Gemma Boleda	Universitat Politècnica de Catalunya
Albert Díaz-Guilera	Universitat de Barcelona
Ramon Ferrer i Cancho	Universitat Politècnica de Catalunya
Lucas Lacasa	Institute for Cross-Disciplinary Physics and Complex Systems
Lucilla de Arcangelis	Second University of Naples

2.1.5. Grup de Recerca en Matemàtica Financera i Control de Risc

Àmbit de Recerca. El principal objectiu d'aquesta línea de recerca és estudiar problemes de caire tant teòric com aplicat que apareixen en Finances Quantitatives. Aquest àmbit de recerca ha experimentat un creixement exponencial en els darrers anys, i es basa en utillatge matemàtic

2.1.5. Research Group in Financial Mathematics and Risk Control

Research Interests. *The main goal of this line of research is to study certain problems, both theoretical and applied, appearing in the field of Quantitative Finance. This area of research has experienced an exponential growth in recent years and the mathematical tools used are as* tan divers com l'Anàlisi Estocàstica, Equacions en Derivades Parcials, Anàlisi Numèrica, Estadística, etc.

diverse as: Stochastic Analysis, Partial Differential Equations, Numerical Analysis, Statistics, etc.

Alguns dels problemes que estudiem són:

- Computació numèrica d'opcions exòtiques "Greeks" en models financers basats en processos de Lévy.
- Simulació numèrica d'equacions diferencials estocàstiques governades per processos de Levi.
- Inversió de processos estocàstics.
- Mètodes Monte Carlo de reducció de variància utilitzant variables antitètiques en alta dimensió.

Some of the problems we are studying are:

- *Numerical computation of exotic options "Greeks" in Lévy driven financial models.*
- *Numerical simulation of stochastic differential equations driven by Lévy processes.*
- *Inversion of the spot processes.*
- *Monte Carlo variance reduction using antithetic variates in higher dimensions.*

Projectes vigents
Current Projects

- MTM2009-06647-E. Explora: Matemática de la Ingeniería Financiera
- CONTRATO FUTURE I-MATH: Matemática Financiera

Membres del grup
Research Team

Salvador Ortiz	(team leader)
Maite Naranjo	(Ph.D. student)
Albert Ferreiro	(Ph.D. student)
Luis Ortiz	(Ph.D. student)

Activitats relacionades
Related Activities

- Seminari de Finances Quantitatives, Xarxa temàtica del CRM
- Financial Engineering Summer School, June 2010, Bolsa de Madrid

Col·laboradors
Related Activities

Sebastian del Baño	Citybank
Arturo Kohatsu-Higa	Ritsumeikan University and Japan Science and Technology Agency
Peter Tankov	Centre de Mathématiques Appliquées. École Polytechnique

2.1.6. Grup de Recerca en Matemàtica Industrial

Àmbit de Recerca. La matemàtica industrial és un terme poc precís que cobreix bàsicament qualsevol aplicació de les matemàtiques en un context industrial. El grup de recerca del CRM centra el seu treball en quatre àrees principals:

☐ Canvi de fase. Es produeixen transicions de fase en un gran nombre de situacions naturals i industrials com, per exemple, la formació del gel, la formació del metall a partir de l'estat fos, la fabricació de discos informàtics, les cobertures de xocolata i molts més. El modelatge de les transicions de fase requereix l'estudi del flux calorífic en les diferents fases, que es defineixen en un domini desconegut i en moviment.

☐ Fluxos de pel·lícula fina. Possiblement, la definició de "fi" sigui una mica ambigua. Els fluxos de pel·lícula fina poden incloure el moviment de lubrificants, pintures, l'aigua que baixa per una finestra, l'aire que suporta un disc dur de rotació ràpida o el moviment de la lava o d'una glacera. El modelatge matemàtic dels fluxos de pel·lícula fina pot donar lloc a una gran varietat de comportaments i, òbviament, té moltes aplicacions.

☐ Fluxos de fluids no newtonians. Un fluid newtonià té una viscositat constant; l'aigua n'és l'exemple més evident. Tanmateix, pràcticament la majoria dels fluids interessants presenten una viscositat variable. Per exemple, les pintures i els olis tenen un comportament pseudoplàstic (esdevenen menys viscosos quan se'ls aplica una força tallant). Alguns fluids com la pasta de dents, la xocolata desfeta o el quetxup es comporten com un sòlid fins que s'aplica la força suficient. La majoria de productes alimentaris líquids i fluids biològics són no newtonians, per exemple, la sang té un comportament pseudoplàstic, però aquest comportament també depèn de la mida del vas sanguini. Per tant, hi ha un gran interès en el modelatge dels fluids no newtonians i en l'aplicació pràctica dels models d'aquest tipus de fluids.

☐ Mecànica dels cristalls líquids. Els cristalls

2.1.6. Research Group in Industrial Mathematics

Research Interests. *Industrial mathematics is a rather loose term, basically covering any application of mathematics in an industrial context. The research group at CRM has four main focus areas:*

☐ *Phase change. Phase transitions occur in a multitude of natural and industrial situations such as in ice formation, metal formation from the molten state, computer disk manufacture, chocolate coating and many more. To model phase transitions requires studying heat flow in the different phases, which are defined over an*

☐ *Thin film flows. The definition of "thin" is perhaps rather ambiguous. Thin film flows can cover the motion of lubricants, paints, water running down a window, the air supporting a rapidly rotating computer hard drive or the motion of lava or a glacier. Mathematical modelling of thin film flows can lead to a rich variety of behaviour and obviously has many applications*

☐ *Non-Newtonian fluid flows. A Newtonian fluid has a constant viscosity. Water is the most obvious example. However, most practically interesting fluids have a variable viscosity. For example, paints and oils are shear thinning (they become less viscous when a shear force is applied). Certain fluids such as toothpaste, molten chocolate or ketchup behave as a solid until sufficient force is applied. Most liquid food products and biological fluids are non-Newtonian, for example, blood is shear thinning, but its behaviour also depends on the size of the blood vessel. There is therefore great interest in the modelling of non-Newtonian fluids as well as the application of non-Newtonian fluid models to practical situations*

☐ *Liquid Crystal Mechanics. Liquid crystals are fluids that have properties from both conventional liquids and solid crystals. They are found in physical and biological systems and are involved in all areas of science, mathematics and engineering. Perhaps the most familiar application of liquid crystals is in electronic displays such as* líquids són fluids que tenen propietats tant dels líquids convencionals com dels cristalls sòlids. Es troben en sistemes físics i biològics, i apareixen en totes les àrees de la ciència, les matemàtiques i l'enginyeria. Possiblement, l'aplicació més coneguda dels cristalls líquids siguin les pantalles electròniques, com les TV LCD i molts dispositius portàtils. La teoria d'Ericksen-Leslie és un dels models continus de més èxit dels cristalls líquids i l'utilitzem per modelar l'estabilitat hidrodinàmica d'un cristall líquid en un sistema de formació de patrons.

LCD TVs and many handheld devices. The Ericksen-Leslie theory is one of the most successful continuum models for liquid crystals and we use this to model the hydrodynamic stability of a liquid crystal in a pattern-forming system.

Projectes vigents
Current Projects

- PIRG06-GA-2009-256417 Industrial Applications of Moving Boundary Problems, coordinat per Tim Myers
- MTM2010-17162 Problemas de frontera móvil en presencia de capas líquidas, coordinat per Tim Myers

Membres del grup
Research Team

Tim Myers	(team leader)
Jonathan Low	(postdoctoral researcher)
Michelle De Decker	(Ph.D. student)
Francesc Font	(Ph.D. student)

Activitats relacionades
Related Activities

- Industrial Mathematics Seminar
- Workshop on Mathematical modelling of blood flow and baroreflex system
- Industrial Mathematics Thematic Network Seminar

Col·laboradors
Related Activities

Jon Chapman	University of Oxford
Jean Charpin	University of Limerick
Linda Cummings	New Jersey Institute of Technology
James Hill	University of Adelaide
Sarah Mitchell	University of Limerick
Ebrahim Momoniat	U. Witwatersrand
Brian Wetton	University of British Columbia

2. 2. Personal investigador del CRM

En correspondència amb els dos eixos d'actuació del CRM, en el centre hi conviuen dos tipus de personal investigador: els investigadors vinculats contractualment al CRM, que llistem en aquesta secció, i els investigadors visitants (secció 2.3).

2.2.1. Investigadors preconsolidats o consolidats

Els investigadors preconsolidats o consolidats del CRM són caps de línia de recerca. A continuació es troben els seus informes de l'any 2010.

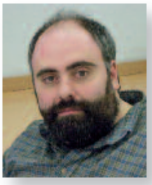
2. 2. CRM Research staff

Accordingly with the two activity axes of CRM, two type of researchers can be found: the ones employed by CRM, quoted in this section, and the visiting researchers (section 2.3)

2.2.1. Investigadors preconsolidats o consolidats

The tenure-track or tenured researchers lead research lines. Their 2010 reports follow.

Report by Tomás Alarcón:



During 2010 my research has focused on modelling two different aspects of tumour growth, namely, the analysis of mechanisms of drug resistance in solid tumours and the analysis of the so-called "tumour dormancy", a phenomenon occurring in a several types of cancer whereby small cancer cell colonies (micro-metastases) can persist for years after surgical removal of the primary tumour in a latent state, undetectable to the usual diagnostic tools and that can regrow at any time thus leading to relapse.

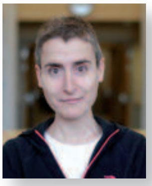
Regarding the former, i.e. mechanisms for drug resistance, we have explored a new mechanism based on quiescence-induced evolutionary escape. Evolutionary escape refers to an evolutionary process where a cell population under stress (in our case, the presence of a drug) develops an strategy that allows a part of the population to elude the action of the toxic agent. The mechanism we have proposed in based on the presence of a part of the tumour cell population which undergo quiescence, i.e. the stay in a latency state where cells do not proliferate but they are immune to the drug. We have shown that this is indeed a mechanism which allows the tumour to evade the action of cytotoxic and radio-therapy. This work has been done in collaboration with Prof. Henrik J. Jensen, Institute for Mathematical Sciences, Imperial College London. See reference [1].

Concerning our study of tumour dormancy, we have applied a probabilistic mathematical model to long-term follow-up studies of postresection patients to investigate the factors involved in mediating breast cancer dormancy. Our results suggest that long-term dormancy is maintained most often by just one growth-restricted dangerous micrometastasis. Analysis of the empirical data by Approximate Bayesian Computation indicated that patients in dormancy have between 1 and 5 micrometastases at 10 years postresection, when they escape growth restriction with a half-life of <69 years and are >0.4 mm in diameter. Before resection, primary tumors seed at most an average of 6 dangerous micrometastases that escape from growth restriction with a half-life of at least 12 years. Our findings suggest that effective preventive treatments will need to eliminate these small numbers of micrometastases, which may be *preangiogenic and nonvascularized until they switch to growth due to one oncogenic mutation or tumor suppressor gene inactivation. In summary, breast cancer dormancy seems to be maintained by small numbers of sizeable micrometastases that escape from growth restriction with a half-life exceeding 12 year. This investigation has been done in collaboration with colleagues in University College London, Cancer Research UK and Oxford University. See reference [2].*

[1] T. Alarcon and H.J. Jensen. Quiescence: a mechanism for escaping the effects of drug on cell populations. J. R. Soc. Interface. 8, 99-106 (2010)
[2] L. Willis, T. Alarcon, G. Elia, J.L. Jones, N. Wright, T.A. Graham, I.P.M. Tomlinson, K.M. Page. Breast cancer dormancy can be maintained by a small number of micrometastases. Cancer Research. 70, 4310-4317 (2010).

Report by Blanca Ayuso de Dios: *My primary scientific interests are concentrated in the field of Numerical Methods for Partial Differential Equations. In particular, my work is focused on Finite Element Methods (of different types). One of my main research interests is the design and analysis of efficient solution methods for the resulting discrete algebraic systems.*

Publications



1. B. Ayuso de Dios, J.A. Carrillo and C.W. Shu, Discontinuous Galerkin Methods for the Multidimensional Vlasov-Poisson system, Preprint CRM 2010, submitted to Numerische Matematik.

2. B. Ayuso de Dios, M.Holst, Y. Zhu and L.T. Zikatanov Multilevel Preconditioners for Discontinuous Galerkin approximations of elliptic problems with jump-coefficient problems, IMA technical report 2356 (2010), submitted to Mathematics of Computation.

3. B. Ayuso de Dios, F. Brezzi , O. Havle, L.D. Marini, L2-error estimates of the IIPG-0 method, submitted to Numerical Methods for Partial Differential Equations (2010).

4. B. Ayuso, L. T. Zikatanov, A Simple Uniformly Convergent Iterative Method for the Non-Symmetric Incomplete Interior Penalty Discontinuous Galerkin discretization, in Domain Decomposition Methods in Science and Engineering XIX, Series: Lecture Notes in Computational Science and Engineering, Vol. 78, pp. 335{342, (2011), Springer.

Contributions to Congresses

1. Invited Plenary Talk at WORKSHOP: Numerical Solutions of Partial Differential Equations: Fast Solution Techniques at Institute for Mathematics and its Applications (IMA), University of Minnesota (December 2010).

2. Talk at Mynisimposia, Multilevel methods for discontinuous Galerkin discretizations of elliptic problems with jump coefficients, SIMAI 2010, Caligari.

3. Contributed talk: Preconditioning DG methods via FE space decompositions, Finite Element Circus May 2010 Brown University.

Seminars/Colloqiums at Universities and Research Centers

1. Discontinuous Galerkin Approximation to the Vlasov-Poisson system, Seminar at Institute for Mathematics and its Applications (IMA), University of Minnesota (November 2010).

2. Canonical decompositions for Discontinuous Galerkin methods and Preconditioning, Mathematical Sciences Department Colloquium, Penn State University, USA (September 2010).

3. Discontinuous Galerkin Approximation to the Vlasov-Poisson system, Mathematics department Colloquium, University of Tennessee at Knoxville, USA (September 2010).

4. Canonical decompositions for Discontinuous Galerkin methods and Preconditioning, Mathematical Sciences Department Colloquium, Worcester Polytechnic Institute, USA, April 2010.

5. Canonical decompositions for Discontinuous Galerkin methods and Preconditioning, The Institute for Computational Engineering and Sciences (ICES), the University of Texas at Austin, USA, March 2010.

6. A new family of Discontinuous Galerkin Methods for the Vlasov-Poisson system, Scientific Computing Seminar at Division of Applied Mathematics, Brown University, USA, February 2010.

Organization of conferences, Workshops & participation in Committees

1. Member of Scientic Committee of the SIMAI 2010 Biannual Congress held at Cagliari (Italy), in June 2010.

2. Advances in Domain Decomposition, Multilevel and Multigrid Methods, at joint SIAM/RSME-SCM-SEMA Meeting, Barcelona, Spain, May-June 2010. (12 speakers),Co-organizer: L.T. Zikatanov.

3. Discontinuous Galerkin Methods for Partial Differential Equations, at joint SIAM/RSME-SCM-SEMA Meeting, Barcelona, Spain, May-June 2010. (24 speakers),Co-organizers: L.D. Marini & C.W. Shu.

4. Domain Decomposition Methods, Iterative Solvers and Adaptive Methods, at SIMAI 2010 Biannual Congress, Cagliari (Italy) June 2010. (12 speakers), Co-organizers: S.Schacchi, S. Perotto, M. Verani.

Invited Research Stays at Universities and Research Centers

1. Institute for Mathematics and its Applications (IMA), University of Minnesota, Minneapolis, USA, 30/10/10-18/12/10, Topic: Simulating Our Complex World: Modeling, Computation and Analysis.

2. Mathematics department, Penn-State University, State College, USA, September 2010, 4 weeks, topic: solvers for DG.

3. Isaac Newton Institute for Mathematical Sciences in Cambridge, Cambridge, UK, 15/08/10—02/09/10, topic: Partial Differential Equations in Kinetic Theories.

4. Instituto di Matematica Applicata e Tecnologie Informatiche, IMATI-CNR, Pavia, Italy, June-July 2010, research collaboration.

5. Division of Applied Mathematics, Brown University, Providence, USA, Feb-May 2010, research collaboration.

6. Mathematics department, Penn-State University, State College, USA, April 2010, research collaboration.

7. The Institute for Computational Engineering and Sciences (ICES), Austin, Texas, USA, April 2010, topic: Subsurface Modeling.

8. Mathematics department, Penn-State University, State College, USA, Enero 2010, research collaboration.

Report by Álvaro Corral

I study the behavior of the so called complex systems, which are systems built by many units under interaction, and are widespread across the natural and the social sciences. We focus in the outcomes of two complex systems: on the one hand, the Earth, at the tectonic, oceanic, atmospheric, and ecological level, investigating diverse natural hazards and related meteorological phenomena, such as earthquakes, hurricanes, rainfall, or forest fires. On the other hand, we are interested in the properties of one of the main products of the human brain: language, as reflected in texts or speech.

Our approach starts at the phenomenological level, with the detailed analysis of observational data or representative text corpora. The goal is finding statistical patterns that could be formulated as new probabilistic laws. The probabilistic description can shed light on the limits of predictability in these systems. In the cases considered so far, it has been found that the probability distributions measuring diverse properties of the phenomena usually verify scaling laws, signaling the existence of scale invariance. In this way, for natural hazards, the very frequent small events can be a model for the occurrence of the scarce big ones. Regarding text analysis, the patterns of word repetitions could help in the automatic detection of keywords. The second step is the introduction of simple models that are able to reproduce the properties of the systems.

Invited Talks

1. *Earthquakes in the Ocean-Atmosphere Interface?,* Workshop on Fluctuations in Materials Properties: Physics, Geoscience and Environment, Courmayeur, Aosta, Italia, January 2010.

2. A. Corral, A. Osso and J. E. Llebot, *Power Law and Scaling in the Energy of Tropical Cyclones,* American Geophysical Union Fall Meeting, San Francisco, EEUU, Diciembre 2010.

3. A. Corral, *Power Laws and Scaling Laws in Natural Hazards and Text Statistics,* Grup d'Estadistica, Departament de Matematiques UAB, 11 de noviembre de 2010.

Non-Invited Communications

1. Deluca, O. Peters, J. D. Neelin, C. Holloway and A. Corral, *Universality and scale invariant features in high resolution rain time serie,* Poster (by A. Deluca), 10th International Precipitation Conference, Coimbra, Portugal, Junio 2010.

2. Corral, A. Osso and J. E. Llebot, *Power-law Behavior and Scaling in the Dissipation of Tropical Cyclones,* International Workshop in Recent Achievements on the Study of Extreme Events, Postdam, Alemania, Septiembre 2010.

3. Corral, O. Peters, A. Deluca, J. Neelin. and C. Holloway, *Universality of Rain Event Size Distributions (poster),* American Geophysical Union Fall Meeting, San Francisco, EEUU, Diciembre 2010.

Published Research Papers

1. Corral, A. Osso and J. E. Llebot, *Scaling of Tropical-Cyclone Dissipatio,* Nature Phys. 6, 693–696 (2010).

2. O. Peters, A. Deluca, A. Corral, J. D. Neelin and C. E. Holloway, Universality of rain event size distributions, J. Stat. Mech. P11030 (2010).

Preprints

1. A. Deluca and A. Corral,Power Laws and Scaling of Rain Events and Dry Spells in the Catalonia Region, Submitted to Natural Hazards and Earth System Sciences, http://www.crm.cat/Publications/10/Pr971.pdf

2. A. Corral, F. Font and J. Camacho, Non-characteristic Half-lives in Radioactive Decay, Submitted to New Journal of Physics.

Book Chapter

A. Corral, Tropical Cyclones as a Critical Phenomenon, Book: Hurricanes and Climate Change: Volume 2, Editores: J. B. Elsner, R. E. Hodges, J. C. Malmstadt and K. N. Scheitlin, Springer, Heidelberg, Serie: Aegean Conferences, Pages: 81–99, ISBN: 978-90-481-9509-1.

Master Thesis Supervised

Director del trabajo de fin de máster de Mathematical Engineering, de Francesc Font Martínez.
Título: Probability Distribution of the Radionuclide Half-lives, Calificacion: 9.5 (sobre 10), Universitat Politecnica de Catalunya, Fecha de la defensa: marzo de 2010.

Appearances of the CRM in Written Communication Media

1. The simple law of hurricanes decrees a stormy future, New Scientist, 17/7/2010, p. 14, Ver: https://www.crm.cat/acorral/papers/corral_hurricanes_new_scientist10.pdf

2. Huracanes, intensidad impredecible, Epoca 15/8/2010, p. 58, Ver: https://www.crm.cat/acorral/papers/corral_hurricanes_epoca10.pdf

Report by Timothy Myers

My research primarily dealt with three distinct topics:

1. *Approximate solution methods for one-dimensional phase change.*
2. *Flow and solidification in a narrow channel.*
3. *Modelling the cardiovascular system.*

The first area involved developing basic methodologies that may then be applied to more general phase change problems, with the aim of finding analytical solutions to complex problems, see [3,4,6,7]. This work has already proved useful in the second field and one of the methods was adapted to approximate the solution to the boundary layer flow of a non-Newtonian fluid [5]. The second area has been applied to the field of contact melting (a process used in thermal storage systems) and phase change valves in micro-channels [1]. It also inspired an investigation into the observed flow enhancement in carbon nanotubes, which in turn led to a possible physical interpretation of the classical Navier slip condition on hydrophobic surfaces [2]. The third area has been carried out in collaboration with a local company Sabirmedical, with the goal of automatically interpreting blood pressure measurements. In July I was a main organizer of the 7th Grups d'Estudi de Matemàtica i Tecnologia (Gemt 2010 also titled 78th European Study Group with Industry) held at CRM. This is a type of meeting, popular throughout the world, where industry representatives present problems of current interest and a group of academics try to make progress on the problem during the meeting. In a similar vein I organized a focused meeting, Mathematical Modeling of Blood Flow and the Baroreflex System, in December. This was in collaboration with a local company, SabirMedical, who specialize in the development of novel technologies for diagnosis, home and patient care. The specific aim of the meeting was to model the cardiovascular system to enable automatic interpretation of the blood pressure signal.

I invited a number of international collaborators to visit CRM, namely: Prof. James Hill (U. Adelaide), Prof. Linda Cummings (NJIT), Dr Sarah Mitchell (U. Limerick), Prof. Andrew Fowler (U. Oxford/U. Limerick), Prof. Mark McGuinness (U. Wellington). Publications are currently in preparation with all but one of these visitors.

Dissemination

In addition to the usual channel of disseminating material through journal publications, see the list below, I began a weekly seminar series on industrial mathematics, involving both local and international speakers. These meetings have now evolved into the Industrial and Biological Mathematics series. I am also a main organizer of the related Industrial Mathematics Thematic Network seminars. An attendee at the blood meeting, Prof. Andrew Fowler, gave the first talk in the series on models for ice age occurrence. I attended and gave talks at meeting in Barcelona (DSPDES, Gennesys congress on Nanotechnology) and Germany (ECMI) and gave departmental colloquia at UPC, UAB and the University of Limerick as well as seminars at UPC (the LACAN group) and UAB (GREDPA). Finally, with the hope of luring local students towards practical applied mathematics I gave a short course at UPC as part of the Jornades D'introducció Als Sistemes Dinàmics summer school and taught a Masters course in the autumn semester on Mathematical Modelling.

Publications

1. Myers T.G. and Low J. *An approximate mathematical model for solidification of a flowing liquid in a microchannel. Submitted to Microfluidics and Nanofluidics Dec. 2010.*

2. T.G. Myers *Why are slip-lengths so large in carbon nanotubes? Microfluidics and Nanofluidics. Available online Dec. 2010.*
DOI 10.1007/s10404-010-0752-7.

3. Myers T.G. & Mitchell S. *Application of the Combined Integral Method to Stefan problems. Submitted to Appl. Math. Modelling 2009.*

4. Mitchell S. & Myers T.G. *Improving the accuracy of heat balance integral methods applied to thermal problems with time dependent boundary conditions. Int. J. Heat & Mass Trans. 2010.*
DOI: 10.1016/j.ijheatmasstransfer.2010.04.015

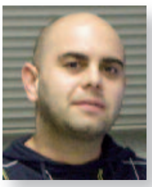
5. Myers T.G. *An approximate solution method for boundary layer flow of a power law fluid over a flat plate. Int. J. Heat & Mass Trans. 2010.*
DOI:10.1016/j.ijheatmasstransfer.2010.02.006

6. Myers T.G. *Optimal exponent heat balance and refined integral methods applied to Stefan problems. Int. J. Heat & Mass Trans. 2010.*
DOI:10.1016/j.ijheatmasstransfer.2009.10.045

7. Mitchell S.L. & Myers T.G. *The application of standard and refined heat balance integral methods to one-dimensional Stefan problems.* SIAM Review 52(1) 2010. DOI.10.1137/080733036

8. Myers T.G., Fowkes N.D. & Ballim Y. *Modelling the cooling of concrete by piped water.* ASCE J. Engng Mech. 2010.
DOI: http://dx.doi.org/10.1061/(ASCE)EM.1943-7889.0000046

Report by Salvador Ortiz



The main topics of my research during 2010 have been: the modelling of financial markets with inside information and the weak approximation of stochastic differential equations driven by Lévy processes.

Modelling of financial markets with inside information. *Here we are interested in the modelling of the portfolio optimization problem, when there are agents with different information flows in the same market. In particular, there is one agent (the insider) that has the information contained in the stock prices and some additional information. In the classical Karatzas-Pikovsky* *approach, this is modelled using the initial enlargement of filtrations technique and the price dynamics is exogenously given. Usually, the optimization problem "explodes" for some additional information, for example, if the additional information is given by maximum of the price process in some finite time interval. In our approach the price process is obtained through an equilibrium mechanism (in the sense of Kyle and Back) and we show that the optimization problem yields finite utilities even for the maximum.*

Weak approximation of SDEs driven by Lévy processes. *Here we study different numerical schemes to approximate the solution of Lévy driven stochastic differential equations. We are interested in weak approximations, that is, in approximating the mathematical expectation of functions of the process at a particular time. We study the case in which the Lévy measure of the driving process is infinite. In this case, the paths of the process have an infinite number of jumps in any time interval, which makes the classical schemes inefficient. We propose to approximate the solution of the original equation by the solution of the same equation but now driven by a Lévy process with finite activity. We find an expansion of the error given by a "classical" term plus a term resulting from an optimization problem with respect to Lévy measure, extending some results in the literature. We also study the case of equations driven by stable Lévy processes. Here, the main difficulty is due to the no existence of the moments of the driven process. These works are ongoing research in collaboration with Arturo Kohatsu-Higa and Peter Tankov.*

Congresess attended

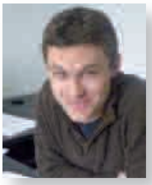
Workshop on ambit processes, non-semimartingales and applications. Thiele Centre, CREATES and Aarhus University. Sandbjerg, Denmark (January 24-28, 2010).

Publications

1. S. Ortiz- A. Kohatsu-Higa, Weak Kyle-Back equilibrium models for Max and ArgMax. SIAM Journal on Financial Mathematics, 1, 179-211, 2010.

2. S. Ortiz-A. Kohatsu-Higa, Modelling of financial markets with inside information in continuous time.
Preprint. http://www.sites.google.com/site/sortizlatorre/publications

Report by Sergey Yu Tikhonov (ICREA)



E. Liflyand In 2010, I have continued my research in Harmonic Analysis and Approximation Theory. More specifically, I have been studying the following topics:

1. *Weighted Fourier Inequalities.*

2. *Weighted Inequalities for Hilbert transforms.*

3. *Approximation inequalities.*

4. *Inequalities for moduli of smoothness.*

5. *Wiener type theorems.*

Published papers

1. M. Ash, S. Tikhonov, J. Tung. “Wiener’s positive Fourier coefficients Theorem in variants of Lp spaces”, Michigan Math. J., Vol. 59, 1 (2010), 143–152.

2. M. Dyachenko, E. Liflyand, S. Tikhonov. “Uniform convergence and integrability of Fourier integrals”, Jour. Math. Anal. Appl., 372, 328–338, 2010.

3. E. Liflyand, S. Tikhonov. “Weighted Paley-Wiener theorem on the Hilbert transform”, C. R. Acad. Sci. Paris, Ser. I 348, 1253–1258, 2010.

4. M.K. Potapov, B.V. Simonov, S. Tikhonov. “Relations between the mixed moduli of smoothness and embedding theorems for Nikolskii classes”, Proceedings of the Steklov Institute of Mathematics, Vol. 269, 197–207, 2010; translation from Russian: Trudy Matem. Inst. V. A. Steklova, Vol. 269, 204–214, 2010.

5. B. Simonov, S. Tikhonov. “Sharp Ul’yanov-type inequalities using fractional smoothness”, Journal of Approx. Theory, Vol. 162, Is. 9 (2010), 1654–1684.

6. S. Tikhonov. “Weak Type Inequalities for Moduli of Smoothness: The Case of Limit Value Parameters”, J. Fourier Anal. Appl., Vol. 16, Is. 4 (2010), 590–608.

7. E. Nursultanov, S. Tikhonov. “Convolution inequalities in Lorentz spaces”, J. Fourier Anal. Appl., Online First.

8. E. Nursultanov, S. Tikhonov. “Net spaces and boundedness of integral operators”, J. of Geometric Analysis, Online First.

9. D. Gorbachev, E. Liflyand, S. Tikhonov, Weighted norm inequalities for Fourier transforms of radial functions, CRM preprint 937, 2010.

10. H. N. Mhaskar, S. Tikhonov, Wiener type theorems for Jacobi series with nonnegative coefficients, CRM preprint 967, 2010

Accepted papers

1. D. Gorbachev, E. Liflyand, S. Tikhonov. “Weighted Fourier Inequalities: Boas conjecture in Rn”, To appear in J. d’Analyse Math.

2. E. Liflyand, S. Tikhonov. “Two-sided weighted Fourier inequalities”. To appear in Annali della Scuola Normale Superiore. Classe di Scienze.

3. E. Liflyand, S. Tikhonov. “A concept of general monotonicity and applications”, To appear in Math. Nachr.

4. H. Mhaskar, S. Tikhonov. “Wiener type theorems for Jacobi series with nonnegative coefficients”. To appear in Proc. Amer. Math. Soc.

5. V. Stepanov, S. Tikhonov. “Two power-weight inequalities for the Hilbert transform on the cones of monotone functions”, To appear in Complex Variables and Elliptic Equations.

6. S. Tikhonov, W. Trebels. “Ulyanov inequalities and generalized Liouville derivatives”, To appear in Proc. Roy. Soc. Edinburgh Sect. A.

Conferences

- 23/08/10-26/08/10: Conference on Approximation Theory, Steklov Mathematical Institute, Moscow, Russia.
- 28/06/10-02/07/10: The Józef Marcinkiewicz Centenary Conference, Poznan, Poland;
- 21/06/10-25/06/10: Summer school and Workshop “Harmonic Analysis and Related Topics IST, Lisbon, Portugal.
- 13/05/10-14/05/10: Conference “Mathematical analysis Alicante, Spain.
- 15/04/10-30/04/10: Intensive Research Program “Euclidean Harmonic Analysis, Nilpotent Lie Groups and PDEs The Centro di Ricerca Matematica Ennio De Giorgi, Pisa, Italy.
- 27/01/10-02/02/10: Conference "Theory of functions and Applications Saratov, Russia.

Seminars, Colloquiums

- 11/10: Colloquium, Delft University of Technology, The Netherlands.
- 10/10; 11/10: Analysis Seminar, Gumilyov Eurasian National University, Astana, Kazakhstan.
- 10/10: Seminar, Kazakh National University Al-Farabi, Almaty, Kazakhstan.
- 04/10: Analysis Seminar, Universidad de La Laguna, Spain.
- 03/10: Barcelona’s Joint Analysis Seminar, Barcelona.

2.2.2. Investigadors postdoctorals

El CRM acull investigadors postdoctorals amb fonts de finançament diverses: beques Marie Curie de la Comissió Europea, programa d'ajudes de recerca per a estades de doctors joves del Ministeri d'Educació (MEC), beques Beatriu de Pinós de la Generalitat de Catalunya, beques de l'EPDI, i beques pròpies del CRM.

Normalment aquestes beques tenen una durada d'entre un i dos anys. El llistat i informes dels investigadors post doctorals que varen treballar al CRM durant l'any 2010 es detalla a continuació:

2.2.2. Postdoctoral researchers

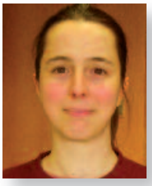
The CRM hosts post-doctoral fellows from several financing sources: Marie Curie Fellowships of the European Commission, research grants for young doctors of the Spanish Ministry of Education, Beatriu de Pinós Fellowships of the Catalan Government, EPDI Fellowships, and CRM's own post-doctoral grants.

Typically these grants have a duration of between one and two years. The list and reports of post-doctoral researchers working at the CRM in 2010 is the following:

Report by Cécile Armana

Research topics: Modular symbols and automorphic forms for function fields of positive characteristic, Drinfeld modular forms, Hecke algebra, Drinfeld modular curves. During my stay at the CRM in 2010, I worked on the following projects in arithmetic geometry and number theory: "Drinfeld modular forms and their expansion, Hecke algebra", "Modular symbols for function fields of positive characteristic","Group of automorphisms of Drinfeld modular curves".

Dissemination



Invited talks at University College , London, March 2010 and Laboratoire Nicolas Oresme, Caen, May 2010.

Talks at the CRM Research Programme "Arithmetic Geometry''
1. "What is a Drinfeld module?" (Jan. 2010).

2. "Torsion of rank-2 Drinfeld modules and Drinfeld modular forms" (Jan. 2010).

3. "On the group of automorphisms of the Drinfeld modular curve X(N)" (Feb. 2010), "Coefficients of Drinfeld modular forms and Hecke operators" (Workshop and Advanced Course on Drinfeld Modules and L-functions) – April 2010.

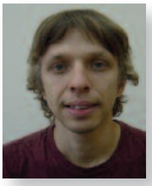
4. In January and February 2010, I organized with Francesc Bars (UAB) and Ignazio Longhi (visitor at the CRM) a workgroup on Anderson's t-motives, based on Anderson's seminal article. I gave two talks during the workgroup.

Publications

1. C. Armana, Coefficients of Drinfeld modular forms and Hecke operators. CRM preprint #947, to appear in Journal of Number Theory 131 (2011), pp. 1435-1460.

2. C. Armana, Sur les symboles modulaires de Manin-Teitelbaum pour F(T). CRM preprint #1001. Submitted.

Report by Andrii Bondarenko

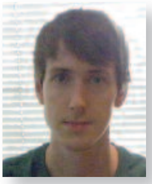


My research focuses on the investigation of optimal configurations on the sphere applying methods of Function Theory and Discrete Mathematics. This includes spherical designs, optimal codes, best packing, energy minimization and other topics related to them. I work on both asymptotic and exact problems. Recently, we have proved the well-known conjecture of Korevaar and Meyers on existence of spherical designs with small cardinalities. I am also interested in different questions in Approximation Theory including shape-preserving approximation. We actively work on the generalizations of Korevaar-Meyers conjecture. We are also going to contribute to a program developed by Hardin and Sloane for spherical designs with the purpose of obtaining its important generalizations for quadrature formulas with positive weights.

Publications

A. Bondarenko, D. Radchenko, and M. Viazovska, Optimal asymptotic bounds for spherical designs, ArXiv:1009.4407v3 [math.MG], submitted.

Report by Sébastien Bubeck



In 2010 my research has been focused on sequential learning. More precisely I moved from the standard setting with a finite set of actions to the more challenging case of an infinite number of actions, represented by a subset of a vector space. I pursued a better understanding of the links between the geometry of the set of actions and the optimal performances one can achieve. In particular, with Jean-Yves Audibert and Gabor Lugosi, we studied the problem of online learning on a graph. This research that was conducted in 2010 will result in several publications in 2011.

Dissemination

Talks at

1. Telecom ParisTech, Paris, November 19th, 2010.

2. Journees MAS 2010 (french conference on applied mathematics), Bordeaux, September 1st, 2010.

3. COLT 2010 (international conference on learning theory), Haifa (Israel), June 29th, 2010.

4. JFPDA 2010 (french conference on planning), Besancon, June 1st, 2010.

5. TRaSH 2010 (international conference on randomized search heuristics), Paris, March 24/25th, 2010.

Publications

1. J.Y. Audibert and S. Bubeck, Regret Bounds and Minimax Policies under Partial Monitoring.
Journal of Machine Learning Research (JMLR) 11, 2635-2686, 2010.

2. J.Y.Audibert, S.Bubeck and R. Munos, Best Arm Identication in Multi-Armed Bandits. In Proceedings of the 23rd Annual Conference on Learning Theory (COLT), 2010.

3. S. Bubeck and R. Munos, Open-Loop Optimistic Planning. In Proceedings of the 23rd Annual Conference on Learning Theory (COLT), 2010.

4. J.Y. Audibert, S. Bubeck and R. Munos, Bandit View on Noisy Optimization. Chapter to appear in the book Optimization for Machine Learning, MIT press, 2010.

5. S. Bubeck, Bandits Games and Clustering Foundations. PhD dissertation, Universit Lille 1, 2010 (runner-up for the Gilles Kahn prize 2010).

Report by José María Cantarero

My area of research is algebraic topology. More specifically, I am interested in equivariant K-theory, topological groups and generalizations and group actions. Some generalizations of topological groups I am particularly interested in are p-local finite groups, p-local compact groups, p-compact groups and loop spaces.

Dissemination

Invited talks at

1. "Completion theorems for groupoid actions", Topologists from Malaga around the world, Universidad de Málaga, February 2010.

2. Seminar talk "The category of spectra is stable", Universitat Autònoma de Barcelona, Junior topology seminar, March 2010.

3. Seminar talk "K-theory and reality", Universitat Autònoma de Barcelona, Topology seminar, March 2010.

4. Seminar talk "About the norm map", Universitat Autònoma de Barcelona, Topology seminar, April 2010.

Meetings attended

1. Advance course on foliations: Dynamics-Geometry-Topology", CRM, May 2010.

2. Conference "Group actions in topology and geometric group theory", Adam Mickiewicz University, Poznan, Poland, June 2010.

Publications

1. "Twisted K-theory for actions of Lie groupoids and its completion theorem", Mathematische Zeitschrift, 2010. DOI: 10.1007/s00209-010-0683-8.

2. "Nilpotent p-local finite groups", with Jérôme Scherer and Antonio Viruel. Preprint, 2010.

Report by
Vincent Feuvrier

I have been working in the field of Analysis and in particular of Geometric Measure Theory. My current interests are the existence of solution to measure-minimization problems and their local (interior) regularity. These problems include but are not limited to the classical Plateau problem, with a different point of view than the classical ones coming from differential geometry. For instance, competitors are allowed to be non-orientable, and even unrectifiable.

Dissemination

Seminars delivered at

1. Barcelona Analysis seminar (October 5, 2009).

2. Tours Geometry seminar (France, March 26, 2010).

3. Barcelona PDE seminar (April 22, 2010).

Meetings attended

Barcelona Analysis seminar, Barcelona EDP seminar, UAB geometry seminar, Gaussian curvature workgroup, Optimal transport workgroup.
I have been a co-organizer of the ``Gaussian curvature'' workgroup (from October 2009 to January 2010). I also have organized the ``Optimal tranport'' workgroup.

Publications

1. Remplissage de l'espace euclidien par des complexes polyédriques d'orientation imposée et de rotondité uniforme (Article accepted on January 2010 in the Bulletin de la SMF).

Report by
Jose Manuel Higes

My research interests are in Geometric group theory, asymptotic dimension, asymptotic topology and 0/1 polytopes. More specifically
1. *Study of the Higson Corona. We want to prove that the dimension of the Higson Corona of a finitely generated group is equal to its asymptotic dimension.*

2. *Study of 0/1 polytopes. We want to give an explicit example of a 0/1 polytope of N vertices and (N/logN)^N factes.*

3. *Study of the geometry of asymptotic cones. We want to study the asymptotic cones of the wreath product of Z with the free group.*

4. *Study of the transfinite asymptotic dimension of a metric space. We want to find examples of metric spaces with a given transfinite asymptotic dimension.*

Dissemination

1. BMS course. Combinatorics. Tibor Tzabo. March 2010- June 2010;

2. BMS seminar. Seminar on matroids. Talk: The excluded-minor characterization of ternary matroids. July 2010.

3. Discretization in Geometry and Dynamics, BMS summer mathematical school TU. Berlin. September 2010.

Publications

1. J. Higes. Assouad–Nagata dimension of locally finite groups and asymptotic cones. Topology and its Applications, Volume 157, Issue 17, 1 November 2010, Pages 2635-2645.

2. T. Banakh, J. Higes and I. Zarichnyi. The coarse classification of countable abelian groups. Trans. Amer. Math. Soc. 362 (2010) 4755-4780.

3. J. Higes. Assouad-Nagata dimension of nilpotent groups with arbitrary left invariant metrics. Proc. Amer. Math. Soc. 138 (2010) 2235-2244.

4. J. Higes & I. Peng. Assouad-Nagata dimension of connected Lie groups, preprint.

5. J. Higes. Transfinite asymptotic dimension as a decomposition game, preprint.

Report by Gemma Huguet

My research interests lie in the area of Dynamical Systems, more precisely, in Hamiltonian Mechanics and applications to Neuroscience. The approach is both theoretical and numerical, including developing original codes, mainly in C. My research has focused on the following projects: Instability of Hamiltonian systems (also known as Arnold diffusion), Ambiguous stimuli and multistability, Phase locking properties of MSO cells.

Conferences

1. Society for Neuroscience (SFN) Annual meeting. November 13-17, 2010. San Diego, California, US. Poster. Modeling tristable perception in visual plaids.

2. CNS retreat. October 1-3, 2010. Montauk, New York, US. Poster. A model for dynamical witching during tristable perception of visual plaids.

3. DSPDEs'10. May 30 - June 4, 2010. Barcelona, Spain. Contributed talk. The Geometric Mechanism of Arnold Diffusion in Hamiltonian Systems: Rigorous Verification in Concrete Examples.

4. 8th AIMS Conference on Dynamical Systems, Differential Equations and Applications. May 25-28, 2010. Dresden, Germany. Invited talk at the Special Session: Dynamics in Neuronal Networks. Modeling tristable perception for visual plaids.

5. Conference on Celestial Mechanics and Hamiltonian Systems. April 15-17, 2010. University of Maryland, College Park, Maryland, US. Invited talk. A geometric mechanism of diffusion in a priori unstable Hamiltonian systems: verification in concrete examples.

Invited talks at Seminars

1. A model for dynamical switching during tristable perception of visual plaids Dynamical Systems Seminar at Courant Institute of Mathematical Sciences, New York University, New York, US. November 3, 2010.

2. A model for dynamical switching during tristable perception of visual plaids. Mathematical Biology Seminar at New Jersey Institute of Technology, Newark, New Jersey, US. October 19, 2010.

3. Modeling tristability in visual plaids. Rinzel's lab meeting at Center for Neural Science, New York University, New York, US. April, 2010.

Publications

1. A. Delshams and G. Huguet. A geometric mechanism of diffusion: Rigorous verification in a priori unstable Hamiltonian systems. J. Differential Equations 250(5): 2601–2623, 2011.

2. G. Huguet, R. de la Llave and Y. Sire. Computation of whiskered invariant tori and their associated manifolds: New fast algorithms. Accepted to Discrete Contin. Dyn. Syst. – Ser. A, 2011.

3. A. Delshams and G. Huguet. A geometric mechanism of diffusion: Rigorous verification in a priori unstable Hamiltonian systems. CRM Preprint 957, 2010.

Report by Martin Koerwien

Our research on the question of the absoluteness of categoricity continued, in particular in concerning the logics L_omega1,omega and L(Q). We finished a work which provides sufficient model theoretic criteria for categoricity in aleph1 to be non-absolute. However, while an example in L(Q) is known, is still an open question whether there are L_omega1,omega-sentences satisfying our properties. We also established that a particular L(Q)-theory which codes families of pairwise disjoint countable dense sets of the Cantor space absolutely has many models in aleph1. On the other hand we were able to show that a similar example where the real line takes the role of the Cantor space consistently has many models in aleph1 under Martin's axiom at aleph1, while it is aleph1-categorical under the Proper Forcing Axiom. In the second half of 2010, we started working on absoluteness questions concerning the notion of model existence in uncountable cardinalities, especially for L_omega1,omega-sentences. We were able to establish that model existence in aleph1 (equivalently the property "having an uncountable model") is an absolute notion. On the other hand we constructed a series of examples of (incomplete) L_omega1,omega-sentences for which the existence of a model in aleph_alpha (alpha>1 a countable successor cardinal) is non-absolute, even modulo ZFC+GCH. However, we have to assume the existence of inaccessible, and in some cases even of supercompact cardinals.

Conferences

1. Talk in the General Logic Seminar at the Université de Paris 7 (France, March 2010) about "Absoluteness of categoricity in Abstract Elementary Classes"

2. Talk in the Infinity Seminar at the CRM (September 23): The Infinity Project Theme "Sets and Models": A Progress Report (joint with John. T. Baldwin)

3. Regular participation at the Model Theory seminar at the Universitat de Barcelona, organized by Enrique Casanovas

4. Participation at Spring School and Conference in Model Theory at the Yonsei University (Seoul, South Corea, May 16-22)

Publications

1. Joint paper with Sy D. Friedman: "On absoluteness of categoricity in Abstract Elementary classes" (accepted for publication at the Notre Dame Journal of Formal Logic)

2. Joint paper with Stevo Todorcevic "An aleph1-categorical theory under PFA". Submitted to Mathematical Logic Quaterly

3. Preprint with Sy D. Friedman on the paper "The non-absoluteness of model existence in uncountable cardinals for L_omega1,omega"

Report by Jonathan Low

My research have been in the areas of Newtonian and non-Newtonian fluid mechanics coupled to Stefan problems. My first task was to establish the basis of solving mathematical equations that describe the motion of fluid in pipe and channel flows. This involved applying methods such as Green's functions, separation of variables and Fourier transform methods. In addition, numerical methods using finite differences and method of lines were developed. My first research project involved the investigation of the solidification of water in microchannels. My second research project, started since August 2010, involves the spreading of a thin sheet of liquid crystal under the influence of an electric field, in collaboration with Cummings (New Jersey's Science and Technology University) and Myers (CRM).

Conferences & Workshops

1. Poster at the Dynamical Systems & Partial Differential Equations 2010 conference held at the Universitat Politècnica de Catalunya between May 31st - June 4th 2010.

2. Study Groups of Mathematics and Technology 2010 held at the CRM on 6th – 8th July, in particular on the industrial problem of fair bandwidth invoicing for Internet Service Providers, presented by Cisco Systems.

3. Between July 14th – 23rd, JORNADES D'INTRODUCCIÓ ALS SISTEMES DINÀMICS I A LES EDP'S (JISD2010) course on Mathematical Modelling of Phase Transitions held at the Universitat Politècnica de Catalunya.

4. European Conference for Mathematics in Industry 2010 held at Wuppertal, Germany on July 26th – 30th.

5. Mathematical modelling of Blood Flow and Baroreflex System in partnership with SabirMedical on December 13th – 17th 2010, working on MATLAB numerical codes to simulate the blood pressure system of human patients.

Organisation

I have been an organiser of the internal CRM seminar series “Industrial Mathematics Seminar” from May 2010. The list of past speakers to date can be found at the website http://crm.cat/IndustrialMathematicsLines/defaultIndustrialMathematicsLines.htm.

I have also presented three talks in this series:

1. Non-Newtonian Flow In Pipes, April 2nd 2010

2. An Introduction To Liquid Crystal Modelling, May 18th 2010

3. Numerical Results on Extensional Flow of a Thin Sheet, October 10th 2010

Publications

1. T. G. Myers and J. Low, An approximate model for solidification of a flowing liquid in a microchannel, submitted to Microfluidics and Nanofluidics on Dec 1st 2010.

2. L. Cummings, T. G. Myers and J. Low, Extensional flow of nematic liquid crystal, in preparation.

3. G. Chavez, S. Costa, M. De Decker, J. Low, E. Rodríguez and J. Rosado, Bandwidth Consumption and Invoicing Models, submitted to GEMT 2010 on Dec 28th 2010. Available at: http://ruth.upc.es/svn/gemt/2010/cisco/CiscoArticle.pdf.

Report by Vivek Mallick

After joining CRM in September 2010, I have been working on derived categories and more generally triangulated categories. In the last few months I have been involved in two workgroups and have been running the belowmentioned seminars with them. The first work group, which meets in Universitat de Barcelona, consists of Prof. Jose Ignacio Burgos, Prof. Juan Carlos Naranjo and Prof. Cristina Martinez (UAB). We are trying to study the derived category of toric varieties which is an extension of the work done by Prof. Rosa-Maria Miro-Roig and Prof. Laura Costa. In Universitat Autonoma de Barcelona, I usually meet Prof. Joachim Kock and Prof. Fei Fei Xu to discuss about the representation theoretic applications of the theory of Paul Balmer and the theory of Benson, Iyengar and Krause regarding supports on triangulated categories. We hope to find some useful results on group cohomology using these abstract machinery.

Talks

November 19, 2010: Triangular Spectrum of some tensor triangulated category in Seminari Geometria Algebraica at Universitat de Barcelona.

Seminars

1. Derived Category Seminar (http://sites.google.com/site/vivekmmallick/home/derived-category-seminar)

2. Algebra and Combinatorics Seminar (http://mat.uab.cat/~xu/ACS.html, http://www.crm.cat/Seminaris/2010-2011/SEMALGCOM/Seminari_ALGCOM.htm)

Preprints

http://in.arxiv.org/abs/1012.0789.

Report by
Dieter Mitsche

My research area is Combinatorics, more concretely

1. Random geometric graphs (counting triangulations of small Delaunay order, calculating treewidth and treedepth) (the paper on triangulations appeared, the treewidth paper is submitted).
2. Stochastic processes on random graphs (information broadcasting on "dynamic" random geometric graphs, where the dynamics is represented by stochastic processes, whose intensity depends on the geometrical distance between two vértices).
3. Expected maximum degree on random graphs without C_k-minor (no cycles of order k or larger permitted).

Dissemination

1. May 2010: CIAC 2010, talk given "On the number of order-k Delaunay triangulations".

2. June 2010: Combinatorics Seminar UPC: "On routing in networks ".

Publications

1. R. Berke, D. Mitsche: Colorings at Minimum Cost. Discrete Mathematics, 310:3 (2010), p. 561-569.

2. D. Mitsche, M. Saumell, R. I. Silveira: On the Number of Higher Order Delaunay Triangulations. CIAC 2010, p.217-228.

3. J. Díaz, D. Mitsche, P. Santi: Theoretical Aspects of Graph Models for MANETs. In: Theoretical Aspects of Distributed Computing in Sensor Networks, Nikoletseas, S., Rolim, J. D.F. (Eds.), book chapter, Springer 2011, p.161-190.

4. J. Díaz, D. Mitsche: The cook-book approach to the differential equation method. In: Computer Science Review, J. Díaz, J. Nesetril (Eds.), Volume 4, Issue 3, August 2010, p. 129-151.

5. J. Díaz, D. Mitsche, A. Marchetti-Spaccamela, P. Santi, J. Stefa: Social-Aware Forwarding Improves Routing Performance in Pocket Switched Networks, preprint.

6. D. Mitsche, G. Perarnau: On the treewidth and treedepth of Random Geometric Graphs, preprint.

Report by
Moritz Müller

Since September 1, 2009, I am a doctoral researcher at the CRM within the Infinity Project led by Sy-David Friedman (Kurt-Gödel Research Center, Vienna, Austria).

Activities attended

1. All activities of the Infinity Project in 2010.

2. International Workshop on Logical Approaches to Barriers in Computing and Complexity in Greifswald, Germany, from February 17 to February 20. I

gave a talk titled "On optimal algorithms for SAT" on joint work with Y. Chen (Jiaotong University Shanghai, China) and J.Flum (Albert-Ludwigs University Freiburg, Germany).

3. Algorithmic Model Theory Meeting (AlMoTh) from February 25 to February 26 at the Göthe University Frankfurt am Main, Germany.

4. Prague Fall School of Logic and Complexity from September 20 to September 24 organized by Jan Krajicek at the Charles University of Prague, Czech Republic.

5. Research stay at the Institute of Mathematics at the Academy of Sciences of the Czech Republic from November 22 to November 26. I gave a talk with the title "Undefinable Forcing" at the Prague Logic Seminar there. This talk reported unpublished ongoing joint work with Albert Atserias from the Universitat Politécnica de Catalunya, Barcelona.

Publications

1. S. Buss, Y. Chen, J. Flum, S.-D. Friedman, M. Müller. Strong isomorphism reductions in complexity theory. The Journal of Symbolic Logic. Accepted for publication, 2010.

2. Y. Chen, J. Flum, M. Mülller. On optimal algorithms for SAT. Logical Approaches to Barriers in Computing and Complexity, Greifswald, preprint of the Department of Mathematics and Computer Science at the University Greifswald No. 6, 2010.

3. Y. Chen, J. Flum, M. Müller. Lower bounds for kernelizations and other preprocessing procedures. Theory of Computing Systems. Accepted for publication, 2010,Submitted

4. Y. Chen, J. Flum, M. Müller. Consistency and Optimality. Submitted.

5. Y. Chen, J. Flum, M. Müller. Hard instances of algorithms and proof systems. Submitted.

Report by Ekin Ozman

My research topic is number theory/arithmetic geometry. In particular I am interested in modular curves, Shimura curves and their twists, Q-curves, jacobians of modular curves and their splittings over finite fields. I am also interested in finding examples of the Hasse principle violation and Brauer-Manin obstruction.

Dissemination

1. Number theory meeting which was held at Universitat de Lleida.

2. Middle East Technical University, Ankara,Turkey.

3. Computational number theory seminar at UPC, invited talk.

Publications

1. Points on Quadratic Twists of Shimura Curves with level structure, preprints.

2. Explicit computations on bi-quadratic twists of X_0(34) (with J.C. Lario and J.F. Gonzalez), preprint.

Report by Radu Saghin

During 2010 I worked on different topics related to the research proposal of my fellowship. These topics include connections between the set of periods and entropy for maps on graphs, different methods to compute the index of a singularity of a smooth vector field using a finite number of terms from the power series expansion at the singularity, the variation of entropy for one-dimensional maps, and several aspects of partially hyperbolic diffeomorphisms.

Dissemination

Talks at

1. 'Periodic points of graph maps', at the Dynamical Systems Seminar, IME-USP Sao Paulo.

2. 'Dirac physical measures for transitive flows', at the AIMS International Conference in Dynamical Systems, Differential Equations and Applications, Dresden.

3. 'On the index of singularities of vector fields', at the Analysis Seminar, DePaul University, Chicago.

Meetings attended

1. DANCE RTNS Winter School in Dynamics, at Segovia, Spain.

2. International Conference in Dynamical Systems, at Buzios, Brazil.

3. Workshops on Geometry and Dynamics of Foliations.

4. Advanced Course on Foliations: Dynamics-Geometry-Topology.

5. Conference on Geometry and Topology of Foliations, at CRM Barcelona.

6. AIMS International Conference in Dynamical Systems, Differential Equations and Applications, at Dresden, Germany.

7. Workshop on Spectral Theory of Dynamical Systems, at the Banach Center, Warsaw, Poland; Midwest Dynamical Systems Conference, at Northwestern University, USA.

8. Dynamical Systems Seminars at UAB and UB-UPC.

Publications

1. R. Saghin, Jaume Llibre, 'Topological entropy and periods for graph maps', to appear in Journal of Difference Equations and Applications.

2. R.Saghin, Jaume Llibre, 'The index of singularities of vector fields and finite jets', submitted.

Report by Graham Smith

Research visits

1. 18th Oct. 2010 – 12th Nov. 2010. Departamento de Geometría y Topología, Universidad de Granada

Talks

1. 20th Oct. 2010, Barrier techniques in the non-linear Plateau problem, Departamento de Geometría y Topología, Universidad de Granada

2. 27th Oct. 2010, Degree Theory of Immersed Submanifolds, Departamento de Geometría y Topología, Universidad de Granada

Publications

"Special Lagrangian Curvature", to appear in Math. Annalen.

Report by Edgar Tchoundja

I am working on operators on holomorphic function spaces: Toeplitz operators, Hankel operators, on various spaces of holomorphic functions in the unit ball, such as Bergman and Hardy spaces, holomorphic Hardy Orlicz and holomorphic Besov spaces of the unit ball. Also, Toeplitz operators with L1 symbols on holomorphic Besov spaces, Hankel operators on Hardy-Orlicz spaces.

Meetings attended

1. Winter school in Complex Analysis and Geometry, 25-29 January 2010, Toulouse, France.

2. Winter School in Analysis, 1-5 February 2010, Bonn, Germany.

3. Workshop in Complex Analysis and Geometry, 29-31 January 2010, Albi, France.

4. Complex Analysis Workshop, 6-10 April 2010 CIRM (Marseille), France: " The d-bar-Neumann and Spectral Analysis of Hankel Operators " , delivered talk-

5. Nordan XIV, Conference in Complex Analysis and Geometry, 7-9 may 2010, Lökeberg (Göteborg), Sweden.

6. Harmonic Analysis and Applications, 14-18 June 2010, Sevilla, Spain.

7. Seventh Advanced Course in Complex Analysis and Operator Theory, 20-24 June 2010, El Puerto de Santa Maria, Spain. With a contributed talk entitled: "Hankel operators with Lipschitz symbols in the unit ball".

Publications

1. D. Agbor and E. Tchoundja: Toeplitz operators with L1 symbols on Bergman Spaces in the unit ball of Cn, Adv. Pure Appl. Math. 2, n0 1 (2011).

2. D. Agbor, D. Bekolle and E. Tchoundja: Bounded and compact operators on the Bergman spaces L1 in the unit disk of C, to appear in Afr Diaspora J. Math.

3. B. Sehba and E. Tchoundja, Hankel operators with weighted Lipschitz symbols in the unit ball, submitted.

2.3. Les xarxes temàtiques del CRM

Estar amatents a les àrees emergents en les matemàtiques i les seves aplicacions és un dels objectius prioritaris del CRM, així com oferir incentius i recursos de manera que els investigadors de les àrees més tradicionals o els investigadors més joves puguin introduir-se en aquests sectors emergents. Donat l'estat actual de la recerca, moltes de les àrees estratègiques o emergents en Ciència i Tecnologia estan relacionades amb noves aplicacions matemàtiques, i permeten així la participació de les matemàtiques en projectes socials a gran escala.

Amb aquest propòsit, el CRM dóna suport a diverses Xarxes Temàtiques, com a continuació d'altres iniciatives empreses en anys anteriors. Tenen per objectiu la formació multidisciplinària en recerca en àrees considerades d'interès i rellevants actualment. Les Xarxes Temàtiques del CRM són una estructura transversal que serveix de pal de paller als grups de recerca catalans actius en una determinada àrea, disposats a col·laborar entre ells a través d'activitats conjuntes, les qual típicament inclouen un seminari estable. El CRM dóna suport financer i administratiu a cada Xarxa Temàtica.

Les xarxes temàtiques actuals al CRM són les següents:

- Xarxa Temàtica en Neurociència Computacional
- Xarxa Temàtica en Matemàtica Industrial

2.3. CRM Thematic Networks

Monitoring emerging areas in mathematics and their applications is a priority objective for the CRM, as well as offering incentives and resources so that researchers in traditional areas or younger researchers can join these emerging sectors. Given the current state of research, many strategic or emerging areas are related to new mathematical applications, in partnership activities with other sciences or with technology, or allowing the participation of mathematics in large-scale social projects.

With this purpose, the CRM supports several Thematic Networks, as a continuation of other initiatives undertaken in previous years. It aims at multidisciplinary research training and practice in areas considered to be of interest and relevant at the present time. The CRM Thematic Networks are a transversal activity that serves as a meeting point of research groups in Catalonia active in one of such areas, willing to collaborate through joint activities, which typically include a stable all-year seminar. The CRM gives financial and administrative support to each Thematic Network.

The current list of CRM Thematic Networks is the following:

- *Thematic Network in Computational Neuroscience*
- *Thematic Network in Industrial Mathematics*

☐ Xarxa Temàtica en Finances Quantitatives

Les activitats d'aquestes xarxes poden veure's a

☐ *Thematic Network in Quantitative Finance*

The activities of these networks can be checked at

http://www.crm.cat/General/ThematicNetworks_eng.htm

2.4. Investigadors visitants

Diversos investigadors fan estades temporals al CRM durant cada curs acadèmic. La majoria d'aquests investigadors són participants invitats als programes de recerca del CRM i la resta s'acullen a les convocatòries públiques del CRM per a estades de recerca en col·laboració amb matemàtics/ques de les universitats catalanes, que són:

☐ Estades de recerca al Centre

☐ Estades de recerca en col·laboració (research in pairs)

☐ Places Lluís Santaló per a visitants d'Amèrica Llatina

El llistat de visitants de 2010 es detalla a continuació. Aquest llistat no inclou el personal investigador propi del CRM (investigadors sènior i becaris) ni els visitants que hagin fet estades inferiors a dues setmanes ni els investigadors visitants en programes de recerca (veure secció 3.1).

2.4. List of Visitors

A number of researchers visit CRM every academic year. Most of them are invited participants at CRM Research programmes, and the rest apply to the competitive calls for research stays in col·laboration with mathematicians in local universities, namely:

☐ *Visiting the CRM*

☐ *Research in pairs at CRM*

☐ *Lluís Santaló visiting positions for Latin-American researchers.*

The list of 2009 visitors is the following. This list does not include CRM staff researchers nor visitors whose stay was shorter than two weeks nor visitors of the research programmes (see section 3.1).

Judit Abardia	Universitat Autònoma de Barcelona (becària Fundació FSB)
Semyon Alesker	Tel Aviv University
Luis Álvarez-Cónsul	ICMAT/ CSIC Madrid
Juan-Carlos Álvarez-Paiva	Université de Lille 1
MichèleArtigue	Université de Paris 7
Arndt Benecke	IHES
David Ben-Zvi	The University of Texas at Austin
Andreas Bernig	Johann Wolfgang Goethe-Universität
Mats Boij	Institute of Technology
Paul Bressloff	University of Oxford
EnriqueCabaña	Universidad de la República
Ciro Ciliberto	Università di Roma "Tor Vergata"
Luis M. Cruz-Orive	Universidad de Cantabria
Linda Cummings	New Jersey Institute of Technology
Galia Dafni	Concordia University
Judit Abardia	Universitat Autònoma de Barcelona (becària Fundació FSB)
Semyon Alesker	Tel Aviv University
Luis Álvarez-Cónsul	ICMAT/ CSIC Madrid
Juan-Carlos Álvarez-Paiva	Université de Lille 1
MichèleArtigue	Université de Paris 7
Arndt Benecke	IHES
David Ben-Zvi	The University of Texas at Austin
Andreas Bernig	Johann Wolfgang Goethe-Universität
Mats Boij	Institute of Technology
Paul Bressloff	University of Oxford
EnriqueCabaña	Universidad de la República
Ciro Ciliberto	Università di Roma "Tor Vergata"
Luis M. Cruz-Orive	Universidad de Cantabria
Linda Cummings	New Jersey Institute of Technology
Galia Dafni	Concordia University
Carlos A. Di Prisco	Instituto Venezolano de Investigaciones Científicas
Paul Embrechts	ETH-Zürich
Mareike Fischer	Center for Integrative Bioinformatics Vienna (CIBIV)
Andrew Fowler	University of Limerick
Joseph Fu	University of Georgia
Oscar García-Prada	ICMAT/ CSIC Madrid
Dmitry Gorbachev	The Tula State Pedagogical University
Tamás Hausel	University of Oxford
James Hill	University of Wollongong
Daniel Hug	Karlsruhe Institute of Technology
Anton Kapustin	California Institute of Technology
Victor Katsnelson	Weizmann Institute of Science
Ekaterina Kutafina	University of Science and Technology

Alex Lerchner	Computational and Theoretical Neuroscience Institute
Olivier Ley	Université de Tours
Elijah Liflyand	Bar-Ilan University
Eugenio Lippiello	Second University of Naples
Yves Matheron	IUFM Midi-Pyrénées Toulouse
Martin Mathieu	The Queen's University of Belfast
Mark McGuinness	Victoria University of Wellington
Hrushikesh Mhaskar	California State University
Juan Carlos Migliore	University of Notre Dame
Rosa Maria Miró-Roig	Universitat de Barcelona
Sarah Mitchell	University of Limerick
Nicholas Moloney	Max Planck Institute
Uwe Nagel	University of Kentucky
Robert Noirfalise	Université Clermont-Ferrand II
Tony Pantev	University of Pennsylvania
Marta Pérez	Universitat Politècnica de Catalunya
Ole Björn Peters	University of California Los Angeles
Sonia Pinto de Carvalho	Universidade Federal de Minas Gerais
Indrani Rao	University of North Carolina at Chapel-Hill
Vladimir Stepanov	Peoples Friendship University of Russia
Cristina Stoica	Wilfrid Laurier University
Samy Tindel	Institut Elie Cartan
Andrew Tonks	London Metropolitan University
María Trigueros	Instituto Tecnológico Autónomo de México (ITAM)
Xiao-Xing Wang	Yale University
Carl Winslow	University of Copenhagen
Fabrizio Zanello	Michigan Technological University
Ludmil T. Zikatanov	The Pennsylvania State University

2.5. La formació en recerca al CRM

Hi ha dos vessants de formació al CRM: doctoral i a nivell de màster.

2.5.1. Estudiants de doctorat

El CRM atorga beques doctorals, destinades a la realització de tesis doctorals en les especialitats especificades en el pla estratègic del centre. Per gaudir d'una beca doctoral del CRM és indispensable matricular-se en un programa de doctorat d'una Universitat catalana. El llistat de becaris predoctorals finançats o cofinançats pel CRM durant l'any 2010 es detalla a continuació.

2.5. Research training at CRM

There are two aspects in training: at doctoral and master level.

2.5.1. Ph.D. students

The CRM awards doctoral grants for PhD theses on topics specified in the CRM strategic plan. To benefit from a CRM Ph.D. grant it is required to be registered in a Ph.D. program at a Catalan University. The list of doctoral researchers financed or cofinanced by the CRM in 2010 is the following:

Lidia Almazán
Since September 2009
Funding: CRM, UAB and i-MATH
Advisor: José Antonio Carrillo

Michelle de Decker
Since February 2010
Funding: CRM
Advisor: Tim Myers

Ana Deluca
Since September 2009
Funding: CRM
Advisor: Álvaro Corral

Albert Ferreiro
Since June 2007
Funding: CRM and UAB
Advisor: Frederic Utzet

Francesc Font
Since September 2010
Funding: CRM
Advisor: Tim Myers

Pedro E. García
February 2007 to September 2010
Funding: CRM and UPF
Advisor: Antoni Guillamon

Somayeh Heidarvand
Since September 2007
Funding: CRM and UPC
Advisor: Jorge Villar

Maite Naranjo
Since October 2009
Funding: CRM
Advisor: Marta Sanz-Solé

Juan José Rivaud
Since September 2009
Funding: CRM, UAB and i-MATH
Advisor: Àngel Calsina

2.5.2. Curs de màster

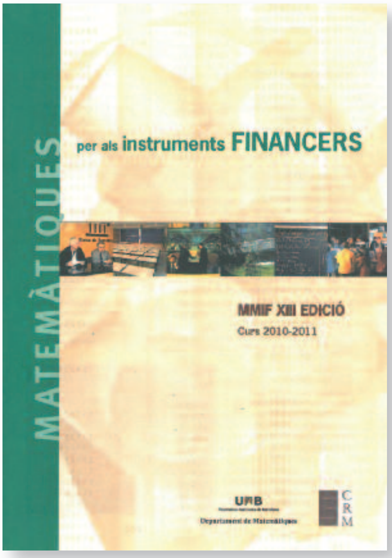
El màster de Matemàtiques per als instruments financers va tenir lloc per tretzena vegada el 2010 gràcies a la col·laboració del Departament de Matemàtiques de la UB, el CRM i diverses entitats: la Borsa de Barcelona (patrocinadora), els departaments d'Economia Aplicada, d'Economia de l'Empresa, i d'Economia i d'Història Econòmica de la UAB, i el Departament d'Estadística de la UB, juntament amb destacats especialistes que treballen en contacte directe amb els mercats. Les empreses col·laboradores que hi donen suport, mitjançant les beques per a la realització de pràctiques, aporten el component necessari d'aprenentatge pràctic. Així s'estableix una línia directa de col·laboració entre els mons acadèmic i professional, que permet desenvolupar i ensenyar les últimes tècniques de valoració de productes financers derivats, càlcul d'estratègies de cobertura i avaluació i control de riscos.

2.5.2. Master's course

The CRM master's course on Financial Mathematics was held for the thirdteenth time in 2010 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 specialists 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 them to develop and teach innovative techniques about the valuation of derived financial products, calculation of coverage strategies, risk assessment and risk control.

El màster està estructurat en tres etapes, dues de teòriques (cadascuna amb 120 hores de docència) i una tercera etapa pràctica en una empresa de finances. La responsabilitat del màster recau en una Comissió Acadèmica i un Comitè Executiu. L'any 2010 han acabat el màster 16 alumnes.

The 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 responsability lies on an Academic Commission and an Executive Committee. In 2010 a total of 16 students completed the master's course.



2.5.3. Treballs de fi de master

El CRM té una convocatòria per promoure entre els estudiants de màster en Matemàtiques de les Universitats Catalanes l'el·laboració de treballs de recerca en temes interdisciplinars i aplicats. L'any 2010 s'han el·laborat els següents treballs.

2.5.3. Master's research projects

The CRM has a call to sponsor research projects in interdisciplinary applied areas addressed to MS students in Mathematics at Catalan Universities. In 2010 the following have been completed:

- Oliver Valero, "*An alternative procedure to generate a more accurate GLM model to compare MRI cortical thickness to study neurodegenerative diseases*"
- Emiliano Sánchez, "*Statistical Arbitrage*"
- Michelle De Decker, "*Methods for solving 1D Stefan problems with application to contact melting*"

Organització d'activitats científiques

Organization of scientific events

3

El CRM organitza des de fa anys sobre una base competitiva, mitjançant convocatòries al seu web, quatre tipus d'activitats:

- Programes de recerca intensius
- Congressos internacionals i workshops
- Cursos avançats
- Jornades temàtiques

Since long ago the CRM organizes on a competitive basis, through open calls in its web site, four types of activities:

- *Intensive Research Programmes*
- *International Conferences and Workshops*
- *Advanced Courses*
- *Thematic Days*

3.1. Programes de recerca

Un programa de recerca del CRM consisteix en un període intensiu de recerca en una àrea determinada de les matemàtiques i les seves aplicacions, durant el qual s'apleguen al CRM investigadors procedents de diferents institucions d'arreu del món per treballar en problemes oberts del seu àmbit d'especialització i per analitzar-ne l'estat i les perspectives.

Els programes de recerca del CRM poden durar normalment entre tres mesos i un curs acadèmic sencer. S'estructuren en dues potes: els investigadors visitants i les activitats programades. Cada programa té un comitè científic responsable de planificar les activitats incloses en el

3.1. Research Programmes

The CRM Research Programmes consist of periods of intensive research in a given area of the mathematical sciences and their applications, bringing together researchers from different institutions to work on open problems in the chosen area and to analyse its present state and perspectives.

Research programmes can run for periods from three months to a whole academic year. They are based in two aspects: the visiting researchers and the activities organized within. Every programme has a scientific committee, which is fully responsible for the planning of all activities included in the programme, the elaboration of programa, elaborar la llista dels investigadors visitants i lliurar un informe final. Típicament, en un programa hi participen investigadors locals a temps complet, investigadors visitants a temps complet (per a estades d'una durada mínima d'un mes), becaris postdoctorals i estudiants de doctorat avançats. Les activitats d'un programa inclouen generalment un o dos seminaris setmanals, un workshop intensiu (preferentment obert a investigadors que no participin en el programa), un congrés internacional i un curs avançat dirigit a estudiants de doctorat.

Els programes de recerca del CRM es convoquen a nivell internacional amb dos anys d'antelació i són avaluats pel Consell Científic.

A continuació es descriuen els programes de recerca organitzats durant l'any 2010.

the list of participants, and the submission of a final report. Typically, participants in a programme include local full-time researchers, visitors on a full-time basis (for stays of at least one month), post-doctoral fellows and advanced doctoral students. A research programme generally includes one or two weekly seminars, one intensive workshop (preferably open to researchers not participating in the programme), a conference and an advanced course addressed to graduate students.

The CRM research programs are called internationally two years in advance and are evaluated by the Scientific Advisory Board.

The CRM Research Programmes that took place in 2010 are described below.

3.1.1. The Infinity Project

September 2009 to July 2011

Coordinator **Sy-David Friedman,** Kurt Gödel Center, Vienna

Summary *This is a multidisciplinary research project, funded by the John Templeton Foundation. The Infinity Postdocs will join the Invited Research Visitors, the Project Director and Barcelona logicians to discover radically new connections between different areas of logic in the context of the seven project themes.*

***1.** History of Set Theory (Loren Graham, Jean-Michel Kantor)*
Cantor's correspondence, the Luzin archive and Hausdorff's work in descriptive set theory.

***2.** Sets and Computations (Sam Buss, Jan Krajicek)*
Forcing in complexity theory.

***3.** Sets and Proofs (Michael Rathjen, Andreas Weiermann)*
Large cardinals and proof-theoretic ordinals.

***4.** Sets and Models (John Baldwin, Tapani Hyttinen)*
Descriptive set theory and first-order model theory.
Abstract elementary classes and axioms for set theory.

***5.** Computations and Proofs*

***6.** Computations and Models*

***7.** Proofs and Models*

Postdoctoral researchers	**Martin Koerwien** **Moritz Müller**	
Visiting researchers in 2010	Tatiana Arrigoni	Fondazione Bruno Kessler
	John T. Baldwin	University of Illinois at Chicago
	Yijia Chen Shanghai	Jiao Tong University
	Fred Drueck	University of Illinois at Chicago
	Jörg Flum	Universität Freiburg
	Rami Grossberg	Carnegie Mellon University
	Tapani Hyttinen	University of Helsinki
	Vadim Kulikov	University of Helsinki
	Juan Carlos Martínez	Universitat de Barcelona
	Michael Rathjen	University of Leeds
	Andrés Villaveces	Universidad Nacional de Colombia
	Andreas Weiermann	University of Ghent
Activities organized	**Monthly seminar among participants**	

3.1.2. CRM Research Programme on Arithmetic Geometry

September 2009 to July 2011

Coordinator	**Francesc Bars**	Universitat Autònoma de Barcelona
	Luis Dieulefait	Universitat de Barcelona
	Victor Rotger	Universitat Politècnica de Catalunya
Scientific Committee	Henri Darmon	McGill University, Montréal
	Fred Diamond	King's College of London
	Luis Dieulefait	Universitat de Barcelona
	Bas Edixhoven	Leiden University
	Víctor Rotger	Universitat Politècnica de Catalunya
	Francesc Bars	Universitat Autònoma de Barcelona
	Gebhard Böckle	Universität Duisburg-Essen
	David Burns	King's College of London
	David Goss	Ohio State University
	Ignazio Longhi	National Taiwan University
	Douglas Ulmer	Georgia Institute of Technology
	Fabien Trihan	University of Nottingham
	Xavier Xarles	Universitat Autònoma de Barcelona

Summary

In this research programme, the object of study were several key objects from the arithmetic of number fields/function fields which constitute a living proof of this fruitful cross-fertilization between the two worlds, such as Drinfeld and classical modular varieties, classical and p-adic L-functions, the Langlands programme, the Birch and Swinnerton-Dyer conjecture, Iwasawa theory and the Bloch–Kato conjecture.

The first and third quadrimesters of the programme were focused on arithme-

tic geometry in the number field case, with an emphasis on modular forms and modularity questions, while the second quadrimester was dedicated to the function field case in characteristic p, with an emphasis on Iwasawa theory and characteristic p L-functions.

Visiting researchers in 2010

Bruno Anglès	Laboratoire de Mathématiques Nicolas Oresme
Sara Arias de Reyna	Universidad de Granada
Andrea Bandini	Università della Calabria
Abhishek Banerjee	Ohio State University
Pilar Bayer	Universitat de Barcelona
Laurent Berger	École Normale Supérieure de Lyon
Lisa Berger	Stony Brook University
Tobias Berger	Cambridge University
Massimo Bertolini	Università di Milano
Gebhard Böckle	Universität Duisburg-Essen
Vincent Bosser	Laboratoire de Mathématiques Nicolas Oresme
Alina Bucur	Institute for Advanced Study
José Ignacio Burgos	ICMAT/ CSIC Madrid
David Burns	King's College London
Ralf Butenuth	Universität Duisburg-Essen
Tommaso Centeleghe	Universität Duisburg-Essen
Chieh-Yu Chang	National Center for Theoretical Sciences (NCTS)
Pierre Charollois	Université de Paris VI
Pierre Colmez	École Polytechnique, Palaiseau
Ricardo Conceiçao	Oxford College of Emory University
Henri Darmon	McGill University
Lassina Dembele	Institut für Experimentelle Mathematik
Michael Dettweiler	University of Heidelberg
Fred Diamond	King's College London
Mladen Dimitrov	Université Denis-Diderot Paris 7
Matt Emerton	Northwestern University
Kazuhiro Fujiwara	Nagoya University
Wojciech Gajda	A. Mickiewicz University of Poznan
Ernst-Ulrich Gekeler	Universität des Saarlandes
David Geraghty	Harvard University
David Goss	Ohio State University at Columbus
Christopher James Hall	University of Wyoming
Urs Hartl	Universität Münster
Harald Andres Helfgott	University of Bristol
Fumiharu Kato	Kyoto University
Kiran Kedlaya	MIT
Ignazio Longhi	National Taiwan University
Matteo Longo	Universita' di Padova
Bartolomé López	Universidad de Cádiz
Catherine Mary Trentacoste	Clemson University
Adam Mohamed	Institut für Experimentelle Mathematik
Santiago Molina	Universitat Politècnica de Catalunya
Fernando Pablos	Universidad de Salamanca

Ariel Martin Pacetti	Universidad de Buenos Aires
Ambrus Pál	Imperial College London
Matthew Papanikolas	Texas A&M University
Mihran Papikian	The Pennsylvania State University
Pierre Parent	Université de Bordeaux I
Vytautas Paskunas	Universität Bielefeld
Federico Pellarin	Université Jean Monnet
Pietro Ploner	Università di Roma "La Sapienza"
Cristian D. Popescu	University of California at San Diego
Adolfo Quirós	Universidad Autónoma de Madrid
Dinakar Ramakrishnan	Caltech University
Kenneth Ribet	University of California at Berkeley
Fernando Rodriguez	The University of Texas at Austin
Michael Schein	Bar-Ilan University
René Schoof	Università di Roma "Tor Vergata"
Alexei Skorobogatov	Imperial College London
Ignacio Sols	Universidad Complutense de Madrid
Lenny Taelman	Universiteit Leiden
Yuichiro Takeda	Kyushu University
Ki-Seng Tan	National Taiwan University
Dinesh S. Thakur	University of Arizona
Jacques Tilouine	Université de Paris XIII
Fabien Trihan	University of Nottingham
Panagiotis Tsaknias	Universität Duisburg-Essen
Douglas Ulmer	Georgia Institute of Technology
Hendrik Verhoek	Università di Roma "Tor Vergata"
Stefano Vigni	Universitat Politècnica de Catalunya
Núria Vila	Universitat de Barcelona
Christelle Vincent	University of Wisconsin-Madison
John Voight	University of Vermont
Gabor Wiese	Institut für Experimentelle Mathematik
Jean-Pierre Wintenberger	Université Louis Pasteur
Malte Witte	Universität Regensburg
Seidai Yasuda	University of Kyoto

Activities organized in 2010

Weekly Seminar on Arithmetic Geometry

Speakers

Cécile Armana (CRM), Francesc Bars (UAB), Debargha Banerjee (Tata Institute of Fundamental Research), Lassina Dembele (Institut für Experimentelle Mathematik), Kazujiro Fujiwara (Nagoya University), E.U. Gekeler (Universität des Saarlandes), Eknath Ghate (Tata Institute of Fundamental Research), Josep González (UPC), Jordi Guardia (Universitat Politècnica de Catalunya), Xevi Guitart (Universitat Politècnica de Catalunya), Harald A. Helfgott (Unviersity of Bristol), Joan Carles Lario (UPC), Ignacio Longhi (National Taiwan University), Matteo Longo (Universita di Milano), Santiago Molina (Centre de Recerca Matemàtica - Universitat Politècnica de Catalunya), Enric Nart (Universitat Autònoma de Barcelona), Ekin Ozman

(University of Wisconsin-Madison), Sebastian Pauli (University of North Carolina at Greensboro), Pietro Ploner (Università di Roma “La Sapienza”), Adolfo Quirós (Universidad Autónoma de Madrid), Fernando Rodríguez (University of Texas at Austin), Alexei Skorobogatov (Imperial College London), Pangiotis Tsaknias (University of Essen), Stefano Vigni (Universitat Politècnica de Catalunya), John Voight (University of Vermont), Hendrik Verhoek (Università di Roma “Tor Vergata”), Xavier Xarles (UAB).

Advanced Course on Arithmetic Geometry for Function Fields of Positive Characteristic

22 February – 5 March 2010

Participants: 24

Lecturers Gebhard Böckle (Universität Duisburg-Essen), David Burns (King's College London), Dinesh S. Thakur (University of Arizona), Douglas Ulmer (Georgia Tech).

Thematic Seminars on Function Field Arithmetic I

29-31 March 2010

Participants: 26

Speakers Urs Hartl (Universität Münster), Ambrus Pal (Imperial College London).

Workshop on Iwasawa Theory over Function Fields of Characteristic p>0

6-10 April 2010

Participants: 32

Speakers Bruno Anglès (Laboratoire de Mathématiques Nicolas Oresme), Andrea Bandini (Università della Calabria), David Burns (King's College London), Ignazio Longhi (National Taiwan University), Fernando Pablos Romo (Universidad de Salamanca), Ambrus Pál (Imperial College London), Cristian D. Popescu (University of California at San Diego), Lenny Taelman (Universiteit Leiden), Ki-Seng Tan (National Taiwan University), Dinesh S. Thakur (University of Arizona), Fabien Trihan (University of Nottingham), Malte Witte (Regensburg Universität), Seidai Yasuda (University of Kyoto).

Workshop and Advanced Course on Drinfeld Modules and L-functions

12-16 April 2010

Participants: 32

Speakers David Goss (Ohio State University at Columbus), Gebhard Böckle (Universität Duisburg-Essen), Chieh-Yu Chang (National Center for Theoretical Sciences (NCTS)), Matthew Papanikolas (Texas A&M University), Mihran Papikian (The Pennsylvania State University), Federico Pellarin (Université Jean Monnet), Lenny Taelman (Universiteit Leiden), Dinesh S. Thakur (University of Arizona).

Thematic Seminar on Function Field Arithmetic II

19-21 April 2010

Participants: 27

Speakers	Ignazio Longhi (National Taiwan University), Fabien Trihan (University of Nottingham).

The Arithmetic of Hilbert Modular Forms
7-8 June and 10-11 June 2010
Participants: 25

Speakers	Mladen Dimitrov (Université Denis-Diderot Paris VII).

Advanced Courses on Modularity
14-25 June 201
Participants: 53

Lecturers	Laurent Berger (École Normale Superieure de Lyon), Gebhard Böckle (Universität Duisburg-Essen), Fred Diamond (King's College of London), Jean-Pierre Wintenberger (Université Louis Pasteur).

Modular Conference: Arithmetic of Modular Forms and Modularity Results
8-9 July 2010
Participants: 51

Speakers	Tobias Berger (Cambridge University), Gebhard Böckle (Universität Duisburg-Essen), Pierre Colmez (École Polytechnique), Lassina Dembélé (University of Warwick), Michael Dettweiler (Universität Heidelberg), Fred Diamond (King's College London), Luis Dieulefait (Universitat de Barcelona), Mladen Dimitrov (Université Denis-Diderot Paris 7), Matt Emerton (Northwestern University), David Geraghty (Harvard University), Pierre Parent (Université de Bordeaux), Vytautas Paskunas (Universität Bielefeld), Dinakar Ramakrishnan (Caltech University), Kenneth Ribet (University of California at Berkeley), Michael Schein (Bar-Ilan University), Jacques Tilouine (Université de Paris XIII), Gabor Wiese (Institut für Experimentelle Mathematik).

3.1.3. CRM Research Programme on Foliations

April to July 2010

Coordinators	**Jesús Álvarez López**	Universidad de Santiago de Compostela
	Marcel Nicolau	Universitat Autònoma de Barcelona
Scientific Committee	Jesús Álvarez López	Universidad de Santiago de Compostela
	Gilbert Hector	Université de Lyon
	Marcel Nicolau	Universitat Autònoma de Barcelona
	Pawel Walczak	Uniwersytet Lodzki
	Robert Wolak	Uniwersytet Jagiellonski

Summary

The subject of the research program was foliation theory in all of its aspects: the primary dynamical and geometric points of view, as well as its interactions with other topics, like Riemannian geometry, symplectic geometry, contact

geometry, holomorphic dynamics, global analysis, arithmetics, cohomology, non-commutative geometry, etc. The main goal of the program was to deal with open problems concerning foliations; many of them were pointed out in previous meetings on foliations. The lectures and courses were oriented to provide the audience with the tools and knowledge sufficient to attack those problems. For that purpose, the program have gathered specialists in foliation theory from all over the world; many of them with worldwide renown in the topic. So we believe that the program was also a great opportunity for the young researchers that participated in it.

The program was structured around the following main events. Three consecutive workshops on "Holomorphic Foliations", "Geometry of Foliations" and "Dynamics of Foliations", the "Advanced Course on Foliations: Dynamics-Geometry-Topology", and the "Conference on Geometry and Topology of Foliations". The weekly seminar of the program, the "Foliation Seminar", has hosted 11 lectures along the semester. There were 29 long stay visitors of the program; 6 of them were young researchers (PhD students and pot-docs).

Visiting researchers	Masayuki Asaoka	Kyoto University
	Dmitry Bolotov	B. Verkin Institute for Low Temperature Physics
	Marco Brunella	Université de Bourgogne
	Gabriel Calsamiglia	Universidade Federal Fluminense
	Alberto Candel	California State University Northridge
	Beniamino Cappelletti	Università di Bari
	Dominique Cerveau	Université de Rennes I
	Nuria Corral	Universidad de Cantabria
	Bertrand Deroin	Université Paris 11
	Aziz El Kacimi Alaoui	Université de Valenciennes
	María Cruz Fernández	Universidad de Sevilla
	Sidney Frankel	Université de Paris 7
	Xavier Gómez-Mont	CIMAT
	Pablo González	University of Edinburgh
	Gilbert Hector	Université Claude Bernard (Lyon I)
	Steven Hurder	University of Illinois at Chicago
	Victor Kleptsyn	Université de Rennes I
	Yuri Kordyukov	Russian Academy of Sciences
	Rémi Langevin	Université de Bourgogne
	Álvaro Lozano	Universidad del País Vasco
	Mònica Manjarín	Université de Rennes I
	Shigenori Matsumoto	Nihon University
	Jean-François Mattei	Université Paul Sabatier
	Michael Maquillan	Università di Roma "Tor Vergata"
	Laurent Meersseman	Université de Bourgogne
	Gaël Meigniez	Université de Bretagne Sud
	Carlos Meniño	Universidade de Santiago de Compostela
	Yoshihito Mitsumatsu	Chuo University
	Hiraku Nozawa	École Normale Superieure de Lyon
	Noboru Ogawa	Chuo University

Jorge Vitório Pereira	IMPA
Julio Rebelo	Université Paul Sabatier
Ken Richardson	Texas Christian University
Vladimir Rovenski	University of Haifa
Jose I. Royo	Universidad del País Vasco
Paul Alexander Schweitzer	PUC RIO
Loïc Teyssier	Université Louis Pasteur
Takashi Tsuboi	University of Tokyo
Alberto Verjovsky	UNAM
Elmar Vogt	Freie Universität Berlin
Pawel Walczak	University of Lodz
Robert Wolak	Uniwersytet Jagiellonski

Activities organized

Weekly Seminar on Foliations

Speakers

Jesús Álvarez López (Universidade de Santiago de Compostela), Marco Brunella (Université de Bourgogne), Maria Cruz Fernández Fernández (Universidad de Sevilla), Rémi Langevin (Université de Bourgogne), Alvaro Lozano (Universidad del País Vasco), Gaël Megniez (Université de Bretagne Sud), Carlos Meniño (Universidade de Santiago de Compostela), Noboru Ogawa (Chuo University), Ken Richardson (Texas Christian University), Alberto Verjovsky (Instituto de Matemáticas UNAM), Elmar Vogt (Freie Universität Berlin).

Workshop on Holomorphic Foliations

21-23 April 2010

Participants: 35

Speakers

Gabriel Calsamiglia (Universidade Federal Fluminense), Dominique Cerveau (Université de Rennes I), Nuria Corral (Universidad de Cantabria), Sidney Frankel (Université de Paris VII), Xavier Gómez-Mont (CIMAT), Victor Kleptsyn (Université de Rennes I), Michael McQuillan (Università di Roma "Tor Vergata"), Laurent Meersseman (Université de Bourgogne), Mónica Manjarín (Université de Rennes I), Jean-François Mattei (Université Paul Sabatier), Julio Rebelo (Université Paul Sabatier), Nessim Sibony (Université de Paris Sud), Loïc Teyssier (Université Louis Pasteur).

Speakers

Workshop on Geometry of Foliations

26-27 April 2010

Participants: 30

Jesús A. Álvarez López (Universidade de Santiago de Compostela), Beniamino Cappelletti (Università di Bari), Gilbert Hector (Université Claude Bernard), Shigenori Matsumoto (Nihon University), Vladimir Rovenski (University of Haifa), Paul Alexander Schweitzer (PUC RIO), Robert Wolak (Uniwersytet Jagiellonski).

Workshop on Dynamics of Foliations
28-30 April 2010
Participants: 34

Speakers

Masayuki Asaoka (Kyoto University), Bertrand Deroin (Université Paris XI), Gilbert Hector (Université Claude Bernard), Steven Hurder (University of Illinois at Chicago), Shigenori Matsumoto (Nihon University), Paul Alexander Schweitzer (PUC RIO), Elmar Vogt (Freie Universität Berlin), Robert Wolak (Uniwersytet Jagiellonski).

Advanced Course on Foliations: Dynamics-Geometry-Topology
3-7 May 2010
Participants: 50

Lecturers

Masayuki Asaoka (Kyoto University), Aziz El Kacimi-Alaoui (Université de Valenciennes), Steven Hurder (University of Illinois at Chicago), Ken Richardson (Texas Christian University), Elmar Vogt (Freie Universität Berlin).

Conference on Geometry and Topology of Foliations
12-16 July 2010
Participants: 41

Speakers

Dmitry Bolotov (B. Verkin Institute for Low Temperature Physics), Alberto Candel (California State University Northridge), Aziz El Kacimi Alaoui (Université de Valenciennes), Steven Hurder (University of Illinois at Chicago), Yuri Kordyukov (Russian Academy of Sciences), Rémi Langevin (Université de Bourgogne), Álvaro Lozano (Universidad del País Vasco), Yoshihito Mitsumatsu (Chuo University), Jorge Vitório Pereira (IMPA), Takashi Tsuboi (University of Tokyo), Pawel Walczak (University of Lodz), Robert Wolak (Uniwersytet Jagiellonski).

3.1.4. CRM Research Programme on Variational Analysis and Optimization: Theory and Applications

From September to December 2010

Coordinators	**Aris Daniilis**	Universitat Autònoma de Barcelona
	Albert Ferrer	Universitat Politècnica de Catalunya
	Juan-Enrique Martínez-Legaz	Universitat Autònoma de Barcelona
Scientific Committee	Yijia Chen Shanghai	Jiao Tong University
	Fred Drueck	University of Illinois at Chicago
	Jörg Flum	Universität Freiburg
	Rami Grossberg	Carnegie Mellon University
	Tapani Hyttinen	University of Helsinki
	Vadim Kulikov	University of Helsinki

Juan Carlos Martínez	Universitat de Barcelona
Michael Rathjen	University of Leeds
Andrés Villaveces	Universidad Nacional de Colombia
Andreas Weiermann	University of Ghent

Summary

The activity "Variational Analysis and Optimization: Theory and Applications" was an intensive research program of four months that took place at the Centre de Recerca Matemàtica (CRM) from September to December 2010. The main goal of the program was to deepen our knowledge on the field of well-structured optimization problem, in both theoretical and practical aspects by means of techniques of convex optimization and variational analysis.

Among the topics treated is the rapidly developing field of "Tame Optimization", a research line based on a fruitful combination variational analysis techniques applied to optimization problems with algebraic-geometric considerations stemming from structural assumptions on the data.

A parallel line of research is the theory of monotone operators, which is of central importance in convex analysis and optimization as well as in other branches of nonlinear analysis. In recent years there has been a breakthrough in the study of such operators, consisting in the possibility of using the very well developed techniques of convex analysis thanks to the introduction of the Fitzpatrick function and other convex representations.

Another topic of fundamental importance concerns deterministic global optimization methods. Some deterministic algorithms perform quite well in small dimensions, but their performance deteriorates quickly as the dimensionality of search space increases. To transcend this drawback a new approximation algorithm for the global minimization of polynomials subject to box-constraints is being developed.

Visiting researchers

Aureli Alabert	Universitat Autònoma de Barcelona
Adil Bagirov	Ballarat University
Jaume Barceló	Universitat Politècnica de Catalunya
Carlos Beltrán	Universidad de Cantabria
Jérôme Bolte	Université de Toulouse
Giuseppe Buttazzo	Università di Pisa
Josefa Canovas	Universidad Miguel Hernández de Elche
Emilio Carrizosa	Universidad de Sevilla
Eduardo Casas	Universidad de Cantabria
Jordi Castro	Universitat Politècnica de Catalunya
Nguyen Dinh	International University Vietnam National University-HCMC
Asen Dontchev	University of Michigan
Dmitriy Drusvyatskiy	Cornell University
Zari Dzalilov	Ballarat University
Laureano Escudero	Universidad Rey Juan Carlos
Elena Fernández	Universitat Politècnica de Catalunya
Albert Ferrer	Universitat Politècnica de Catalunya
Jacek Gondzio	University of Edinburgh

Didier Henrion	LAAS- CNRS
Francisco-Javier Heredia	Universitat Politècnica de Catalunya
Glenn Hurlbert	Arizona State University
Alexander Ioffe	Technion-Israel Inst. of Technology
Hubertus Jongen	RWTH Aachen
Abelardo Jordán	Pontificia Universidad Católica del Perú
Angel Alejandro Juan	Universitat Oberta de Catalunya
Marta Kornafel	Cracow University of Economics
Jean Bernard	Lasserre LAAS- CNRS
Adrian Lewis	Cornell University
Marco Antonio López	Universitat d'Alacant
Roberto Lucchetti	Politecnico di Milano
Victoria Martín	Universidad de Sevilla
Narcís Nabona	Universitat Politècnica de Catalunya
Yurii Nesterov	Université Catholique de Louvain
Tim Netzer	Universität Leipzig
Miquel Oliu	Université Pierre et Marie Curie
Jeffrey Pang	MIT
Juan Parra	Universidad Miguel Hernández de Elche
Juan Peypouquet	Universidad Técnica Federico Santa María
János D. Pintér	Pintér Consulting Services, Inc. (PCS)
Marc Quincampoix	Université de Brest
Philipp Renner	University of Zurich
Julian Revalski	Bulgarian Academy of Science
Marco Rocco	Università degli Studi di Bergamo
Claudia Sagastizábal	Electric Energy Research Center of CEPEL
Markus Schweighofer	Universität Konstanz
Hristo Stoyanov Sendov	The University of Western Ontario
Stephen Simons	University of California at Santa Barbara
Mikhail Solodov	IMPA
Sylvain Sorin	Université Paris 6
Maxim Todorov	UDLAP
Anna-Laura Wickström	Universität Zürich
Constantin Zalinescu	University of Iasi

Activities organized

Weekly Seminar on Variational Analysis and Optimization: Theory and Applications

Speakers

Adil Bagirov (Ballarat University), Emilio Carrizosa (Universidad de Sevilla), Nguyen Dinh (Vietnam National University-HCMC), Dmitriy Drusvyatskiy (Cornell University), Alexander Ioffe (The Technion University), Marta Kornafel (Cracow University of Economics), Jean Lasserre (LAAS- CNRS), Marco Antonio López (Universitat d'Alacant), Victoria Martín-Márquez (Universidad de Sevilla), Marc Quincampoix (Université de Brest), Philipp Renner (University of Zurich), Christo Sendov (The University of Western Ontario), Stephen Simons (University of California at Santa Barbara), Mikhail Solodov (IMPA), Maxim Todorov (UDLAP),

Conference on Numerical Optimization and Applications in Engineering
13-15 October 2010
Participants: 46

Speakers Adil Bagirov (Ballarat University), Jaume Barceló (Universitat Politècnica de Catalunya), Laureano Escudero (Universidad Rey Juan Carlos), Jacek Gondzio (Edinburgh University), Glenn Hurlbert (Arizona State University), Janos Pinter (Özyeğin University), Claudia Sagastizábal (Electric Energy Research Center of Eletrobras Group).

Elena Fernández (Universitat Politècnica de Catalunya), Narcís Nabona (Universitat Politècnica de Catalunya), Emilio Carrizosa (Universidad de Sevilla), Jordi Castro (Universitat Politècnica de Catalunya), Zari Dzalilov (Ballarat University), Francisco-Javier Heredia (Universitat Politècnica de Catalunya), Ángel Alejandro Juan Pérez (Universitat Oberta de Catalunya), Esteve Codina (Universitat Politècnica de Catalunya).

International Conference on Advances in Optimization and Related Topics
29 November – 3 December 2010
Participants: 62

Speakers Giuseppe Buttazzo (Università di Pisa), Eduardo Casas (Universidad de Santander), Asen L. Dontchev (American Mathematical Society), Alexander Ioffe (Technion University of Haifa), Hubertus Jongen (Aachen Universität), Roberto Lucchetti (Politecnico di Milano), Yurii Nesterov (CORE, Université Catholique de Louvain-la-Neuve), Marc Quincampoix (Université de Brest), Julian Revalski (Bulgarian Academy of Sciences), Markus Schweighofer (Universität Konstanz), Hristo Sendov (University of Western Ontario), Stephen Simons (University of California), Sylvain Sorin (Université de Paris VI - Jussieu), Constantin Zalinescu (University of Iasi).

3.2. Congressos, workshops i cursos avançats

En aquest apartat es detallen els congressos, workshops, cursos avançats i jornades temàtiques que va organitzar el CRM durant l'any 2010 al marge dels programes de recerca.

3.2. Conferences, Workshops and Advanced Courses

This section lists the congress, workshops, advanced courses and thematic days organizad by CRM Turing 2010, not included in research programmes.

3.2.1. Thematic Day on the Geometric Langlands Correspondence III

January 14, 2010

Coordinators	**Luis Álvarez-Cónsul**	ICMAT - CSIC
	José Ignacio Burgos	ICMAT - CSIC
	Óscar García-Prada	ICMAT - CSIC
	Ignasi Mundet	Universitat de Barcelona

Speakers	Artur Travesa (Universitat de Barcelona), Joan Nualart (Universitat de Barcelona), Pilar Bayer (Universitat de Barcelona), Luis Dieulefait (Universitat de Barcelona).	

3.2.2. III International Conference on the Anthropological Theory of the Didactic

25-29 January 2010
Participants: 70

Speakers	Speakers: Michèle Artigue (Université de Paris VII), Yves Matheron (IUFM Midi-Pyrénées Toulouse), Robert Noirfalise (Instituto Tecnológico Autónomo de Trigueros), Carl Winslow (University of Copenhagen).

3.2.3. Seminar on Quantum Processing: Mathematics, Physics and Technology

24-25 February 2010
Place: FME – UPC and Institut d'Estudis Catalans

Coordinator	**Sebastià Xambó**	Universitat Politècnica de Catalunya

Speakers:	Antoni Acín (Institut de Ciències Fotòniques), Ignacio Cirac (Max Planck Institute of Quantum Optics), Maciej Lewenstein (Institut de Ciències Fotòniques), Morgan Mitchell (Institut de Ciències Fotòniques), Juan José Rué (ICMAT – CSIC), Sebastià Xambó (Universitat Politècnica de Catalunya)

3.2.4. Second International School on Geometry and Physics. Geometric Langlands and Gauge Theory

17-26 March 2010
Participants: 51

Coordinators	**Luis Álvarez-Cónsul**	ICMAT – CSIC
	José Ignacio Burgos	ICMAT – CSIC
	Óscar García-Prada	ICMAT – CSIC
	Ignasi Mundet	Universitat de Barcelona

Lecturers	David Ben-ZVI (University of Texas at Austin), Olivier Biquard (Institute de Mathématique Jussieu), Tamás Hausel (University of Oxford), Anton Kapustin (California Institute of Technology), Tony Pantev (University of Pennsylvania).

3.2.5. Teichmüller Theory and its Interactions in Mathematics and Physics, an ESF-EMS-ERCOM meeting

28 June - 3 July 2010
Participants: 82

Speakers	Norbert A'Campo (University of Basel), Jorgen Ellegaard Andersen (Aarhus University), Benson Farb (Chicago University), Vladimir Fock (Strasbourg University), William Goldman (Maryland University), Ursula Hamenstädt (Universität Bonn), Kirill Krasnov (Nottingham University), Vladimir Markovic (Warwick University), Gabriele Mondello (Università di Roma "La Sapienza"), Jean-Marc Schlenker (IMT Toulouse), John Smillie (Cornell University-veificar institució), Nathalie Wahl (Copenhagen University), Anna Wienhard (Princeton University), Scott Wolpert (Maryland University), Andrei Zelevinsky (Norheastern University).

3.2.6. Financial Engineering Summer School

6-9 July 2010
Participants: 71

Coordinators	**Paul MacManus**	Analistas Financieros Internacionales
	Sebastian del Baño	Centre de Recerca Matemàtica
Lecturers	Jon Danielsson (London School of Economics), Christopher Finger (RiskMetrics Group), Richard Martin (MAN Group), Alexander McNeil (Heriot-Watt University).	

3.2.7. Study Groups of Mathematics and Technology (GEMT 2010)

6-8 July 2010

Coordinators	**Aureli Alabert**	Universitat Autònoma de Barcelona
	Tim Myers	Centre de Recerca Matemàtica
	Jordi Saludes	Universitat Politècnica de Catalunya
Speakers	Vicent Ribas Ripoll (Sabirmedical), Joseba Quevedo (Sistemas Avanzados de Control), Enric Foch (Cisco Systems)	

3.2.8. Advanced Course on Integral Geometry and Valuation Theory

6-10 September 2010
Participants: 33

Coordinators	**Eduard Gallego**	Universitat Autònoma de Barcelona
	Ximo Gual	Universitat Jaume I
	Gil Solanes	Universitat Autònoma de Barcelona
	Eberhard Teufel	Universität Stuttgart
Lecturers	Semyon Alesker (Tel Aviv University), Joseph Fu (University of Georgia), Juan-Carlos Álvarez-Paiva (Université des Sciences et Technologies de Lille),	

Andreas Bernig (Johann Wolfgang Goethe-Universität Frankfurt), Luis Manuel Cruz-Orive (Univesidad de Cantabria), Daniel Hug (Karlsruhe Institute of Technology).

3.2.9. Thematic Days on equivariant stable homotopy

20 and 21 October

Coordinator **Grup de Topologia Algebraica de Barcelona (GTAB)**

Speaker Stefan Schwede (Universität Bonn)

3.2.10. Workshop on Mathematical Modeling of Blood Flow and the Baroreflex System

13-17 December 2010
Participants: 10

Speakers Tim Myers (Centre de Recerca Matemàtica), Michelle De Decker (Centre de Recerca Matemàtica), Francesc Font (Centre de Recerca Matemàtica), Andrew Fowler (Oxford University and Limerick University), Jonathan Low (Centre de Recerca Matemàtica), Adam Mahdi (University of North Carolina), Mark McGuinness (University of Wellington), Sarah Mitchell (University of Limerick), Vicent Ribas (Sabirmedical), Anna Saez de Tejada (Sabirmedical).

3.2.11. Seminar Cycle on Computational and Systems Neuroscience

Monthly seminar
Place: Pompeu Fabra University, at the IDIBAPS or at the CRM.

Coordinators	**Albert Compte**	IDIBAPS, Barcelona
	Gustavo Deco	Universitat Pompeu Fabra
	Antoni Guillamon	Universitat Politècnica Catalunya
	Jordi G. Ojalvo	Universitat Politècnica Catalunya

Speakers Alain Destexhe (Université de Neuroscience, Information & Complexité), Georgia Gregoriou (Institute of Applied and Computational Mathematics), Joaquim Fuster (UCLA), Peter Rosinson (University of Cambridge), Tatiana Pasternak (University of Rochester), Xiao-Xing Wang (Yale University School of Medicine), Paul Bressloff (Oxford Center for Collaborative Applied Mathematics Institute), Nikos Logothetis (MPI for Biological Cybernetics), Alexander Lerchner (Gatsby Unit, UCL)

3.2.12. Seminar Cycle on Quantitative Finance

Coordinators	**Joan del Castillo**	Universitat Autònoma de Barcelona
	José Manuel Corcuera	Universitat de Barcelona
	Josep J. Masdemont	Universitat Politècnica de Catalunya
	Frederic Utzet	Universitat Autònoma de Barcelona
	Josep Vives	Universitat de Barcelona

Speakers Wim Schoutens (Catholic University of Leuven), Paul Embrechts (ETH Zürich)

3.3. Activitats Divulgatives
3.3. Informative Activities

3.3.1. Joint CRG – CRM Meeting on Mathematical in Genomics and Systems Biology

22 October 2010
Place: Parc de Recerca Biomèdica de Barcelona (PRBB)

Coordinator **Roderic Guigó (CRG)**

Speakers Gerald Rubin (Janelia Farm Research Campus), Arndt Benecke (IHES, Paris), Luis Serrano (CRG), Gian Gaetano Tartaglia (CRG), Tomás Alarcón (CRM), Yogi Jaeger (CRG), Roderic Guigó (CRG), Àngel Calsina (UAB), Robert Castelo (GRIB), Marta Casanellas (UPC), Juan Valcárcel (CRG), Ben Lehner (CRG), Frances Comellas (UPC), Cedric Notredame (CRG), Hernán López-Schier (CRG), Elisenda Feliu (UB), Mark Isalan (CRG), Antoni Guillamon (UPC), Matthieu Louis (CRG), Roger Guimerà (URV), Omiros Papaspiliopoulos (UPF).

3.3.2. 2010 CRM Open Day

El 8 d'octubre de 2010, el CRM va organitzar una jornada que ha esdevingut anual i que té dos propòsits: aplegar la comunitat matemàtica local per a un intercanvi informal d'impressions i comptar amb la presència de destacadíssims matemàtics en l'esfera internacional i de responsables de política científica dels diversos governs.

On October 8, 2010, the CRM organised a meeting which is held annually and serves two purposes: to gather together the local mathematical community for an informal exchange of views about current developments, and to offer talks by first-class mathematicians as well as by scientific policy makers.

Speakers Marco Antonio López-Cerdà (Universitat d'Alacant), Marta Sanz-Solé (Universitat de Barcelona, Presidenta de l'EMS)

Publicacions del CRM

CRM Publications

4

4.1. Advanced Courses in Mathematics CRM Barcelona

Els volums d'aquests sèrie, publicada per l'editorial suïssa Birkhäuser, recullen el contingut d'alguns dels cursos avançats impartits al CRM, a partir de les notes prèvies lliurades als participants i reelaborades pels autors. Es tracta de llibres de text, especialment adreçats a estudiants de doctorat avançats i a investigadors postdoctorals.

Des de setembre de 2008 l'editor responsable d'aquesta sèrie és Carles Casacuberta. Ha substituït en aquest càrrec a Manuel Castellet, que va iniciar la sèrie l'any 2001.

L'any 2010 ha apregut un volum d'aquesta sèrie:

The volumes of this series, published by the Swiss publishing company Birkhäuser, cover the content of some of the advanced courses taught by specialists at the CRM. They are based on notes handed out to students and later reworked by the authors. These volumes are especially addressed to advanced doctoral and young post-doctoral students.

Since 2008, the responsible editor of this series is Carles Casacuberta. He replaced Manuel Castellet, who started the series in 2001.

One volume of this series was published in 2010:

Simplicial Methods for Operads and Algebraic Geometry
by Ieke Moerdijk and Bertrand Toën
edited by C. Casacuberta and J. Kock
ISBN: 978-3-0348-0051-8

4.2. Documents del CRM

El CRM va iniciar una nova sèrie de volums amb ISBN l'any 2008, anomenada Documents. En aquesta sèrie s'hi publicaran monografies, actes

The CRM launched a new series of volumes with ISBN in 2008, called Documents. These include monographs, proceedings of events, reports of de jornades o congressos, informes de projectes de recerca i altres reculls de material de qualitat. Els volums de la sèrie publicats aquest any 2010 han estat els següents:

research programmes, and other quality material. The following volume was published in 2010:

Grups d'Estudi de Matemàtica i Tecnologia (GEMT 2009)
editat per A. Alabert, J. Saludes, i J. Solà-Morales (vol. 6, 2010)

DocCourse Combinatorics and Geometry 2009, Part I: Intensive Courses

DocCourse Combinatorics and Geometry 2009, Part II: Seminars

DocCourse Combinatorics and Geometry 2009, Part III: Research Reports
editat per M. Noy i J. Pfeifle (vol. 5, 2010)

Homotopy Theory and Higher Categories
editat per C. Casacuberta i J. Kock (vol. 4, 2010)

4.3. Quaderns del CRM

La sèrie Quaderns recull el contingut d'activitats especialitzades, principalment els apunts lliurats prèviament pel professorat de cursos avançats del CRM. Durant l'any 2010 s'han publicat els següents exemplars:

Booklets in this series contain specialised texts, mostly preliminary notes delivered by lecturers of CRM Advanced Courses. The following issues were printed in 2010:

D. Ben-Zvi, O. Biquard, T. Hausel, A. Kapustin, T. Pantev
Advanced Course on Second International School on Geometry and Physics Geometric Langlands and Gauge Theory
Març 2010

D. Goss
Workshop and Advanced Course on Drinfeld Modules and L-functions
Abril 2010

M. Asaoka, A. El Kacimi-Alaoui, S. Hurder, K. Richardson, E. Vogt
Advanced Course on Foliations: Dynamics-Geometry-Topology
Maig 2010

S. Alesker, J. Fu
Advanced Course on Integral Geometry and Valuation Theory
Setembre 2010

4.4. Preprints del CRM

La sèrie de prepublicacions del CRM s'ha incrementat amb els 83 títols següents durant l'any 2010:

The CRM preprint series grew with the following 83 issues in 2010:

J.A. Carrillo, S. Cordier, S. Mancini
A decision-making Fokker-Planck model in computational neuroscience

T.G. Myers
Optimal exponent heat balance and refined integral methods applied to Stefan problems

T.G. Myers, N.D. Fowkes, Y. Ballim
Modelling the cooling of concrete by piped water

F. Bassino, A. Martino, C. Nicaud, E. Ventura, P. Weil
Statistical properties of subgroups of free groups

A. Bandini, F. Bars, I. Longhi
Aspects of Iwasawa theory over function fields

C. McDiarmid
On graphs with few disjoint t-stars

J.I. Burgos, E. Feliu
Higher arithmetic Chow groups

J.I. Burgos, R. Litcanu
Singular Bott-Chern classes and the arithmetic Grothendieck-Riemann-Roch theorem for closed immersions

E. Morozov
A general multiserver state-dependent queueing system

S. Molina
Ribet bimodules and the specialization of Heegner points

P. Hajlasz
Sobolev mappings: Lipschitz density is not an isometric invariant of the target

S.L. Mitchell, T. Myers
Application of standard and refined heat balance integral methods to one-dimensional Stefan problems

N. Bessonov, P. Kurbatova, V. Volpert
Dynamics of growing cell populations

M. Longo, V. Rotger, S. Vigni
On rigid analytic uniformizations of Jacobians of Shimura curves

M. Longo, S. Vigni
An irreducibility criterion for group representations, with arithmetic applications

K. Astala, A. Clop, X. Tolsa, I. Uriarte-Tuero, J. Verdera
Quasiconformal distortion of Riesz capacities and Hausdorff measures in the plane

J. Díaz, D. Mitsche, P. Santi
Theoretical aspects of graph models for MANETs

D. Mitsche, M. Saumell, R. I. Silveira
On the number of higher order Delaunay triangulations

D. Gorbachev, E. Liflyand, S. Tikhonov
Weighted norm inequalities for Fourier transforms of radial functions

M. J. Cáceres, J. A Carrillo, L. Tao
A numerical solver for a nonlinear Fokker-Planck equation representation of neuronal network dynamics

N. Bournaveas, A. Buguin, V. Calvez, B. Perthame, J. Saragosti, P. Silberzan
Mathematical description of bacterial traveling pulses

V. Calvez, N. Meunier
A one-dimensional Keller-Segel equation with a drift issued from the boundary

V. Calvez, L. Corrias, M. A. Ebd
Blow-up, concentration phenomenon and global existence for the Keller-Segel model in high dimension

P. Goldstein, P. Hajłasz
Sobolev mappings, degree, homotopy classes and rational homology spheres

S. Molina
Equations of hyperelliptic Shimura curves

T. Ando, Y. Kabashima, H. Takahashi, O. Watanabe, M. Yamamoto
Spectral analysis of random sparse matrices

E. Maneva, T. Shigezumi, Y. Uno, O. Watanabe
Level-wise node size distribution of randomly generated regular trees

V. Rovenski
Integral formulae for a Riemannian manifold with a distribution

C. Armana
Coefficients of Drinfeld modular forms and Hecke operators

A. Coja-Oghlan, M. Onsjö, O. Watanabe
Propagation connectivity of random hypergraphs

J. Brüning, F. W. Kamber, K. Richardson
The eta invariant and equivariant index of transversally elliptic operators

A. Atserias, E. Maneva
Mean-payoff games and propositional proofs

T. M. Fiore, N. Gambino, J. Kock
Monads in double categories

L. Dieulefait, A. Pacetti, M. Schütt, J. Burgos
Modularity of the Consani-Scholten quintic

N. Bhatnagar, A. Sly, P. Tetali
Reconstruction threshold for the hardcore model

L. R. Berrone, L. Dieulefait
A functional equation related to the product in a quadratic number field

A. Ferreiro-Castilla, F. Utzet
Lévy area for Gaussian processes: A double Wiener--Itô integral approach

J. T. Baldwin
Amalgamation, absoluteness, and categoricity

A. Delshams, G. Huguet
A geometric mechanism of diffusion: Rigorous verification in a priori unstable Hamiltonian systems

V. Calvez, J. A. Carrillo
Refined asymptotics for the subcritical Keller-Segel system and related functional inequalities

T. M. Fiore, W. Lück, R. Sauer
Euler characteristics of categories and homotopy colimits

P. Ara, M. Mathieu
When is the second local multiplier algebra of a C-algebra equal to the first?*

T. G. Myers
Why are slip lengths so large in carbon nanotubes?

B. Ayuso de Dios, J. A. Carrillo, C.-W. Shu
Discontinuous Galerkin methods for the Multi-dimensional Vlasov-Poisson problem

J. J. Gutiérrez, R. M. Vogt
A model structure for coloured operads in symmetric spectra

J. Bolte, A. Daniilidis, A. S. Lewis
Generic optimality conditions for semi-algebraic convex programs

J. Valero, J. Ginebra, M. Pérez-Casany
Extended truncated Tweedie-Poisson model

J. Valero, M. Pérez-Casany, J. Ginebra
On left-truncating and mixing Poisson distributions

H. N. Mhaskar, S. Tikhonov
Wiener type theorems for Jacobi series with nonnegative coefficients

E. Nualart, L. Quer-Sardanyons
Gaussian estimates for the density of the non-linear stochastic heat equation in any space dimension

J. C. Martinez, L. Soukup
Superatomic Boolean algebras constructed from strongly unbounded functions

M. J. Cáceres, J. A. Carrillo, B. Perthame
Analysis of nonlinear noisy integrate \& fire neuron models: blow-up and steady states

A. Deluca, A. Corral
Power laws and scaling of rain events and dry spells in the Catalonia region

O. Peters, A. Deluca, A. Corral, J. D. Neelin, C. E. Holloway
Universality of rain event size distributions

M. Kalmoun, L. Garrido, V. Caselles
Line search multilevel optimization as computational methods for dense optical flow

E.-U. Gekeler
On the zeroes of Goss polynomials

D. Marín, J. V. Pereira
Rigid flat webs on the projective plane

L. Dembélé, J. Voight
Explicit methods for Hilbert modular forms

J. Tilouine
Note on companion forms of low weight on GSp4(Q)

.A. Álvarez, M. Calaza
A type of perturbation of the harmonic oscillator

J. Brüning, F.W. Kamber, K. Richardson
The eta invariant and equivariant index of transversally elliptic operators

G. Habib, K. Richardson
Modified differentials and basic cohomology for Riemannian foliations

J. Brüning, F.W. Kamber, K. Richardson
Index theory for basic Dirac operators on Riemannian foliations

E.-U. Gekeler
Eisenstein series for principal congruence subgroups of GL(2,Fq[T])

J.B. Lasserre
An algorithm for semi-infinite polynomial optimization

A.D. Ioffe
On stability of solutions to systems of convex inequalities

J.C. Martínez
On finite unions and finite products with the D-property

V. Rotger, M.A. Seveso
A survey on recent p-adic integration theories and arithmetic applications

M. Kornafel
Existence and uniqueness of viscosity solution for Hamilton-Jacobi equation with discontinuous coefficients dependent on time

G. Hurlbert
A linear optimization technique for graph pebbling

H. Nozawa
On continuity of the Álvarez class under deformation

E. González-Gutiérrez, L. Hernandez, M.I. Todorov
Relaxation methods for solving linear inequality systems: Converging results

D. Ionescu, A.A. Juan, J. Faulin, A. Ferrer
A parameter-free approach for solving combinatorial optimization problems through biased randomization of efficient heuristics

N. Dinh, M.A. Goberna, M.A. López
On the stability of the optimal value and the optimal set in optimization problems

E. Nursultanov, T. Aubakirovz
Interpolation methods for stochastic processes spaces

J. Baldwin, T. Hyttinen, M. Kesälä
Beyond first order logic: From number of structures to structure of numbers

T. Arrigoni, S.-D. Friedman
Foundational implications of the inner model hypothesis

S. R. Buss
Sharpened lower bounds for cut elimination

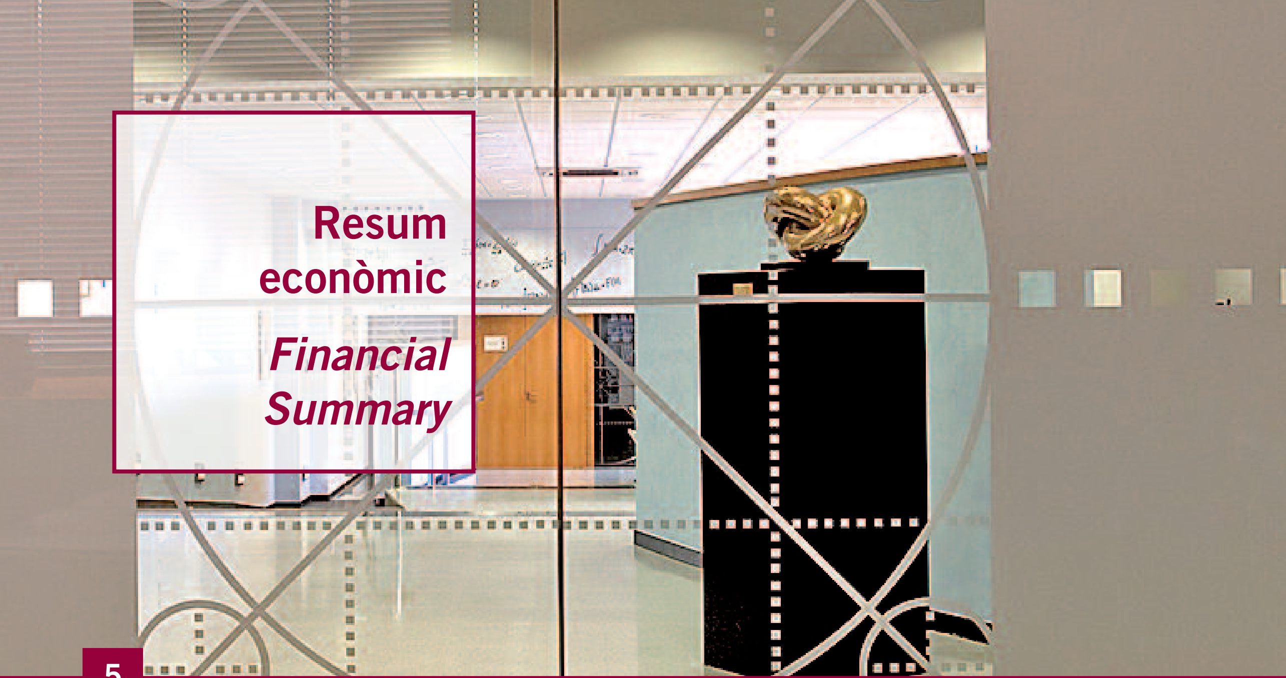
Y. Chen, J. Flum
On p-optimal proof systems and logics for PTIME

Y. Chen, J. Flum
On slicewise monotone parameterized problems and optimal proof systems for TAUT

S.-D. Friedman, T. Hyttinen, V. Kulikov
Generalized descriptive set theory and classification theory

T. M. Fiore, N. Gambino, J. Kock
Double adjunctions

C. Armana
Sur les symboles modulaires de Manin-Teitelbaum pour Fq(T)



5 Resum econòmic

Financial Summary

5.1. Ingressos 2010 — *5.1. Income 2010*

Ingressos competitius *Competitive funding*	683.595,03 €
Ingressos no competitius *Non-competitive funding*	1.022.857,79 €
TOTAL	**1.706.452,82 €**

5.2. Despeses 2010 — *5.2. Expenses 2010*

Despeses de personal *Personnel expenses*	980.452,36 €
Despeses d'explotació *Opertating expenses*	577.165,36 €
Altres despeses *Other expenses*	28.254,00 €
Amortització inmobilitzat *Depreciation of intangibles*	87.464,29 €
Resultat financer (despesa) *Financial outcome (expenditure)*	34.533,44 €
Resultat exercici *Annual profit*	-1.416,67 €
TOTAL	**1.706.452,78 €**