"TIBERIU POPOVICIU" INSTITUTE OF NUMERICAL ANALYSIS AT ITS SEMI-CENTENNIAL

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The Department of Mathematics of the Romanian Academy, Cluj-Napoca Branch, was founded under the leadership of Professor Tiberiu Popoviciu in 1951, shortly after his coming at the University of Cluj and his appointment as corresponding member of the Romanian Academy. Fundamental researches were carried out within this Department in the fields of Numerical Analysis and Approximation Theory, and conditions were created for developing connections between mathematicians and specialists from various fields of practical activity.

The outstanding results, both theoretical and applicative, obtained within this department by Professor Tiberiu Popoviciu and his collaborators, convinced the leadership of the Romanian Academy, of the necessity of a research institute dedicated exclusively to approaches in the domains of Numerical Analysis and Approximation Theory, with applications to various practical fields. Thus, in 1957 the Institute of Numerical Analysis was founded, under the leadership of Professor Tiberiu Popoviciu. This institute was meant to organize powerful research teams, to establish scientific connections with similar institutes worldwide.

Within this institute, the Numerical Analysis and the Approximation Theory were considered, on one hand, as mathematical fields developed in close connection with the modern methods of Functional Analysis, Algebra, Geometry etc., and, on the other hand, in their connection with practical problems. This last aspect determined the leadership of the institute to focus on the development of a department called "Computing Machines", which was concerned with the construction and utilization of computers. Thus, two "DACICC" computers were designed and constructed in the 60's. It is worth mentioning that the first DACICC was the second electronic computer constructed in our country (the first one, MECIPT, was built in Timişoara). These computers made possible both the verification of the accuracy of the numerical algorithms elaborated in the institute, as well as the solving of a significant number of practical problems suggested by various companies. The

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second computer, called "DACICC 200", together with the software elaborated in the institute, represented a unitary, coherent, advanced and daring achievement for that period of time.

The results obtained by the collaborators of the institute made possible the publishing, under the auspices of the Romanian Academy, of the journal "Revue d'Analyse Numérique et de Théorie de l'Approximation", the first issue being issued in 1972. This journal, with a well-defined profile, has published, and keeps publishing even nowadays, results of Romanian mathematicians, and also, of mathematicians from abroad. It is also appropriate to remind the organization, by the Institute of Numerical Analysis, between 1960-1973, of six international colloquiums, which enjoyed the participation of a significant number of well-known mathematicians from all over the world.

Between 1957-1975, The Institute of Numerical Analysis continuously developed its research capacity, by employing, year after year, some young researchers, recruited from the most gifted graduates of the mathematical faculties. This fact created the possibility that the concerns of the institute could develop harmoniously and dynamically, in almost all directions regarding Numerical Analysis and Approximation Theory.

Unfortunately, in 1975, when the researchers of the institute had reached the scientific maturity, most of them were obliged to leave the institute, as a consequence of the decree issued by the communist leadership of the country, decree which put an end to the activity of the Academy's institutes of Mathematics from Bucharest, Cluj and Iaşi.

Therefore, after the decree, from a number of 48 employees, only a nucleus of 6 researchers remained to work within the Institute of Numerical Analysis. These 6 researchers formed a team within the Faculty of Mathematics of the University of Cluj, which, together with other specialists from the university, have continued the tradition and the research directions established by Tiberiu Popoviciu. This team functioned in the Faculty of Mathematics (Ministry of Education), between 1975-1990. This was an unfortunate period, both with regard to the development of fundamental researches, and also regarding the development of their applications, due to the conception of that time of the Ministry of Education, totally inadequate to the research activity.

The present institute took shape, beginning with 1990, upon the nucleus mentioned above, after its return to the Romanian Academy. As a homage paid to the memory of Tiberiu Popoviciu, beginning with 1995, the institute is called the "Tiberiu Popoviciu" Institute of Numerical Analysis.

The return of the institute to the Romanian Academy has created the possibility to approach fundamental and applicative research from an modern point of view. Outstanding results have thus been obtained, which have been published and recognized in the country and abroad. The main research directions which have been especially developed by the institute after 1990, are the following:

– Numerical Analysis (iterative methods for solving equations in finite dimensional spaces, the method of inverse interpolation and applications to the solving of non-linear equations, etc.);

– Approximation Theory (uniform approximation by linear and positive operators, the best approximation in function spaces and abstract spaces, spline functions and applications);

– Non-Linear Functional Analysis (iterative methods for solving equations in Banach spaces, numerical stability of methods and estimation of errors);

– Dynamical systems (the inverse and direct problem of Dynamics in Celestial Mechanics, measurable dynamical systems and stochastic processes in thermodynamics);

– Mathematical Modeling (mathematical models of some phenomena from physics, chemistry, hydrodynamics, hydrology, etc.);

– Numerical Simulations (simulation of diffusion with applications in finances, technological processes, transport in porous materials, etc.).

All these research directions have been mainly developed within two research themes:

1) numerical and approximation methods in linear and non-linear analysis;

2) study of some non-linear continuous dynamical systems and of their associated discrete ones.

The Institute has achieved international cooperations with similar institutes from France (Luminy Institute of Mathematics from Marseilles), Greece (Physics Department of Aristotle University from Salonika), Hungary (Renyi Institute from Budapest), USA (Department of Mathematical Sciences, Cameron University), Germany (Research Center ICG-4, Jülich), The Republic of Moldavia (Numerical Analysis Department of Chişinău University), Holland (Faculty of Mathematics and Computer Science of the Technical University of Eindhoven). The results of the cooperations performed have led to joint publications in prestigious journals and, last but not least, in the carrying out of some beneficent bilateral scientific exchanges.

The Institute issues, at the Romanian Academy Publishing House, two journals: "Revue d'Analyse Numérique et de Théorie de l'Approximation" (2 issues/year), and "Mathematica (Cluj)", the later in association with the Faculty of Mathematics and Computer Science of the "Babeş-Bolyai" University from Cluj (2 issues/year).

The Library of the Institute has been enriched year after year, both by the exchange of publications achieved with the two journals mentioned above, and by the reviewed books.

With a research capacity based mainly on 11 researchers, beginning with 1990, when the institute has returned to the Romanian Academy, results have been materialized in: 100 articles published in journals issued by the Romanian Academy, 145 articles published in other journals of Romanian universities, 12 books and 120 works published in journals from abroad, from which 41 articles

in ISI journals. For additional information, one may visit the web page of our institute: `www.ictp.acad.ro`.

From the most important results obtained by the researchers of our institute, we mention the following:

– the study and determination of optimal methods regarding the convergence order or the efficiency index for certain classes of iterative methods of interpolatory type, for the approximation of the solutions of nonlinear equations;

– the obtaining of some new classes of linear and positive operators of approximation in the expression of which appear the basic sequence of a delta operator and a Sheffer sequence for this delta operator;

– the equivalence of three iterative procedures (Mann, Ishikawa and Krasnoselski) has been proved, important specifications regarding their practical applications have been revealed;

– the study of the influence of the sources of perturbations on the Newton iterations for solving nonlinear systems, as well as on the successive approximations for fixed point problems - characterization of the convergence orders in terms of the perturbations;

– the study of Krylov solvers for large linear systems, with applications to the case when used in each step of Newton-type methods;

– the determination of an automatic method for the estimation of the monotone component of an arbitrary time series.

– results regarding the best approximation in asymmetric-normed spaces, and semi-Lipschitz functions spaces.

The staff of our institute have obtained research grants from the Romanian Academy, the Ministry of Education and Research (MEdC), National Council of Scientific Research from the Higher Education (CNCSIS). Thus, a number of 23 grants has been obtained. Besides, 3 research contracts with ITIM Cluj-Napoca ("Technical Institute of Mining Engineering") have been also obtained. In 2006 the institute has obtained a Grant of Excellence covering a period of 3 years.

As a consequence of the achievements of this kind, the material basis of the institute has been completed and modernized, by the acquisition of some advanced computer equipments. All these have made possible the approach to computing problems from a new point of view, very close to applicative necessities.

In order to disseminate the results obtained at the institute, besides their publication in prestigious journals, the researchers have participated, with contributed talks and papers, to numerous scientific events in the country and abroad. The institute has organized, periodically, within the "Academic Days of Cluj", a series of symposiums, some of them with international participation.

The achievements mentioned above have been possible also thanks to the healthy research climate created by the Romanian Academy, climate cultivated with care and responsibility within the institute.

This year (2007) we celebrate 50 years from the foundation of our institute, period in which our researchers have obtained results appreciated and recognized everywhere, despite the fact that it has also encountered in its activity more difficult periods, as that from 1975 which we have already mentioned, when the institute was almost suppressed.

Unfortunately, even recently, in 2003, we have faced an almost similar situation. The institute has been evacuated by the "Babeş-Bolyai" University from the building where they had carried out their activity over 55 years. At present, the institute functions in two apartments from the 5th floor of a block of flats situated in the suburbs of the city of Cluj-Napoca.

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