BULLETIN

INTERNATIONAL CENTER FOR MATHEMATICS

December 1999 7

CIM Administration Board for 2000/ 2004

At the General Assembly meeting on 4th December 1999 the CIM Administration Board for the period 2000/2004 was elected. The next President will be Professor Luís Trabucho, Universidade de Lisboa, with Professors Amílcar Sernadas, Instituto Superior Técnico and João Filipe Queiró, Universidade de Coimbra, as Vice-Presidents.

Professors Carlos Guedes de Oliveira, Universidade do Porto and Luís Nunes Vicente, Universidade de Coimbra, will serve as Secretary and Treasurer respectively.

Professor Paula Oliveira, Universidade de Coimbra, will be the General Assembly President while Professora Estelita Vaz, Universidade do Minho, is the Administrative Council President.

Coming Events

MACAU 2000

Mathematics and its Role in Civilization

Organizers

Portugal

Graciano Neves de Oliveira, Department of Mathematics, University of Coimbra, president of the Portuguese Mathematical Society;

João Filipe Queiró, Department of Mathematics, University of Coimbra, representing the Centro Internacional de Matemática.

China

Yu Chong-hua, Department of Mathematics, Fudan University, Shanghai;

Zhang Wen-ling, National Natural Science Foundation of China, Beijing.

Macau

Iu Vai Pan, dean of the Faculty of Science and Technology, University of Macau;

Raymond Che-Man Cheng, Faculty of Science and Technology, University of Macau;

Zhou Chao Chen, Director of UNU/IIST, International Institute for Software Technology, United Nations University.

Scientific Committee

E. R.Arantes e Oliveira (Lisboa),

D. G.Crighton (Cambridge),

C. Dafermos (Providence, RI),

GU Chaohao (Shanghai),

G. Kahn (Paris),

LI Ta-tsien (Shanghai),

J-L. Lions (Chairman, Paris),

J. Palis (Rio de Janeiro),

J. F. Rodrigues (Lisboa).

Structure

Aiming at a worldwide participation, the scope of the conference includes topics such as:

Comparison of the role of Mathematics in different civilizations, and exchanges and interactions in the past, with particular emphasis on the East/West encounter of mathematical cultures;

The role of Mathematics in calendars, astronomy and cartography, and other aspects of Mathematics as a driving force in human progress;

Current co-operation between industrialized and developing countries in the mathematical sciences and contributions of Mathematics for sustainable economical, industrial and social development;

Mathematical research and education for science and technology and the popularization and understanding of Mathematics in diverse cultures;

Perspectives of Mathematics in the future of civilization and its role in the Information Society.

Main Speakers

E.R.Arantes e Oliveira,

M. S. Narasimhan,

C. Dafermos,

I.Fonseca,

QI Min-You,

Wu-Yi HSIANG,

A. Quarteroni,

G. Kahn,

M. Rabin,

J.Mawhin,

L. Saraiva,

WU Wen-Jun,

Philippe Flajolet.

Round Tables

Mathematics, History and Culture,

Mathematics, Technology and Development,

Mathematics, Computer and Information Society.

Date

11th to 14th January 2000.

Registration

Dr. Raymond C. M. Cheng, Faculty of Science and Technology, University of Macau, Macau. Fax: (853) 838 314. Email: mo2000@umac.mo.

It is also possible to register online, at:

http://www.fst.umac.mo/news/conf/mo2000/

where other information about the conference can be found.

Thematic Term on Dynamics, Bifurcation and Biology

Organizers

J.A. Basto-Gonçalves, I.S. Labouriau, CMAUP and Faculdade de Ciências da Universidade do Porto.

Each subevent has its own organizing committee.

Date

May to July 2000.

Structure

2nd May to 5th May, School on Dynamical Systems

FCUP, PORTO, e-mail: dynsys@fc.up.pt

The school is specially intended for postgraduate students and young researchers in dynamical systems.

Courses:

* Genericity and weak forms of hyperbolicity - C. Bonatti (Dijon, France).
* Dimension and its computation - M. Pollicott (Manchester, UK).
* Ergodic theory of chaotic systems - M. Viana (Rio de Janeiro, Brasil).
* Nonuniformly hyperbolic horseshoes - J.-C. Yoccoz (Paris, France).

Organizers: M. J. Costa, A. A. Pinto, M. Pollicott

8th May to 13th May, International Conference on Dynamical Systems

FCUP, PORTO, e-mail: dynsys@fc.up.pt

Scientific Commitee:
M. Benedicks, J. Palis, Ya. Sinai, S. van Strien and J.-C. Yoccoz.

Organizers: M. J. Costa, A. A. Pinto, M. Pollicott

June, School on singularities

29th June to 4th July, Conference on Bifurcations, Symmetry and Patterns

(in honour of Martin Golubitsky and Ian Stewart)

FCUP, PORTO, e-mail: bif2000@fc.up.pt

Confirmed invited speakers:
P. Ashwin (UK), P. Chossat (F), B. Dionne (CA), B. Fiedler (D), M. Field (USA), M. Golubitsky (USA), E. Knobloch (USA), J. Lamb (UK), W. Langford (CA), I. Melbourne (USA), M. Roberts (UK), M. Silber (USA), I. Stewart (UK), H. Swinney (USA).

Organizers:
I. Labouriau , S. Castro, J. Buescu , A. Dias.

5th July to 14th July, School on Bifurcations, Symmetry, and Patterns

CIM (Observatório Astronómico), COIMBRA, e-mail: bif2000@fc.up.pt

The school is specially intended for postgraduate students and young researchers in bifurcation and its applications. It also has a course in common with the school in Mathematical Biology.

Courses:

* Numerical methods for dynamical systems - M. Dellnitz (D).
* Complex dynamics in symmetric systems - M. Field (Houston, USA).
* Symmetry, dynamics, bifurcations and applications - M. Golubitsky (Houston, USA) and I. Stewart (Warwick, UK).
* Models of biological pattern formation - H. Meinhardt (D).

Organizers:
I. Labouriau, S. Castro , A. Dias .

10th July to 21st July, School on Dynamics and Patterns in Biology

CIM (Observatório Astronómico), COIMBRA

24th July to 28th July, Workshop on Dynamics and Patterns in Biology

CIM (Observatório Astronómico), COIMBRA

SUPPORT

Centro Internacional de Matemática (Portugal)
Centro de Matemática Aplicada, UP
Fundação Calouste Gulbenkian (Portugal)
Fundação para a Ciência e Tecnologia (Programa Praxis XXI)
Departamento de Matemática Aplicada, UP
Departamento de Matemática Pura, UP
Faculdade de Ciências, UP
Centro de Análise Matemática, Geometria e Sistemas Dinâmicos, IST

For more information on these events and registration forms , please visit the site:

http://www.fc.up.pt/ma/cma/act/trimes/

Mathematical aspects of evolving interfaces

Organizers

P.Colli, University of Pavia, Italy;

J.F.Rodrigues, University of Lisbon, Portugal.

This is a CIM/CIME Summer School.

Date

3rd to 9th July 2000.

Structure

Series of five complementary courses with 3 or 4 lectures of 1h/1h30m for each course and a limited number of selected talks of 20/30 minutes each by young researchers or postdocs.

For details please see http://maei.lmc.fc.ul.pt/

Workshop on Partially Known Matrices and Operators

The present state of knowledge on the study of eigenvalues and other properties of matrices when only part of the entries are known will be discussed. Applications of this kind of problems to Systems Theory, extensions to operators in infinite dimensional spaces and the use of techniques from Combinatorics and Algebraic Combinatorics will also be discussed.

Several experts in the field will be present.

Organizers

Fernando C. Silva, University of Lisbon;

António Leal Duarte, University of Coimbra;

Isabel Cabral, New University of Lisbon;

Susana Furtado, University of Oporto.

Date

3 days in September 2000.

Structure

12 invited 1-hour talks and some contributed 20-minute talks.

Support

Centro de Estruturas Lineares e Combinatórias

Centro de Matemática da Universidade de Coimbra

Fundação para a Ciência e Tecnologia

Great Moments in XXth Century Mathematics

by Efim Zelmanov

Professor F. J. Craveiro de Carvalho asked me to choose two outsanding mathematical events of this century. I'll restrict myself to the field of Abstract Algebra (even that won't be easy!).

Emmy Noether's work on ideals in commutative rings (preceded and influenced by the work of her mentor David Hilbert). I don't think that this work is very deep and certainly it is not the best work of Emmy Noether. Still I find it remarkable as a manifesto of the beautiful, controversial, and seductive axiomatic method. Time tempered the euphorea and indicated the limits within which this

method is helpful. But even the staunchest critics of "axiomatizing" perhaps won't argue that it affected the way in which they present their own work.

The deep and powerful "odd order theorem" of W. Feit and J. Thompson and the whole classification project of finite simple groups (a collective effort of a group of first rate mathematicians).

Efim Zelmanov was awarded a Fields Medal at the Zurich ICM, 1994, for his solution of the Restricted Burnside Problem. He is currently Full Professor at Yale University.

An Interview with David Chillingworth

*Your father was a mathematician. In fact the author of a very successful textbook on complex variable theory (*H. R. Chillingworth*, Complex Variables, Pergamon Press, 1973). Was that influential in your becoming a mathematician?*

Certainly. My father loved mathematics and, as he was unable to stay on at university after an M.Sc. degree, he went back to research in his later career as a lecturer in a college for teacher training and gained a Ph.D. at that stage. There was always mathematics around at home, on the backs of envelopes, margins of newspapers and so on. Nevertheless, I might easily have taken a different path when the time came to make key decisions about subject choices: perhaps it was ultimately through conservatism that I stayed with mathematics.

You went up to Cambridge as an undergraduate. What was it like to be an undergraduate in Cambridge in the 60's? Who were the big names at that time? Did you happen to have some interaction with them?

Undergraduates in mathematics may not be aware of who are the big names. I attended lectures on complex variables by Harold Davenport and on differential equations by Mary Cartwright, among others. I could have done but did not attend lectures by Paul Dirac, because (foolishly) I thought I wasn't interested in Quantum Theory which was 'applied' and therefore – following the unfortunate precept of G.H. Hardy – not as respectable as 'pure' mathematics. Of course now I wish I had heard Dirac in person. My Director of Studies was Frank Smithies, still at Cambridge and involved in mathematics.

It is amazing to realize now how few text books there were at that time. For one lecture course I attended on Analysis the recommended texts were by Goursat and de la Vallée Poussin, and there seemed to be only one book on Linear Algebra (Mirsky). It is rather different now!

Cambridge in the 60's was still fairly traditional. Academic gowns were (officially) to be worn when attending lectures, meeting tutors, and walking in the street after dark – as well as when dining. There were no mixed undergraduate colleges and few women. College gates were locked at night, so climbing in was fairly common: those whose rooms lay on popular routes were frequently disturbed.

David Chillingworth

After graduating you stayed on to do postgraduate work. I think that W. B. R. Lickorish was your research supervisor. What was the subject of your thesis?

I was offered the chance to move to the new University of Warwick as one of the first batch of research students, but lacked the pioneering courage and decided to stay in Cambridge. In my final undergraduate year I had been fascinated to read a short section from Hilton & Wylie: *Homology Theory* dealing with integration along paths and cohomology theory (de Rham cohomology); until then I had no idea that algebraic topology had any connection with calculus. Therefore I gave the proposed title

for a thesis as Applications of Topology to the Solution of Differential Equations. In fact I worked on a different topic: curves on surfaces, and homeomorphisms of surfaces. At the time it seemed rather a backwater (that was before Thurston's ideas burst upon the scene!), but at least something I could understand, as it was low-dimensional and I did not have to grapple with exotic spheres, the Hauptvermutung, the s-cobordism theorem and other (to me) alarming monsters in the jungle of high-dimensional topology.

Part of my work was an extension of results by Raymond Lickorish, whom I found to be a very congenial and encouraging research supervisor. Life as a mathematics research student is a strange experience, as you have a very unstructured programme in which you devote almost all your energies to doing something that almost nobody is interested in ... but Ray's good humour and humanity were important in keeping me on track.

Another strand of my research arose by good fortune. One of the other research students Les Harris happened to come across a paper on *winding numbers* for curves on surfaces which he showed to me as he knew I liked that sort of thing. It was from trying to understand that paper that I was able to build a theory of winding numbers that gave a partial solution to a problem Raymond Lickorish had suggested to me, namely how to decide when an element of the fundamental group of a surface is represented by a simple closed curve. For that I owe a debt of gratitude to Les, and never forget how important it is to talk to others and to keep eyes and ears open for useful ideas.

In the second half of the 60's you moved to Warwick, then a very new university. You were then exposed to new ideas in other mathematical areas (Dynamical Systems, Catastrophe Theory . . .) and also actively involved in them. For instance, you edited the proceedings of a year-long symposium on Dynamical Systems (volume 206, Lecture Notes in Mathematics*). For a young mathematician it must have been an exciting place and an exciting time. Can you give us an idea of the Warwick scene at that time?*

My first post was as a 1-year Temporary Assistant Lecturer at Warwick, during which time I was finishing off my Ph.D. thesis. At that period Christopher Zeeman, who founded the Mathematics Department and Research Centre at Warwick, had moved away from 'pure' topology and become increasingly interested in dynamical systems – which was, after all, the motivation for the creation of much of the machinery of topology by Henri Poincaré in the first place. There was a big meeting at Berkeley in 1968 in which the pioneering work of Stephen Smale and his students and others in dynamical systems played a major role, and in 1968/69 Zeeman organized a year-long Symposium on Differential Equations and Dynamical Systems at Warwick in which many of the Berkeley people took part. In associaton with this there were a number of 3-year postdoctoral positions, one of which I was fortunate to hold: editing the Symposium Proceedings was an excellent apprenticeship in the subject.

My own interest in the area had been sparked by a visit by Zeeman to Cambridge when I was a research student. He had come to give a seminar talk in topology (I forget the topic), and at tea afterwards he was enthusiastically showing how the phase space for the spherical pendulum decomposes into pieces of different topological types at different energy levels, and so to understand this mechanical system it is necessary to understand some specific geometry and topology. To me this was a revelation: for the first time I realized that sophisticated tools from 'pure' mathematics were needed in even such an 'applied' problem as the motion of a pendulum. Suddenly the abstract world of topology in which I had been living and working for three years seemed to make contact with reality! So the wheel turned full circle and I ended up working in the applications of topology to differential equations after all.

It was certainly a very exciting time, with a wide range of famous visitors not only from the USA but from Japan and Eastern Europe: I had the pleasure to meet Urabe, Halanay, Kurzweil and others. (However, I do not recall any from the Soviet Union.)

The following year Zeeman and several of the Symposium participants moved to IHES, Paris, and I was lucky enough to be able to spend a year there too: it would be difficult to imagine a better way to learn the subject than this total immersion. Of course Catastrophe Theory was flourishing at that time: David Fowler was working on the English translation of René Thom's *Stabilité Structurelle et Morphogénèse*, and Zeeman was inventing his catastrophe machine. Also Floris Takens was there, developing ideas with David Ruelle on dynamical systems models for turbulence. Charles Pugh was busy constructing a chicken-wire and plaster series of models to illustrate Smale's famous theorem on everting a 2-sphere in 3-space, and Alexandre Grothendieck was renouncing mathematics and circulating tracts about the survival of the human race. That was a stimulating year.

After Warwick you got a position at the University of Southampton where you have been since 1971. How has your mathematical career developed? How have your research interests varied over the years?

Although I try to keep in touch with the main directions of research in dynamical systems, my own work has been mainly in the application of differential topology in general and singularity theory in particular to problems in bifurcation theory. Recently I have been increasingly interested in the role of *symmetry* in dynamics and bifurcation theory, and I have tried to relate some of the current thinking on detection of symmetry in chaotic dynamics to fundamental geometric ideas developed by Stewart Robertson and students here at Southampton. In a different direction, I have formulated a general description of phase-space geometry for a simple impact oscillator (say a forced linear oscillator with one degree

of freedom and and obstacle at a fixed position); this, too, involves singularity theory.

As a former Southampton research student I know that you are a very good lecturer and made intense use of some written notes of yours and of your book Differential Topology with a View to Applications *(Pitman Research Notes in Mathematics, 9). Do you have plans for some more work in this area?*

Thank you for the kind remarks. The book you mention is now 20 years out of date: it was written before the Lorenz equations, the Mandelbrot set and other now famous dynamical examples had been discovered or come to public notice. I would like to write an updated version, but currently the pressure to publish research papers puts it at the back of the queue. Maybe when I retire ...

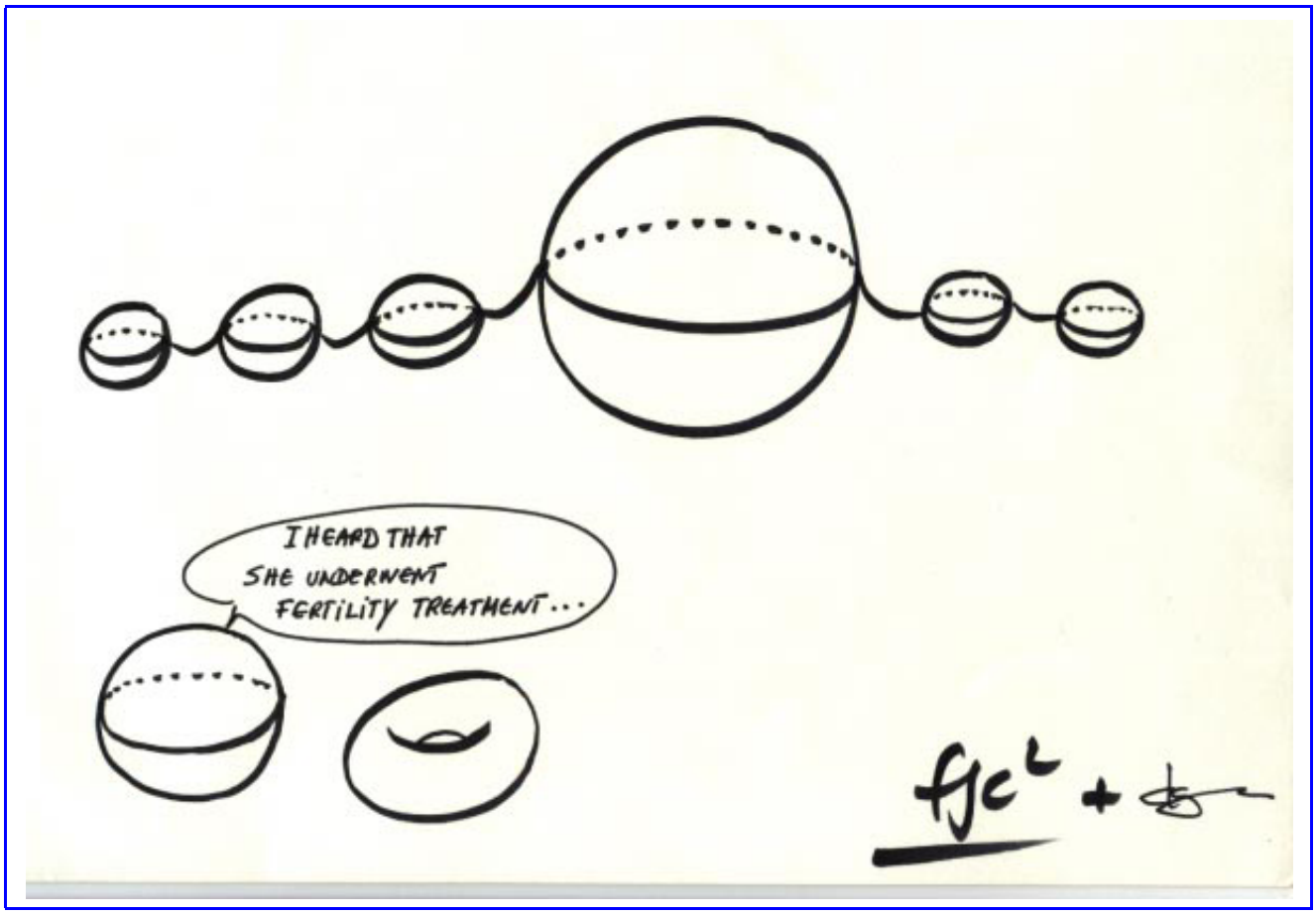
We will finish on a lighter note. As it happens with many mathematicians music is one of your great interests outside mathematics. Do you still play the guitar?

I have to say no, although I do take it out of its case every now and then. However, I still belong to the Southampton Classical Guitar Society after 25 years, and enjoy recitals of guitar or other plucked stringed instruments – including the Indian sitar. Now there's a project for retirement ....

David Chillingworth was born near Manchester, England in 1943 and was brought up in London. He graduated from Cambridge University in 1964 and stayed on to do postgraduate work. His Ph.D. dissertation was in low-dimensional topology (homeomorphisms of surfaces).

He has held academic posts at the universities of Warwick and Southampton where he has been since 1971. He has given mathematical talks in numerous countries and spent several months at universities in Europe and USA, including visits to research institutes such as I.H.E.S.– Paris and IMA – Minneapolis.

These days he is attracted to applications of differential topology, particularly using singularity theory to study bifurcations of differential equations. He is the author of a very successful textbook, "Differential Topology with a View to Applications", published by Pitman.



Luís de Albuquerque, the historian of science

Aquilino Ribeiro said that the Portuguese language was a mausoleum of a great literature. But there are other things that seem to be buried in that language. One of these is the Portuguese history of the maritime discoveries. It does not require a great effort to confirm this addition of mine to Aquilino's mausoleum. If one simply browses through any standard history of science in English or French one barely finds any reference to the Portuguese maritime explorations in the 15th and 16th century.

Luís de Albuquerque spent a sizable part of his life uncovering and dusting off important pieces of what would be assembled into a remarkable mosaic telling this story, one that deserves a better place in the history of science books. Realizing the importance of Portuguese contributions to science and technology of the 15th and 16th centuries Albuquerque was unique in conducting this type of research. He ploughed through piles of documents reading them closely with an intuitive sense for the relevant documents; and collected data that he scrutinized and evaluated with a keen and critical eye. Indeed he wrote indefatigably on practically all scientific and technological aspects of the discoveries, producing an impressive array of books and papers, many of them not well-known even among his colleagues and countrymen. Hopefully one of his students will gather a team capable of preparing an edition of his complete works.

It is, nevertheless, outside Portugal that his writings should be better known. With the means at his disposal (and they were remotely far from what the young generation has available nowadays) he did what he could to bring the fruits of his research to the attention of the wider world. One of the difficulties in Albuquerque's works gaining attention outside Portugal was that his English pieces (some two dozen, including thirteen encyclopedia entries) were scattered over too many disperse publications for them to make a mark. Another difficulty was the fact that many of his writings were published in Portugal, and so had only a limited circulation outside of the country. Of his encyclopedia entries, practically only those written in the *Christopher Columbus Encyclopedia* and the *Dictionary of Scientific Biography* enjoyed a broader circulation, but those pieces form only a mere fraction of Albuquerque's research.

A good selection and edition of his papers already available in English would most certainly attract the attention of a prestigious publisher interested in the history of science. Actually, it may be the case that one of Albuquerque's most productive former students may accept the challenge of carrying out such a task. But there are other works of his which could and should be translated.

Luís de Albuquerque

Conspicuously missing is an English series or library of classic works of Portuguese culture. Figuring prominently among them should be a translation of at least one of Albuquerque's books. The inclusion of his *Portuguese navigation: an historical development* in the book catalogue of the "Circa 1992: Art in the Age of Exploration" exhibit at the National Gallery of Art in Washington, DC, is a mere example of the interest a translation of his works would generate (ed. Jay A. Stevenson, Washington, 1992, pp. 35-39). Luís de Albuquerque tried to entice foreign historians of science with the unknown data available in the Portuguese travel literature of the discoveries, but very few could penetrate to the fruits contained

within, due to their lack of knowledge of the Portuguese language. One exception was the Dutch historian of science Reyer Hooykaas, who took up the challenge and produced a most impressive study on Dom João de Castro ("Science in Manueline style"), which, despite its near 300 pages, was unfortunately buried as an appendix to the Portuguese edition of the complete works of D. João de Castro. Fortunately, one of Hooykaas students, H. Floris Cohen, took note of that study and recognized the contribution of the Portuguese (and of D. João de Castro in particular) among the path breakers for the roads to modern science in his book *The Scientific Revolution: A Historiographical Inquiry* (Chicago: The University of Chicago press, 1994) and he will do so again in his forthcoming volume *How Modern Science Came Into the World*.

Luís de Albuquerque would be glad to know that his work has, after all, had an impact in the historiography of science. But I am sure that if I were to bring him the news he would dismiss it with his habitual modesty and proceed to change the conversation. Always ready for a good laugh he would ask, "Don't you have any new joke about Mathematicians?"

Onésimo Teotónio Almeida

Brown University

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Research in Pairs at CIM

CIM has **facilities for research work in pairs** and welcomes applications for their use for periods of 1-2 weeks from January to May or from September to December.

These facilities are located at Complexo do Observatrio Astronmico in Coimbra and include:

- **office space** with unix workstations and some secretarial support;
- **free access to the library** of the Department of Mathematics of the University of Coimbra (30 minutes away by bus);
- **lodging**: a two room flat.

At least one of the researchers should be affiliated with an associate of CIM.

Applicants should fill in the electronic application form (http://www.cim.pt/cim.www/cim_app/application.htm).