BULLETIN

INTERNACIONAL CENTER FOR MATHEMATICS

December 1997

3

Coming events

Linear Algebra and Control Theory: Thematic Term

CIM (Coimbra, Observatório Astronómico), May - July 1998

This is the first notification of a thematic term on the subject of Linear Algebra and Control Theory to be held at the Coimbra Astronomical Observatory in the Spring of 1998 (May 11th to end of July). The main goals of the term will be:

⋄ To bring together researchers from all over the world to work together in the areas of Linear Algebra, Matrix Theory and Linear Systems, exchanging ideas, producing papers and in general contributing to the development of this interdisciplinary field through theoretical, practical and numerical perspectives;

⋄ To further the training of graduates, mostly from Spain and Portugal;

⋄ To foster a closer relationship between the scientific communities of Portugal, Spain and the rest of the world.

STRUCTURE (Provisional)

1. It is hoped that some researchers will atend the event throughout the full three months, whilst others may prefer to participate for periods of one month or less. The invitation procedure is still under way.
2. A weekly research seminar will be organized, led by either one of the permanent members or by guest speakers.
3. There will be two summer schools aimed at graduate students, each consisting of two ten-hour courses. The first is planned for the end of May/beginning of June and will be on Linear Systems: Structure and Design; whilst the second, will be on Linear Algebra and Control Theory, is provisionally booked for July.
4. A workshop will be held in the last week of June, when most short-stay researchers will be present.
5. Two travel/accommodation awards will be available for postdoctoral students.

The following researchers have already agreed to participate in the Thematic Term:

May to July:
P. Fuhrmann (Ben Gurion University of the Negev, Israel); J.Queiró, E.Marques de Sá (University of Coimbra); F.C.Silva (University of Lisbon); I.Zaballa (Basque Country University).

May only:
I. Baragaña (Basque Country University), J.J. Loiseau (CNRS of Nantes, France); P.Zagalk (Academy of Sciences, Prague, Czech Republic).

June only:
P.Lancaster (University of Calgary, Canada); J.J.Climent (University of Alicante, Spain); J.M.Garcia (Basque Country University); D.Hinrichsen (University of Bremen, Germany); Ch.Johnson (The William and Mary College, Virginia, USA); A.Markus (Ben Gurion University of the Negev, Israel); V.Mehrmann (Chemnitz University of Technology, Germany); P.Van Dooren (Catholic University of Louvain, Belgium).

July only:
F.Puerta (Technological University of Catalonia); J. Rosenthal (University of Notre Dame, Indiana, USA); C. Schere (Technological University of Delft, The Netherlands).

Information
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Summer School on Optimal Shape Design

2-7 June 1998, Tróia, Portugal

There will be 5 courses in paralel, on the theory and techniques to determine the best possible shape to build structures and devices, such as ships, buildings, airplanes, in the sense of having the smallest possible cost (be it of construction, of maintenance or mixed), under certain restrictions retained adequate. They are aimed at graduate students and young post-docs interested in developing research in this area, coming either from mathematics (specially functional analysis, differential equations or numerical analysis) or from engineering. The intention is to show to young mathematicians how to deal with a class of problems coming from engineering, and how to solve them using theoretical and numerical methods ; and on the other hand to present to young engineers the best theoretical methods that mathematicians have recently developed, and to show that these may in fact be used to solve difficult engineering problems.

This is a joint organization of CIM with CIME (Florence, Italy).

Courses:

Some nonconvex shape optimization problems (Kawohl - Koeln, Germany)
Mesh adaptation for optimal shape design (Pironneau - Analyse Numérique, Paris VI, France)
Homogenization methods in optimal shape design (Tartar - Carnegie-Mellon, USA)
Explicit solution in elastic optimization (Villaggio - Pisa, Italy)
Optimal shape design: theory, models, numerical algorithms (Zolesio - INRIA, France)

Informations

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Autumn School on Nonlinear Analysis and Differential Equations

CMAF - CIM (Lisbon), September 14 - October 30, 1998

SHORT COURSES on:

Longtime behaviour of solutions to the Navier-Stokes equation for compressible flow (E. Feireisl)

Continuation theorems for differential systems with p-Laplacian like operators (J. Mawhin)

Twist mappings, invariant curves and periodic differential equations (R. Ortega)

Variational inequalities with application to obstacle problems (K. Schmitt)

Remarks about ordinary differential equations for population models (F. Zanolin)

Other short courses will be delivered by D. G. de Figueiredo, P. Habets, and M.M. Marques.

A SEMINAR will take place on wednesdays. The following persons are expected to participate:

J. Andres, D. Arcoya, A. Cabada, A. Cañada, A. Capietto, M. Feckan, A. Fonda, J.P. Gossez, G. Ladas, D. Lupo, J.J. Nieto, M. N. Nkashama, D. O'Regan, F. Pacella, M.Tarallo, S. Terracini, S. Tersian, C. Troestler, E. Serra, M. Willem.

There will be ample time for discussions and working sessions between participants. Research students may collaborate in the SEMINAR with short talks to present their work.

Local organizers:

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School of Finite Elements and Applications

CIM (Coimbra, Portugal), September 28 - October 2, 1998

The objectives of this school are the presentation of the basic concepts of the finite element method (mathematical and numerical aspects, scientific computing) and the diffusion of research works in the area of the applications of that method. The program of this school consists of:

⋄ A short course on finite elements (7h30m) by professor Juan Viaño Rey (Univ. Santiago de Compostela, Spain).

⋄ Presentation of software on finite elements (3h45m) by professor Nuno Ferreira Rilo (Univ. Coimbra, Portugal).

⋄ Nine conferences (1h15m each) by professors Isabel N. Figueiredo (Univ. Coimbra, Portugal), José Miranda Guedes (Instituto Superior Técnico, Portugal), Rogério P. Leal (Univ. Coimbra, Portugal), Paulo B. Lourenço (Univ. Minho, Portugal), Luís F. Menezes (Univ. Coimbra, Portugal), Luís A. Oliveira (Univ. Coimbra, Portugal), Luís M. Trabucho (Univ. Lisboa, Portugal), Luís N. Vicente (Univ. Coimbra, Portugal) and Enrike Zuazua (Univ. Complutense de Madrid, Spain).

The school has a multidisciplinar character (mathematics, mechanics, physics and scientific computing) and is addressed to mathematicians and engineers.

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News

A debate on "Mathematical research in Portugal: trends, organization and perspectives" was held in Coimbra on 6, 7 December. This was an initiative of CIM.

The debate consisted of a sequence of sessions, with subjects introduced by invited speakers.

Around 80 people participated in the debate, representing research units in Mathematics and CIM associated institutions. CIM is considering the possibility of publishing a book with the contributions to the debate.

Support from JNICT, CMAF and CMUC is acknowledged.

PROGRAM

O financiamento do ensino superior e a investigação
Eduardo Marçal Grilo (Minister of Education)

O processo de avaliação de 1996
Irene Fonseca (Carnegie Mellon University e Max Planck Institut - Leipzig)

O futuro da avaliação
Luís Magalhães (Fundação para a Ciência e Tecnologia)

A Matemática e a Economia portuguesa
Artur Alves (Universidade de Coimbra)
Luís Trabucho (CMAF - Lisbon)

A organização institucional da investigação
Fernando Dias Agudo (Academia das Ciências)
José Francisco Rodrigues (CMAF - Lisbon)

Cultura vs. especialização
Maria Paula Oliveira (CMUC)
Teresa Monteiro Fernandes (CMAF - Lisbon)

Áreas preferenciais de investigação
Eduardo Rêgo (Centro de Mat. da Univ. do Porto)
João Paulo Dias (CMAF - Lisbon)

Escolas nacionais de Matemática
Ana Bela Cruzeiro (Grupo de Física-Mat. - Lisbon)
Graciano de Oliveira (CMUC) ▽

Five Questions to João Caraça

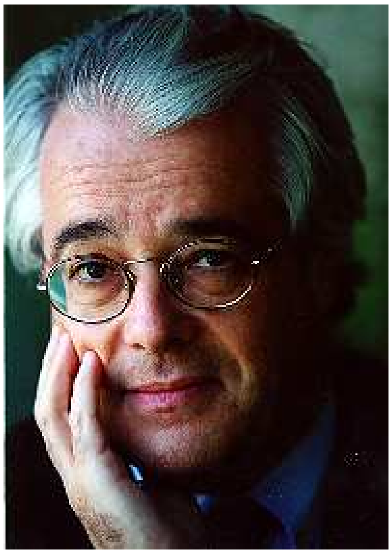
João Caraça, who has a D. Phil. in Nuclear Physics from Oxford University and gained his Aggregate Professorship in Physics from Lisbon University, is Director of the Science Department at the Calouste Gulbenkian Foundation, and Professor at the School of Business and Management at the Technical University of Lisbon, where he supervises the Master's Degree in Economics and Management of Science and Technology. He is also the science adviser of the President of the Republic.

His interests lie mostly in the areas of science and technology policy, and in prospective studies. He has written over a hundred scientific papers and books including *From Knowing to Doing: Why Organize Science?* (*Do Saber ao Fazer: Porquê Organizar a Ciência?*; 1993) and *Science* (*Ciência*; 1997), and collaborated in *Limits to Competition* (*Limites à Competição*; 1994).

The portuguese scientific community has greatly benefited from Professor Caraça's activities in the Calouste Gulbenkian Foundation and JNICT. We would like to mention the strong interest he showed in the possibility of having some CIM activities funded by the Calouste Gulbenkian Foundation.

If you don't mind, I would like to begin with a rather abrupt question. Professor Caraça, What is Science?

'As I have tried to explain in my book, science is a particular way of conjecturing about reality which cannot easily be summed up by a simple definition or schematic phrase. It is a collection of responses which have evolved over time and result from different perspectives: the historical perspective; the world vision; epistemological perspective; learning, cultural, social, communicational perspectives etc.



It may be said, however, that science, as a specific area of disciplinary knowledge that requires very precise language, exists on an immaterial dimension; that is to say, it only comes into being because it is communicated, because its hypotheses are continually being tested, checked and verified (or refuted), incessantly "infecting" new brains and serving as a base for new hypotheses. The aim of this comunicational network is to gain a better understanding of our interaction with nature. The criteria and procedures with which science examines truth (the so-called "scientific method") are incomprehensible without a strategy, as is the existence of distinct scientific communities.

You have published other books on a similar theme to *What is Science? (O que é Ciência?)*; for example, *From Knowing to Doing: Why organize Science? ("Do saber ao fazer: Porquê organizar a Ciência?"*, Gradiva, 1993). Do you have any other projects in this area?

'Yes, I have. I have already finished planning a book, in collaboration with Prof. Manuel Maria Carrilho, about the relationship between knowledge and power throughout history. But obviously, for the actual writing of the book, the authors require a certain amount of shared space and time. Even though it is difficult at the moment, this is such an interesting and fruitful project that I am sure that it will not be shelved.'

You are the Director of the Science Department at the Calouste Gulbenkian Foundation. What exactly is that department, and as director, what kinds of problems have you had to deal with?

'The C.G.F. Science Department awards grants to stimulate scientific culture and scientific research in Portugal. According to the North American definition, the Science Department corresponds to the operation of the Foundation as a "grant-giving institution" within the area of science. It has essentially two roles: firstly, to support scientific culture and advanced-level training, and secondly, to stimulate scientific creativity.

The first aspect involves: the organization of scientific exhibitions, the launching of journals and books, the training of professionals in the area of scientific journalism, supporting experimental education in schools, promoting exchanges and meetings (such as the "Gulbenkian Professor's" programme) and advanced training in the areas of biology and medicine (for example, it co-finances the "Gulbenkian Doctorate in Biology and Medicine"). The second aspect involves providing support for university research reinforcement programmes and interdisciplinary studies into science and society: the Gulbenkian Prize for Science, one of the most prestigious in the area, has been awarded annually since 1976, and incentives are offered to encourage the work of young researchers (aged under 30) submitted to an annual selection procedure (the "Gulbenkian Programme to Stimulate Research").

The aims and activities of my department are very interesting. During the ten years in which I have been responsible for its coordination, there have naturally arisen problems and challenging situations: firstly, there is the question of financial resources, which are (always) insufficient; secondly, new ways to stimulate research have continually to be reinvented (since this is the true *raison d'être* of a Foundation) in order to keep in line with changing times; finally, C.G.F. has to play a more active role in science in our country, with the aim of making "science" a priority for Portuguese society in the 21st century.'

Before formulating the next question, a brief quotation:

> *"One thing is certain: against science, without that knowledge which is created and used every day, which pulsates in the brains of the members of the scientific community and which illuminates those who learn it, generation after generation, it will not be possible to arrive at the 21 st century."*
>
> **"O que é Ciência"**

How do you envisualize the future for institutions like the International Centre for Mathematics in Portugal at the turn of the century?

'It is natural that institutions like the CIM should emerge, and this is an indication of the maturity of the scientific community. Science cannot be circumscribed by physical or intellectual boundaries; it is through systematic communication between good interlocutors that new ideas and better ideas are generated, circulated, internalized. This does not mean that university departments, with their discipline-based structure, should disappear – on the contrary; however, these can no longer be the only pillars of the construction of new science. Research is by nature an interdisciplinary activity: without the courage to cross the boundaries of knowledge, learning does not take place.'

My last question is almost inevitable. We know that you were very young when your father died. Nevertheless, as Bento de Jesus Caraça was very influential during the 1930's and 40's in Portugal, there must certainly have been some reflection in your own work. I hope that it would not be too intrusive if I asked you to talk about this?

'This is a part of my life which I have been learning to open up to others. Obviously, the conscious memories that I have of my father are very few (I was only three when he died); but perhaps you mean the other kind of influence: the long shelves of books that I would contemplate during my childhood; the contact with my mother and other relatives and friends who always tried to transmit some of the moments, hours, years that they shared with my father; his extraordinary conference papers, which I devoured as an adolescent; the perspectives which came to me out of the luminous pages of the "Fundamental Concepts of Mathematics", and later, his books of physics and philosophy, with hundreds and hundreds of annotations, references and exclamations, which I could compare with my own opinions.

Obviously there is still a lot left to say. But there is always a subsequent occasion. I am very pleased to have inherited from my father a profound and unreserved love for science, knowledge and culture, and also the certainty that, in the end, the only thing that matters is the solidarity that connects the collective soul of humanity.'

Bernd Wegner was born in Berlin in 1942. He attended both the Technical and the Free Universities. E. Kähler, K. Leichtweiß and W. Haack were among his teachers. In 1970 he became assistant professor in the Technical University of Berlin having been promoted to professor in 1972.

Topology, Differential Geometry and General Relativity are some of the areas where his interests lie and during his career he has supervised many research students.

In 1974 Bernd Wegner was appointed Editor-in-chief of Zentralblatt für Mathematik and in 1993 he became Managing Editor for Beiträge zur Algebra und Geometrie/ Contributions to Algebra and Geometry. He is also responsible for the scientific supervision of the EMIS information service provided by the EMS.

Last but not least he belongs to the CIM Scientific Council.

We shall start with your mathematical research. An important part of your work concerns the study of *Transnormal Submanifolds*. *Transnormality* was introduced in the 60's by S. A. Robertson. How did you come about being interested in such a topic? Who was your thesis advisor?

'The topic has been indicated to me by Tom Willmore (Durham) during a meeting at Oberwolfach. I began to work on the subject quite independently and presented my first results to K. Leichtweiß. He was convinced of my achievements and agreed to give me the necessary guidance for the preparation of my thesis.'

Have your mathematical interests changed much over the years?

'My mathematical interests have spread out to several areas in geometry though I permanently return to subjects related to transnormality and constant width. Some of my publications deal with the main streams in submanifold theory, others concern topological considerations and in recent times I became more and more interested in problems from discrete geometry. One major topic which kept me busy all the time was Lorentzian geometry and its applications to cosmology. But as a principle, I have reserved this field exclusively for some of my research students. Several interesting results have been developed and published by them in this field under my advisorship.'

Göttingen is a great moment in the history of german mathematics which, unfortunately, was destroyed "...literally in a day, by Hitler.", to quote words of Constance Reid. Would you like to comment on the situation of mathematics these days in Germany? Is it possible to compare the situation today with the past great times?

'I have no special relation to what is called german mathematics and the tradition related to the mathematicians working in Göttingen during the first half of this century. It is obvious that these mathematicians had a lot of influence on the further development of mathematics. The development of german mathematics during the Nazi regime is a subject of several publications in the history of mathematics, as it will be with other national groups of mathematicians under a totalitarian government. This cannot be described in a honest manner by a short comment. But such developments show drastically that mathematicians (as other scientists) cannot evade from having an impact on politics and from being a political individuum.

Certainly the influence of german mathematicians has become lower nowadays, and in view of the unification of Europe it will not make sense to try to improve this again. Mathematicians have the possibilities to enter a world-wide cooperation easily, and they do it frequently. The concentration and coordination of regional research activities will be an important task of local mathematical societies, but to represent and propagate the achievements of European mathematicians likewise it is done by the AMS for the North-American can only be done successfully by the European Mathematical Society EMS.'

The next ICM is to take place in Berlin, at your university. Have you been involved in the organisation? Suppose you would have to help someone to decide whether or not to attend the congress. How would you convince him to go to Berlin?

'Being now editor-in-chief of Zentralblatt für Mathematik for more than 20 years I plan to organize some events related to documentation and information in mathematics. This will include the update of the mathematics classification MSC 1991 (which was formerly the AMS classification) and the discussion of the production of databases and electronic versions for old mathematical literature.

I think that such a congress like the ICM is a big social event in mathematics. You will have represented most of the current research activities in overview lectures, and also other mathematical activities find a recognition at such a congress like nowhere else. Last but not least, Berlin is a pleasant place in August and the offer of interesting events for tourists has increased a lot after the unification. Hence this should be sufficient motivation to take part in the ICM.'

You are now a member of the CIM Scientific Council. From your viewpoint what is the future of such an institution in a small country like Portugal?

'An institution like CIM is very important for coordinating and facilitating the research activities of the Portuguese mathematicians. It also may have impact on some part of Spain. The mathematical community representing the customers of CIM will be just suitable for CIM to run its activities without a very big budget, but with a high efficiency concerning the exchange of knowledge. There is a chance that every Portuguese mathematician may have a benefit from this institution, and that not only some privileged will have access to the offers of CIM. Assuming this as the future policy of CIM I think that this institution will get a good recognition and support from the Portuguese mathemaical community.'

You do a lot of work for Springer Verlag, namely you are the Editor-in-chief for *Zentralblatt für Mathematik*. Computer facilities are already having a great effect on publication. Do you think the traditional mathematical journals and textbooks will survive? Will electronic versions take over?

'Electronic publications in mathematics are an important addition to the literature in mathematics. They provide a lot of additional facilities which cannot be met in conventional publications on paper. But this development is a rather new one, and nobody knows definitely what the standards and the underlying economics will be for electronic publications. Most offers are in an experimental state with the exception of literature databases which from the side of Zentralblatt have been offered since 1978 already. But also here the technical background is changing permanently.

Those who have dealt with electronic publications already for some time did not give up to use print publications simultaneously. My personal experience is that a printed textbook for a student cannot be replaced by some internet offer on a local server. These are two different kinds of availabilities and usages, and every one has its own advantages. Printing out the content from the server cannot be taken as a replacement for a textbook. It will become too expensive for the whole text, and the result will be worse than a paperback textbook.

This example shows that print publications will survive to some extent and that the electronic publications will take over only some part of the business. This will be different with the information on mathematical literature. The classical print version of Zentralblatt now publishes about 15.000 pages annually covering about 60.000 items. It has reduced search facilities compared with the on-line version in the internet or the off-line version on CD-ROM. Here the future exclusively will belong to the electronic offers as soon as most mathematicians will have the tools to use them.'

Impressions on António Aniceto Monteiro

I got to know Monteiro because of Bento de Jesus Caraça. Before him, the only portuguese mathematicians I had heard of were Pedro Nunes and Gomes Teixeira. Not mentioning Serrasqueiro's elementary books on Algebra and Arithmetic, highly regarded by my secondary school teachers and by students of the generation preceding mine.

No one introduced or suggested Caraça to me. I found him by chance, at a second-hand bookstore in Fortaleza, as a book with its pages still unopened. It was called "Lições de Álgebra e Análise", vol 1. Some admirer had surely bought it for the title or received it as a present and discarded it, disappointed by its table of contents. It was exactly this strange summary and the unexpected concepts that I glimpsed at on the exposed pages that fascinated me. I bought the book, and through it, I launched myself into the world of sets, transfinite numbers, natural numbers, integers, real and complex numbers, all constructed step by step. Caraça was my only mentor, my guide. One interesting aspect of the book was the annotated bibliography at the end of each chapter. Those suggestions led me to order "Pure Mathematics" by Hardy and "Survey of Modern Algebra" by Birkhoff and MacLane at a bookshop in Rio. Together with the books came a catalogue which mentioned the monograph "Filtros e Ideais" by Monteiro and "Aritmética Racional", which he wrote with J. Silva Paulo.

António Aniceto Monteiro

I thought it easier to start with Monteiro. The "Aritmética" was delicious, although I was curious to know if the secondary school students in Portugal (or in any other country) were, except for the extremely able, capable of appreciating the elegance and subtlety of that exposition.

Monteiro lived in Rio de Janeiro for around four years between 1945 and 1949. At that time, his interests were divided between General Topology and Ordered Sets, evolving from the first to the latter. But his personal energy was considerable enough to allow him to also have a political activity, and in this field, his main interest was the overthrowing of Salazar's dictatorship. There wasn't, of course, much room for maneuver, especially because the high administration of the Universidade do Brasil (then the name of the Universidade Federal do Brasil), was linked by ideological and emotional ties to the Portuguese government. Monteiro's position made it harder and harder for him to have his contract renewed, and he finally had to emigrate to Argentina. In Bahia Blanca, fulfilling his vocation as a pioneer, and by now definitely dedicated to Mathematical Logic, he founded and led a group, which is still today both flourishing and significant, of researchers in that area, among which is his son. The cultural and geographic distance led him away from Portuguese politics and brought him closer to Mathematics and to his involvement in the creation of a very high-level school. This also demanded an effort and political skills, but in another way.

While he was in Brasil, Monteiro mostly collaborated with Leopoldo Nachbin and Mauricio Peixoto, at the time young mathematicians trying to launch their careers in an environment in which the tradition for mathematical research was practically non-existing. With his strong and restless personality, he gathered students, organized seminars and founded a collection of monographs called "Notas de Matemática", of which the first volume was his work on Filters and Ideals. The affinity of mathematical interests between Monteiro and Nachbin was greater than with Peixoto. His influence on Nachbin can be seen in the monograph entitled "Topologia e Ordem", published by Nachbin, about ordered topological spaces. It is interesting, however, to note that Peixoto was the only Brazilian mathematician with whom Monteiro co-wrote a paper, published in the journal Portugaliae Mathematica under the title "Le nombre de Lebesgue et la continuité uniforme".

"Filtros e Ideais" was my first example of how to elaborate an abstract and not trivial mathematical theory from a system of extremely simple axioms like the one of ordered sets. Although later studies and personal choice made me follow very different paths in mathematics, reading Monteiro's monograph made me familiar with the general methods and this was useful years later for my doctorate thesis, when I developed the theory of spectra of topological spaces.

I met Monteiro twice when he visited Brazil while already living in Argentina. The first time, in Rio, when I was still a student, and the second time in Poços de Caldas, at a mathematical meeting, after returning from my studies in Chicago. On both occasions, I expressed my admiration for the work he had extended to three countries, and for his role in my studies. I am certain that many Portuguese, Brazilian and Argentinean mathematicians have benefited even more from his work and feel even more grateful than I do.

Elon Lages Lima
(I.M.P.A., Rio de Janeiro)

(Tradução de S.J.)

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