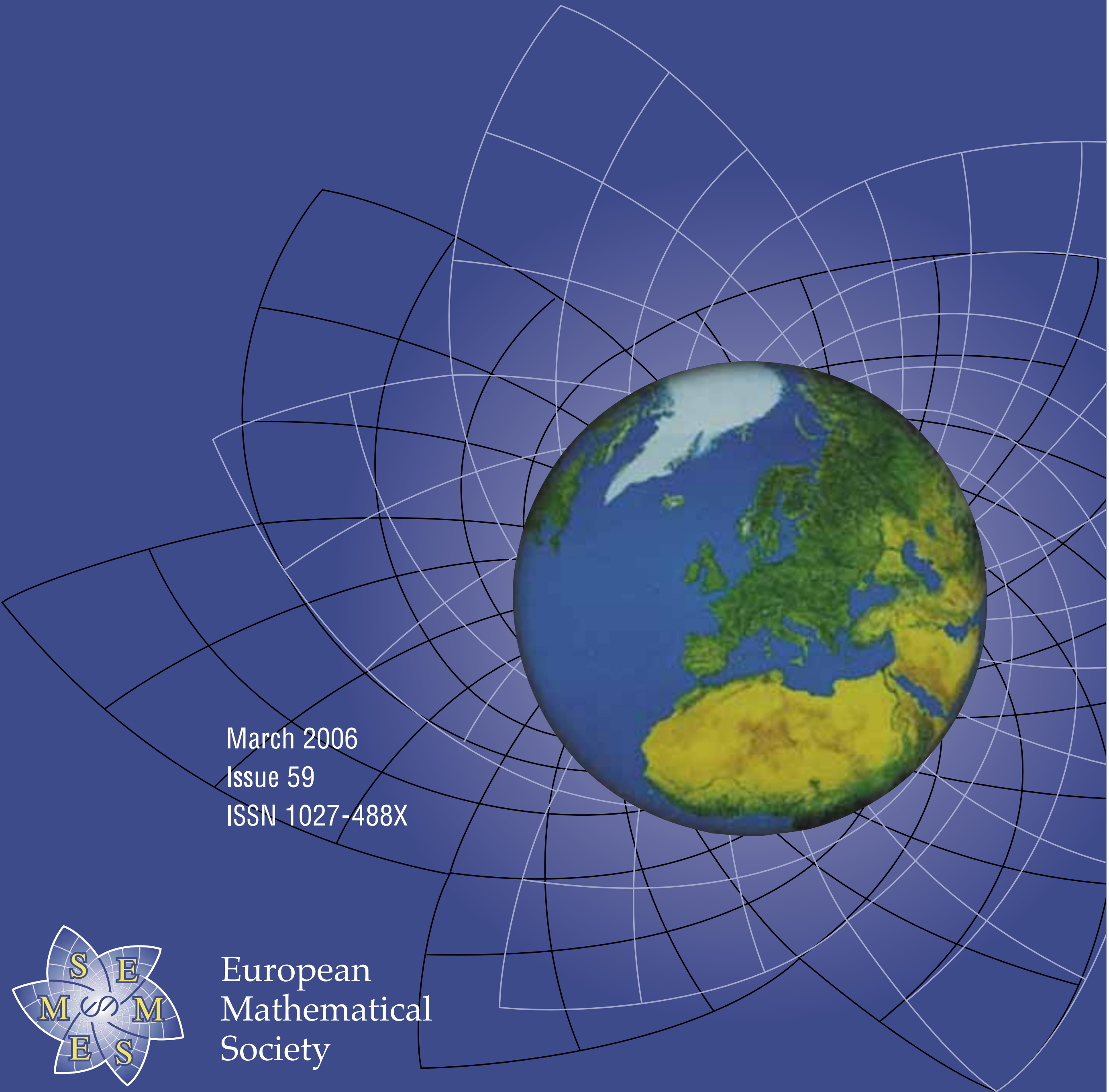
NEWSLETTER

OF THE EUROPEAN MATHEMATICAL SOCIETY



March 2006
Issue 59
ISSN 1027-488X

European
Mathematical
Society

European Mathematical Society

Newsletter No. 59, March 2006

ISSN 1027-488X

Published by the
EMS Publishing House
ETH-Zentrum FLI C4
CH-8092 Zürich, Switzerland.
homepage: www.ems-ph.org

For advertisements contact: newsletter@ems-ph.org

Interview with Professor Viorel Barbu

Conducted by Vasile Berinde (Baia Mare, Romania)

Short Biographical Note

Professor Viorel Barbu was born on 14th June 1941 in Deleni, Vaslui County, Romania. He graduated from Al. I. Cuza University of Iași, Faculty of Mathematics, in 1964 and after doctoral studies at the same university (1966–1969), he completed his PhD in Mathematics, in 1969, with a dissertation about the "Regularity of Differential Operators". During the period from 1964 to 1973 he was successively a Preparatory Assistant, Assistant, and Lecturer and then Associate Professor (1974–1980) and full Professor (since 1980) at the Faculty of Mathematics, Al. I. Cuza University of Iași.

V. Barbu published about 150 original works and more than ten books (monographs and treatises) in the field of partial differential equations, integral equations, and evolution and optimal control equations.

Among the most important monographs (co-)authored by V. Barbu are:

1. *Nonlinear Semigroups and Differential Equations in Banach Spaces*, Nordhoff, Leyden (1976); 2. *Convexity and Optimization in Banach Spaces*, Sijthoff (1978), second edition D. Reidel, Dordrecht (1986) – one of the most cited of his books; 3. *Optimal Control of Variational Equations*, Pitman, London (1984); 4. *Analysis and Control of Infinite Dimensional Systems*, Academic Press, New York, San Diego (1983); 5. *Mathematical Methods in Optimization of Differential Systems*, Kluwer Publishers, Dordrecht (1995); 6. *Boundary Value Problems for Partial Differential Equations*, Kluwer Publishers, Dordrecht (1998).

His papers have been quoted or used by over 800 foreign mathematicians in over 1200 works. Among these authors are the following mathematicians of international renown: J.L. Lions, H. Brezis, P.L. Lions, E. Magenes, A. Pazy, Avner Friedman, M.G. Crandall, L.C. Evans, J. Hale, H.T. Banks, J.A. Nohel, J. A. Peletier, H. Amann, H.O. Fattorini, R.T. Rockafeller and F. Clarke.

Viorel Barbu's results are also mentioned and presented in major mathematical encyclopedias like the *Encyclopedia of Mathematics* (Springer-Verlag 1991–1995), the *Systems & Control Encyclopedia* (Pergamon Press,1988,1995) and the *Matematiceskaya Enciclopedia* (Moscow 1983–1988).

V. Barbu has been a visiting professor at several universities including: Concordia University, Montreal, Canada; CNR University, Rome, Italy; INRIA, Paris, France; Purdue University, USA; Scuola Normalle Superiore Pisa, Italy; Ohio University, U.S.A.; Bologna; University, Italy; University Paris VI, France; Trento University, Italy. He was also an Otto Szaz Visiting Professor, University of Cincinnati, U.S.A.

V. Barbu has been a member of the Romanian Academy since 1991 and the President of the Iasi Branch of the Romanian Academy since 2001 and he was the Vice-president of the Romanian Academy from 1998 to 2002. Since 1990, he has been the Director of the Institute of Mathematics at the Romanian Academy in Iasi (Northeastern Romania) and is President of the Romanian Society for Cell Biology. He was Rector of Al. I. Cuza University of Iasi from 1981 to 1989.

He has received the following awards and honours: S. Stoilow Prize from the Romanian Academy (1972); Honorary Doctor of Nebraska University in Omaha (USA, 1993); Honorary Professor of Wuhan University (China, 1999).

V. Barbu is on the editorial boards of several international journals: *Numerical Functional Analysis and Optimization*; *Journal of Differential and Integral Equations*; *Communications in Applied Analysis; Advances in Differential Equations*; *Revue Roumaine de Mathematiques Pures et Appliquées*; *Panamerican Mathematical Journal*; *Nonlinear Functional Analysis*; *Abstract and Applied Analysis*.

Your field of research, differential equations, is strongly represented at Al. I. Cuza University in Iași. Could you tell us some of the history behind the Iași mathematical school, its present status and maybe speculate on its future?

Alexandru Myller,[1] the founder of the mathematical school at the University of Iași, was a former PhD student of David Hilbert at Göttingen and his thesis was on integral equations, a work that is still cited in literature. However, since returning to Romania and taking the professorship position with the University of Iași in 1910, his main scientific interest has been oriented toward Riemannian geometry. Before the war, differential equations at Iasi were studied by Constantin Popovici,[2] Simion Sanieleveci,[3] Mendel Haimovici[4] and Adolf Haimovici,[5] who continued their work into the late sixties and beyond. In 1956, Constantin Corduneanu[6] began his seminar on qualitative theory of differential equations, which ran for more than thirty years. In 1970, we began a new seminar on nonlinear analysis and applications to partial differential equations, which is still running. In this Seminar,

"O. Mayer" Institute of Mathematics in Iasi

"Al. I. Cuza" University Iasi

several mathematicians well-known for their outstanding contributions began their research activity. Let me mention a few of them: N. Pavel, C. Ursescu,T. Precupanu, Gh. Morosanu, N. Popescu, A. Rascanu, C. Zalinescu, I. Vrabie, O. Carja, D. Motreanu, R. Vescan, D. Tiba, D. Tataru, L. Nicolaescu, S. Anita and I. Sarbu. Some of them are now professors at American and European universities while others are with the Department of Mathematics of the Al. I. Cuza University or with the Institute of Mathematics of the Romanian Academy in Iasi. The main directions of research are nonlinear partial differential equations (PDEs) and control theory of PDEs, convex analysis, and stochastic analysis.

What is needed for a school or a tradition in mathematics to be established and to last?

A school in mathematics or in science is created by a group of dedicated young mathematicians around a scientifically productive leader able to orient research and provide new ideas. To last, it needs continuous influx of talented young people and new leaders. In general, a school disappears or changes its profile with the retirement of the leader who created it.

What have been the main trends and results in your area of interest in the last 30–40 years and what are the present trends?

If I am referring strictly to my field of scientific interest, perhaps I should mention here the new methods and functional techniques in the theory of nonlinear partial differential equations known as „monotonicity methods", the theory of nonlinear semigroups, which has influenced the existence theory of dynamic PDEs, as well as optimal control of parameter distributed control. A special mention should be made for the new sharp existence and uniqueness results for Hamilton Jacobi equations (the theory of viscosity solutions) and the new techniques and results on controllability and stabilization of parabolic equations, hyperbolic equations and the Navier-Stokes equations.

Let us discuss the present situation of mathematics research in Romania, in both universities and research institutes. How do you see its evolution in the last fifteen years and what do you predict for the near and far future?

Most of the research groups and schools in the big Romanian universities and institutes of the Romanian Academy have continued to exist and produce scientific results, though perhaps not at the same level as in the past. On the other hand, many young Romanian mathematicians (most of whom are members of foreign universities now) are represented in the best international mathematical journals and are in the 'elite' of the international mathematics community. However, there are very few bright young mathematicians who apply for academic positions in Romania nowadays and this will have, without any doubt, a devastating effect in the near future at the level of school and research.

What is your opinion about the extent to which the current brain drain affects mathematics in East European countries, in particular Romania?

The so-called 'brain drain' effect has a noticeable negative impact on the quality of research in institutes as well as at the level of graduate programs in mathematics. The fact that the best students apply for graduate studies at foreign universities and after graduation remain abroad is something new in Romanian history and the consequences are hard to evaluate. For mathematics in Romania, there is the real possibility that in a few years professional mathematicians will have almost disappeared.

In the same context, what can be done to attract talented young students into mathematics and especially to keep the best qualified mathematicians in the departments of mathematics of Romanian universities?

A governmental program, comparable with that of Western societies, to attract the best young scientists with well-paid positions (obtained by national competition) at Romanian universities, institutes and research facilities would bring, without any doubt, many brilliant people back into Romania. Such a program has already been implemented by several countries (e.g. China, Mexico) and the results have been positive. On the other hand, this venture should be connected to the forthcoming reform of the Romanian university and research system.

Do you agree that supporting short visits abroad for people teaching at university could be a possible short-term solution?

Yes, for a short term this is a solution, but Romania should stabilize its research and university system, creating competitive positions for at least a few percent of its brightest young mathematicians.

Does any 'pressure to publish' exist at universities and research institutes? Is it of benefit for researchers or should the scientific work be left to the researcher's discretion?

Of course there is, but this not only true in Romania but throughout the world. To find a good position at university or in research and in order to be promoted or to get financial support for research, you must publish in good journals. Many thousands of papers are submitted each year to a few main mathematical journals, some taking years to be published or rejected. This also puts pressure on the mathematical journals and the peer review system, which was intended for a smaller workload. The scientific work published is, however, the principal product of research activity and so it should be evaluated and monitored.

What do you think about 'fashion' in mathematics? Are you receptive to fashionable mathematics and do you pay attention to it?

No, I am not receptive to 'fashion' in mathematics but it should not be blamed because this is one of the main ways that novel and new fields are spread in mathematics. After the novelty goes away, there always remains something practical and permanent.

Differential equations had and have perhaps the most important number of applications in other sciences. In the last decades not only the theory but also numerical methods, software and applied examples in biology, medicine, the social sciences etc. have developed significantly. Is this still influencing the theory?

Since most of physical laws are expressed in terms of variations, the differential and, implicitly, differential equations, have a fundamental role in the construction of mathematical models in the sciences. This is true not only of physics but also of chemistry, biology, econometrics and the social sciences. From the time of Newton, the mathematical field of differential equations has developed under the direct influence and impulse of Newtonian mechanics, electromagnetism (the Maxwell equations), quantum mechanics, the theory of relativity, fluid mechanics and, more recently, automatic control theory and new models arising in mathematical biology, thermodynamics and engineering. There is of course a 'pure component' of this theory that apparently has an autonomous evolution (the theory of dynamic systems for instance) but the 'applied component' is, without any doubt, dominant. For this part of the theory, most of the research arguments and problems come from the applied arena and were originally physical or engineering problems. For instance, this is the case with chaos phenomena and inertial manifolds in the stability of nonlinear systems, accidentally discovered in the numerical treatment of a differential system used in meteorology (Lorenz system). Other examples are numerous.

How do you see the classical dichotomy between 'pure' and 'applied' mathematics, with special emphasis on your field of interest?

In our field, the distinction between 'pure' and 'applied' is less apparent. It refers mainly to the objectives and goals rather than the research arguments and problems. Applied research is mainly devoted to predicting evolutions and computing or putting into a new light a specific physical phenomenon. However, this usually involves sharp arguments of 'pure' mathematics.

What is your opinion about the direction in which research in mathematics is going nowadays? What do you think about the increasing tendency toward hyper-specialization in recent years?

It is a hard question because nobody can predict the evolution of mathematics. The research arguments in mathematics are closely related with evolution of other sciences and of technology. Of course, mathematics has its own open problems and conjectures awaiting answers but the spectacular results are to be expected from problems arising in the most dynamic fields of contemporary science. As regards to specialization, this is a general phenomenon in modern science but it should not be dramatized because it is necessary for getting sharp results and, in mathematics at least, it is not absolute. Indeed, in spite of growing specialization of its methods, mathematics also provides science with the general tools for integrating and understanding apparently uncorrelated and distant phenomena and theories.

What do you think makes a mathematical result outstanding? Could you present some crucial moments and results in your area of interest during your experience of research?

The mathematical community has its own system of evaluation for validating outstanding results. One might include in this category a mathematical result that puts a large class of existing results into a new perspective or relationship. An outstanding result might also be the answer to an old or famous conjecture or one that has a great impact in physics, in the natural sciences or in economics. For instance, characterization of hypoelliptic differential operators (L. Hörmander), division of distributions (L. Hörmander), the introduction and calculus of pseudo-differential operators (Kohn and L. Nirenberg), the existence theory of nonlinear infinite dimensional equations of monotone type (G. Minty, F. Browder, T. Komura, M.G. Crandall, A. Pazy, H. Brezis) to mention just a few examples.

What recent development in mathematics in general, in your field of research or in science at large has made the greatest impression on you?

Perhaps chaos phenomena in differential systems and in general long time behaviour of trajectories of differential and dynamic systems. Spectacular phenomena arise here that are related to undeterministic behaviour, turbulence and unpredictable evolution in physical systems, which are real mathematical challenges.

Most people think that the mathematical world is now becoming divided into two parts: on one side an elite of researchers who don't have teaching duties and on the other side active teachers trying to cope with the research competition. Do you agree with this? What do you think the situation is in Romania in this respect?
Of course the mathematical research should be done by professional mathematicians and it would be desirable that these people have no other duties to perturb their activity. On the other hand, the university should not be removed from research. The best university professors are those who are active in research as well. I should also mention that the students in mathematics represent a high scientific potential that must be oriented and integrated by professional mathematicians.

Differential equations is one of the most important subjects of mathematics. Do you expect major advances in the future, both in theory and applications? What are the research challenges in this area just now?
I tried to point out above some hot directions of research related to long time behaviour of infinite dimensional dynamic systems and of evolution equations in particular.

Do you sometimes question yourself about the way in which what's important in mathematical research and what's not are decided? Case study: Romania?
This reminds me of what one physicist said about mathematics: "What I really do not understand is how mathematicians realize that a certain result is important or not". The truth is that we do not have very precise criteria to immediately evaluate a certain discovery or a new result in mathematics. Maxwell's equations, which were without any doubt among the greatest scientific discoveries of the nineteenth century, remained ignored by mathematicians and physicists for almost twenty years, while Fourier's work on heat conduction was denied a prize by the French Academy. There are many other examples, some quite recent.

Notes

1 Al. Myller (1879–1965), Romanian mathematician, Professor of Mathematics at Al. I. Cuza University of Iasi (AICU). He obtained his PhD from Göttingen in 1906. In 1912, he founded a famous mathematical seminar, which is nowadays named after him.
2 C.C. Popovici (1870–1956), Romanian mathematician, Professor of Mathematics at AICU and the University of Bucharest. He obtained his PhD from Sorbonne in 1908. He was the first in Romania to study the fundamentals of functional equations.
3 S. Sanielevici (1870–1963), Romanian mathematician, Professor of Mathematics at AICU.
4 M. Haimovici (1906–1973), Romanian mathematician, Professor of Mathematics at AICU.
5 A. Haimovici (1912–1993), Romanian mathematician, Professor of Mathematics at AICU.
6 C. Corduneanu (1928–), Romanian mathematician, Professor of Mathematics at AICU and the University of Texas in Arlington (U.S.A.).

The interviewer, Vasile Berinde [vberinde@ubm.ro], is professor of mathematics at Universitea de Nord, Baia Mare, Romania and associate editor of the Newsletter.