BULLETIN

INTERNATIONAL CENTER FOR MATHEMATICS

June 2000 8

Coming Events

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 post-graduate 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.

8th June to 14th June, School on Singularities

FCUP, PORTO

e-mail: Sing2000@fc.up.pt

The school is specially intended for post-graduate students and young researchers in singularities.

Courses:

- Introduction to the Generic Geometry of Manifolds - M. C. Romero-Fuster, J. Nuno Balesteros, E. Sanabria Codesal (Valencia, Spain).
- First Order Implicit ODE's and Their Applications - A. Davydov (U. Vladimir, Russia).

Organizers:

J.A. Basto-Gonçalves, I.S. Labouriau.

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 post-graduate 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

e-mail: BioMath@fc.up.pt

Support

- Centro Internacional de Matemática (Portugal)
- Centro de Matemática Aplicada, UP
- Fundação Calouste Gulbenkian (Portugal)
- Fundação para a Ciência e Tecnologia (Programa Praxis XXI)
- European Science Foundation
- Universidade do Porto (Reitoria; Faculdade de Ciências; Departamentos de Matemática Aplicada e de Matemática Pura)
- Centro de Análise Matemática, Geometria e Sistemas Dinâmicos, Instituto Superior Técnico, Lisboa

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 Univ. de Coimbra

Fundação para a Ciência e Tecnologia

Programme for 2001

At the meeting on 1st April 2000 the Scientific Council of CIM approved the following events for 2001:

Thematic Term on Semigroups, Algorithms, Automata and Languages

Organizers

Gracinda M. S. Gomes (University of Lisbon; CAUL).

Jean-Eric Pin (University of Paris VII; CNRS).

Pedro V. Silva (University of Oporto; CMUP).

Dates

May, June and July 2001.

Aims and broad structure

The activities to be developed include simultaneous visits by various specialists of the areas to which the thematic term is dedicated, with the purpose of developing joint research work and collaborate in the workshops and schools to be held.

The programme will include three schools and two workshops dedicated to specific areas considered presently to

have great importance to the study of semigroups, algorithms, automata and languages. These areas were selected considering their huge recent development, motivation from other fields of mathematics and computer science, and their potential applications.

This initiative is mainly directed to young university graduates in these areas, including Portuguese as well as foreign researchers. The courses should be viewed as post-graduation courses.

It is expected, on one hand, to strengthen the already established research in semigroups and languages in Portugal, and, on the other hand, to develop links with related areas such as theoretical computer science, computational algebra, logic and geometry.

Calendar

1-15 May: School on Algorithmic aspects of the theory of semigroups and its applications.

1-7 June: School on Automata and languages

8-10 June: Workshop on Logic, profinite topology and semigroups

1-7 July: School on Semigroups and applications

8-10 July: Workshop on Presentations and Geometry

Short Course on Analytical and Numerical Methods in Non-Newtonian Fluid Mechanics

Organizers

E. Vaz (University of Minho).

J. Maia (University of Minho).

K. Walters (University of Wales Aberystwyth).

Dates

July 2-8, 2001.

Aims

Despite its relevance to a wide number of industries, Rheology and Non-Newtonian Fluid Mechanics are subjects that are often viewed as being of prohibitive complexity to newcomers to the field and have often not been used to the fullest possible extent. The aim of the School is, therefore, to interest young researchers into the field by helping to bridge the gap between the available theoretical tools and existing problems of a mathematical nature in industry and academia.

Advanced School on Recent Developments in Large-Scale Scientific Computing

Organizers

Filomena Dias d'Almeida (University of Oporto).

Paulo Beleza de Vasconcelos (University of Oporto).

Dates

July 2001.

Aims

Modern industrial and social sciences applications involve large scale problems that need the solution of large linear systems or large eigenvalue problems. The school is aimed at presenting the state-of-the-art methods and tools to solve such large scale linear problems. The dimension of the systems requires the use of parallel processing and non-stationary iterative methods or alternatively direct methods with sparse techniques. Message passing software, parallel processing paradigms and libraries will also be presented.

Workshop on Electronic Media in Mathematics

Organizers

F. Miguel Dionísio (Inst. Sup. Técnico, Lisbon; CMA).

José Carlos Teixeira (University of Coimbra).

Bernd Wegner (Technische Universität Berlin).

Dates

September 13-15, 2001.

Aims

The workshop will provide an open forum for the exchange of information and presentations on electronic media in Mathematics for mathematicians and people using mathematics in applications. Three main subject areas are to be covered:

a) *Computational devices for mathematics*: Mathematica, Maple and other general software packages, special packages in numerical mathematics, computational algebra, computational geometry, proof theory and their applications in mathematical research, support for teaching mathematics, support for applications of mathematics in industry.

b) *Visualization and applications of CAD*: visualization of geometric and physical objects, animation software, CAD-package and geometric construction.

c) *Electronic information and communication*: electronic publishing, preprint-servers and preprint databases, electronic document delivery, electronic access to software, literature data bases, organization of information in the web.

Workshop – From Brownian Motion to Infinite Dimensional Analysis

Organizers

A. B. Cruzeiro (University of Lisbon).

L. Streit (University of Bielefeld).

Dates

September 2001.

Aims

The need for the development of infinite dimensional Analysis on spaces of continuous paths or of less regular objects such as distributions has become evident mainly by physical motivations (e.g. Quantum Mechanics and Quantum Field Theory). These spaces are endowed with probability measures, one of the more regular cases being the law of Brownian motion. In this case Itô calculus provides the underlying techniques to manipulate irregular functionals of the paths and the corresponding infinite dimensional Analysis has developed intensively in the past recent decades giving rise to important results in Mathematics, but also applications outside the initial framework (e.g., Filtering and Control Theory, Financial Mathematics). More recently, special attention has been given to the geometry of (curved) spaces. The goal of the workshop is to bring together various approaches to infinite dimensional Analysis.

Great Moments in XXth Century Mathematics

by Richard Brualdi

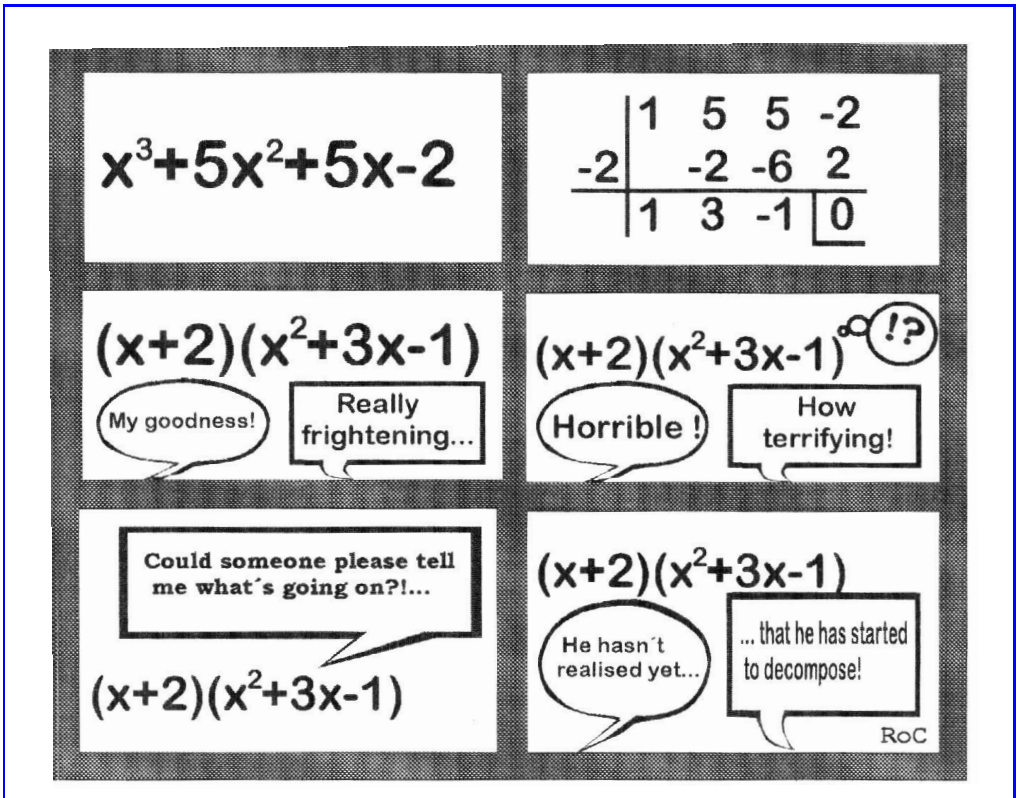
Professor F.J. Craveiro de Carvalho asked me (and others) the following question: "If you had to mention one or two great moments in XXth century mathematics which one(s) would you pick?" Previous responders have, quite appropriately, interpreted "great moments" to be spectacular individual achievements such as the solution of Fermat's Problem and the classification of the finite simple groups. Another interpretation might be changes in the direction or culture of mathematics that have greatly influenced its development.

Using this interpretation, I would like to respond with the work of Gian-Carlo Rota which as Richard P. Stanley put it "lifted the subject of combinatorics from disrepute to eminent respectability." Rota started this change with the first (of ten) of his "Foundation's" papers in 1964 subtitled "Theory of Möbius functions." His further work (and his charisma, charm, and worldliness) greatly influenced the development of mathematics in the last half of the twentieth century.

As we begin the twenty-first century, combinatorics is on a firm footing and is not only respectable but is considered to be very important in many parts of mathematics. Combinatorial ideas and constructs are now essential and widespread from algebra (e.g. representation theory) to geometry and topology (e.g. Grassmannians and flag manifolds) to analysis (e.g. harmonic analysis). And, of course, as an area of mathematics in itself, combinatorics is flourishing and has some of the best mathematical minds.

Gian-Carlo Rota died in April of 1999. One can read about him and his work in the February 2000 issue of the Notices of the American Mathematical Society.

Richard Brualdi is Professor of Mathematics at the University of Wisconsin-Madison, having been department chair from 1993 to 1999. He has been Co-editor-in-chief of the journal "Linear Algebra and its Applications" since 1979. At present he is President of the International Linear Algebra Society.



An Interview with Izu Vaisman

Professor Vaisman, you are a distinguished mathematician who has published lots of research papers and several books. Would you like to elaborate on your mathematical beginnings and the development of your career?

I am born in Romania and my mathematical education was in that country, at the University of Jassy, where I graduated (equivalent to the MSc degree) in 1959, I obtained a doctorate in mathematics (equivalent to a PhD degree) in 1965, and I was a faculty member from 1959 until 1976.

The university of Jassy had a known school of differential geometry which from the 1920's to the 1950's specialized mainly in the study of the differential geometry of geometric objects (curves, surfaces, line congruences, etc.) in various spaces of Klein's Erlangen Programme, such as projective, affine, centro-affine, etc. More general spaces, on the line of E. Cartan's works, were also studied there. Then, in the late 1950's and in the 1960's a sharp change to modern differential geometry (differentiable manifolds, global problems) occurred.

Accordingly, I wrote a thesis on projective-symplectic differential geometry, where I developed a theory of curves, surfaces, etc. in an odd-dimensional, projective space, endowed with an invariant, bilinear, nondegenerate, skew-symmetric form in the homogeneous coordinates, and I also discussed manifolds with the tangent spaces equipped as above, and with a corresponding connection, à la Cartan. This thesis explains my later interest in the geometry of the symplectic and Poisson manifolds.

Then, I changed my research subject and studied various structures on differentiable manifolds: foliations (cohomology of differential forms, conformal foliations, etc.), locally conformal Kähler structures, which were not studied seriously before and turned out to be important in the study of the complex surfaces in particular, symplectic structures (geometric quantization, Maslov classes, symplectic connections, Lagrangian foliations) and Poisson structures (Poisson cohomology, Poisson-Nijenhuis structures, etc.).

In 1976, when my main research subject was locally conformal Kähler geometry, I emigrated from Romania to Israel. Here, I was nominated full professor at the Department of Mathematics of the University of Haifa, and I am still holding this position now. It was a crucial point in my career since it allowed me free contacts with the international mathematical community. I was able to travel a lot and visit important mathematical centers. Paris, Berkeley and Oxford were among these, as well as many universities in France, U.S.A., Canada, Spain, Italy, Belgium, Japan, etc. Modern mathematical research is best done within the framework of such contacts.

Izu Vaisman

I am working in the field of mathematics, doing research and teaching undergraduate and graduate courses, for over fourty years now. I published more than one hundred research articles and a few research monographs and textbooks. I can say that this is a demanding but intellectually rewarding activity, and I believe that, should I start my life again, I would most probably choose the same profession.

Besides yours I can mention a few names of israeli mathematicians of outstanding reputation. For instance I have attended talks by Saharon Shelah and Aner Shalev at important international meetings. How is israeli mathematics doing these days?

Israeli mathematics was and is characterized by the effort to achieve excellence, by incorporation in the main stream research, by openness, and by involvement in the activity of the best mathematical centers worldwide.

All along its history, the Israeli mathematical community was a mixture between an immigrational influx and a local component, educated in the Israeli universities. In particular, in the latest years, a number of first class Jewish mathematicians from the former Soviet Union

have joined Israeli universities. On the other hand, usually, the fresh PhD graduates of the Israeli universities are taking jobs in foreign countries (the U.S.A., mainly) and, after having got an important research and teaching experience there, may later return to Israel. In these ways, Israeli mathematics is strongly connected with the places where the main stream of today mathematics is produced.

We had and we have very good schools of combinatorics, logic, algebra, functional analysis, partial differential equations, and others, in Israel. And, now, more fields are flourishing, such as algebraic geometry, low-dimensional topology, global analysis, symplectic geometry, applied mathematics, etc. Overall, in Israel we have a very active mathematical life, and a very strong research.

However, like all over the world, many mathematically gifted young students prefer computer science as a career, wanting a field with plenty of well paid jobs. In the same time, funding of theoretical research, and of pure mathematics in particular, is more difficult than funding of applied computer science research, seen as immediately profitable to industry and governments. These two processes have a negative influence on the mathematics departments in universities, and on mathematical research.

The Wolf prize for mathematics is really prestigious. Has it had any significant impact on israeli mathematics?

The Wolf prize is an international prize. It is awarded by the Israeli parliament, the Kneseth, following proposals from all over the world, in a process similar to that used for the Nobel prizes, because this was the way the donor wanted it to be. The benefit of Israeli mathematics is that the award of the Wolf prizes leads to visits of famous mathematicians, and strengthens our contacts with the first class world mathematics. On the other hand, the Wolf foundation also provides some funding for mathematical research, postdoctorate grants, etc.

You have written books on symplectic geometry. On the other hand Dusa McDuff and Dietmar Salamon wrote "An introduction to symplectic topology". Could you please make the distinction between symplectic geometry and symplectic topology precise to our nonexpert readers?

Since you want an explanation for a non expert, let me first tell that symplectic geometry and topology is a field of mathematics which studies symplectic manifolds and generalizations, these being objects which the non expert should think of as phase spaces of mechanical systems. There is a large overlap between symplectic geometry and symplectic topology. My feeling about the difference between the two is as follows. Symplectic topology is the study of the category of symplectic manifolds and their natural equivalences (symplectomorphisms). The main interest of symplectic topology is in the global invariants, which are able to distinguish diffeomorphic, symplectically nonequivalent manifolds. Such invariants were discovered in the 1980's and their study is based on hard analysis. In symplectic geometry, I include the general study of symplectic manifolds and their generalizations, under all the aspects which are of interest either in mathematics itself or in applications to mathematical physics. This means that I also include aspects of a differential geometric character, quantization theories and so on. Let me add the remark that, more generally, what differentiates differential geometry from differential topology is the presence of curvature phenomena.

You are now in Portugal lecturing an introductory course on Poisson and symplectic geometry. How does this type of activity fit in your mathematical work? Do you enjoy it? Do you regard it as a form of leading the way as far as the younger ones are concerned?

I enjoy very much being here in Coimbra and lecturing at the summer course, and I want to express my gratitude to the organizers for having invited me here. I am quite sure that this kind of meetings can be of a real help in the formation of the young generation of researchers, since it may open a new perspective to those who participate.

Izu Vaisman was born in Jassy, Romania. He studied Maths at the local university where he obtained his PhD in 1965. He stayed on as a member of the staff until 1976 when he left for Israel. He has been Full Professor at the University of Haifa since then.

Professor Vaisman has published more than 100 research papers in Differential Geometry and has written 8 books at both textbook and research monograph levels.

In September 1999 Professor Vaisman was in Coimbra to lecture a 12 hour course on *Poisson and Symplectic Geometry* in the Summer School on Differential Geometry organized by CIM.

Almeida Costa and Algebra in Portugal

In the 1940s, I was a Mathematics student in the Faculty of Science at Lisbon University, and at that time, what we learned of the so-called *Modern Algebra* consisted only of groups of permutations and their application to Galois Theory about equations solvable by radicals. There was nothing at all about abstract groups, rings or other algebraic structures.

While I was a student, I had the opportunity of attending an extra-curricular seminar organised by some of the most respected mathematicians of the time, who had recently returned from studies abroad and were trying to do something about the academic backwardness that they found in Portugal. One of the subjects studied in this seminar was Group Theory, and the bibliography contained, amongst half a dozen books by foreign authors, one by a Portuguese: *Elements of Group Theory* (Elementos da Teoria dos Grupos) by A. Almeida Costa (1942, 153 pp.). Thus it was that I first heard of the scientist who, in the same year, had published *Abelian Groups, Rings and Non-Commutative Ideals* (Grupos abelianos, anéis e ideais não comutativos) (173 pp.) and, immediately afterwards, in 1943, *Elements of Ring Theory* (Elementos da Teoria dos Anéis) (282 pp.)

How had Almeida Costa become so enthusiastic about these matters?

In 1928/9, he assumed responsibility for the courses in Astronomy in the Faculty of Science in Oporto, and when, in this same year, the National Education Committee (*Junta de Educação Nacional* - henceforth J.E.N.) was set up, he immediately applied to them for a monthly subsidy in order to prepare his doctorate dissertation. His proposal was received favourably, since he clearly revealed exceptional intelligence and diligence, and his area of study (certain elements of surface theory by vector calculus methods) was recognised to be of topical interest. However, the scholarship was not awarded that year because "the candidate had not yet revealed his talent for research through written work".

The young Almeida Costa was not discouraged, and two years later, his first publications began to appear: *Notes on Vector Calculus* (Notas de Cálculo Vectorial) and *On the Dynamics of Holonomic Systems* (Sobre a dinâmica dos sistemas holonómos), which he presented with his application for a professorship.

In 1934, he once more requested a grant from the J.E.N., this time in order to travel abroad to pursue his studies into astronomy and geometry at the University of Paris, the latter under Élie Cartan (but with "the possibility of replacing, at his own responsibility, the study in geometry with physics, under the direction of Louis de Broglie").

Almeida Costa

However, the Committee was very demanding in its concession of the grant, particularly as regarded the subject matter proposed and national acceptance of the candidate's specialization. But Almeida Costa did not give up, and in this struggle, revealed his determination to fight for what he believed in, a quality that remained with him all his life. In successive applications, he revealed himself to be highly informed about what was happening in Europe, and in 1937 (three years after his first application), having personally explained to Prof. Max von Laue the aims of his scholarship (the study of theoretical physics, particularly quantum theory and theory of relativity), he finally received a grant to study at the Physikalischer Institut in Berlin, where he remained for 22 months.

There, he began to attend courses on Matrices and Group Theory, as well as *Theoretical Electricity* and *Thermodynamics*. When the Institute for High Culture

(which had replaced the J.E.N.) observed that he should not diversify his attentions so much, he replied, "I cannot forget that a background in mathematics is absolutely indispensable for the serious study of theoretical physics. Pages and pages of physics books are given over to matrix theory, series expansions of complete functions, orthogonal or not ... group theory ...".

The influence of Hilbert was obvious in the teaching of mathematics and theoretical physics at that time, and the last studies done by Almeida Costa in Berlin demonstrated his familiarity with methods of physical mathematics according to Courant and Hilbert, and quantum groups according to Hermann Weyl, another of Hilbert's disciples.

In conclusion: until September 1937, Almeida Costa had lived in the world of applied mathematics (essentially mechanics and astronomy) at the Faculty of Science in Oporto; the J.E.N. effectively rerouted him in the direction of theoretical physics, when he went to study in Berlin; and as a result of this, he dropped his interest in astronomy, and from the 1940s, moved into a completely different scientific world where he demonstrated zeal in transmitting to others what he had learned abroad.

In 1950, he became a Full Professor of Celestial Mechanics at the Faculty of Science in Oporto, and two years later, accepted the Chair in Algebra at the Faculty of Science in Lisbon, where he was able to lecture on subjects more in keeping with the choices he had made in the previous decade. This eventually made possible the modernization of the teaching of this subject.

It was thus in 1952 that I met him personally. Hardly had he arrived in Lisbon when he instigated a series of seminars on the topics that most interested him, seeking to transmit to the young academics his enthusiasm for "modern" algebra. During the academic year, there were regular expositions (at least once a week) on group theory, theory of rings and non-commutative ideals, and field theory. I became familiar with his massive work *Hypercomplex Systems and Representations* (Sistemas hipercomplexos e representações), and perhaps because of this, he himself suggested that I, still a teaching assistant, should be responsible for the course of Physical Mathematics, lecturing among other things group representations.

His enthusiasm for his subject was such that he even suggested that students who had passed his course with the minimum of 10 should re-sit the exam in the next session, since he could not be sure that they had attained sufficient mastery of the material! It was as if he felt, in his innermost self, the words of the famous algebrist Paul Halmos, "It saddens me that educated people don't even know that my subject exists!"

He was elected correspondent member of the Lisbon Academy of Sciences in 1959, and full member in 1972, and five years later, became its president. His activities in algebra did not cease upon his retirement in 1973, for the following year, the third volume of his *Course in General Algebra* (Cours d'Algèbre Générale) appeared, and he continued to present papers to the Academy until 1978, the year of his death.

Almeida Costa worked until the end, and was the greatest specialist in Semiring Theory, and the true founder of the Portuguese school of algebra.

F. R. Dias Agudo
Professor Jubilado da Faculdade de Ciências de Lisboa
Membro da Academia das Ciências de Lisboa

Editors: F. J. Craveiro de Carvalho (fjcc@mat.uc.pt), F. Miguel Dionísio (fmd@math.ist.utl.pt), Carlota Simões (carlota@mat.uc.pt), Carlos Leal (carlosl@mat.uc.pt), Sofia Gonçalves Pereira (sofiagp@iseg.utl.pt).

Address: Departamento de Matemática, Universidade de Coimbra, 3000 Coimbra, Portugal.

The bulletin of the CIM will be published twice yearly. Material intended for publication should be sent to one of the editors. This bulletin is available at http://www.cim.pt.

The CIM acknowledges the support of:

- Departamento de Matemática da Universidade de Coimbra
- Departamento de Matemática do Instituto Superior Técnico da UTL
- Fundação para a Ciência e Tecnologia