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SOME ASPECTS OF THE HISTORY OF APPLIED MATHEMATICS IN ARGENTINA

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This article is dedicated to Professor Mischa Cotlar, in whose honor this issue is published; I was lucky enough to have known Dr. Cotlar since 1965, when I assisted to a superb course he taught on real functions.

Abstract. In this paper we shall briefly describe some aspects of the history, evolution and problems of applied mathematics in Argentina.

1. Introduction

This article treats, as its title shows, some aspects, not all, of the history of what is usually (and loosely) called applied mathematics in Argentina, and I apologize for any omission in it; it is absolutely impossible to screen all the rich panorama (and mention all the names involved) in this area in a short paper, and more detailed and complete research is in progress. I have maintained the bibliography very concise, with the purpose only to guide the reader to further inquires (the references [1], [4], [5], [7] and [13] offer a broad panorama of topics discussed here, and I have used their information in many parts of this article), but of course I could have enlarged it enormously. Some very valuable documentation may be found in papers published in the journal *Saber y Tiempo*, dedicated to history of science (especially to history of Argentinean science), and of course some very valuable documentation may be found in the long history of this journal.

2. The beginning

In the territories that after 1810 would become Argentina, there was no particular difference between pure and applied mathematics. In fact, then there was probably no particular difference between pure and applied mathematics anywhere: the separation in both branches is more modern, although it is not easy to define exactly the difference between pure and applied mathematics.

The first chair in mathematics was created in 1809 at the University located in Córdoba (Real Universidad de San Carlos y de Nuestra Señora de Montserrat).

Key words and phrases. Argentinean applied mathematics, history.

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It was the only University then existing in what is now Argentina. The Dean Gregorio Funes, President of the University (he eventually served after 1810 in the new revolutionary government) paid from his patrimony the salary of the professor, because the University had no money. Next year, on May 25th, 1810, the Viceroy was overthrown, and an autonomous revolutionary government began a process that led to the Declaration of Independence in 1816 and a South American war against Spain that only finished in 1824 with the defeat of the Spanish Army and its expulsion from South America.

This new government needed an Army to combat the Spaniards, and the Army needed competent officials. Therefore, in September, 1810, the Secretary of the Revolutionary Junta, Mariano Moreno, created the School of Mathematics in Buenos Aires. It is interesting to know some of the reasons of this creation, namely, "In this establishment the young man who dedicates himself to the beautiful military career, because he feels in his heart those male affects that are introductory to the path of heroism, will find all the assistance that the mathematical science can provide applied to the lethal, although necessary, art of war" [1]. So the School of Mathematics was created by the revolutionary government to be able to apply mathematics to war. Anyway, the duration of this School was short, and it had a sudden (and unhappy) end: the School was closed in 1812 because its Head, the Lieutenant Colonel Felipe de Sentenach, was shot due to the fact that he participated in the (failed) conspiracy directed by Álzaga against the new government.

Anyway, mathematics was necessary for the officers of the new Army, so that in 1816 the Academy of Mathematics was created, also in Buenos Aires. In 1821, when the University of Buenos Aires was created by the brand new Province of Buenos Aires, the School was incorporated to the University.

3. Until the creation of the Department of Exact Sciences

The University of Buenos Aires had, at its beginning, a Department of Preparatory Studies, with chairs of mathematics. During most of the 1820's decade, Avelino Díaz was in charge of the chairs of physics-mathematics and of geometry. He published three textbooks, on arithmetic, algebra and geometry, respectively.

During almost all the 1820's the central government of Argentina disappeared, and the Province of Buenos Aires, whose capital was the city of Buenos Aires, was in charge of the Argentinean foreign affairs. After many years of civil war, eventually Juan Manuel de Rosas established in 1835 a dictatorship as governor of the Province of Buenos Aires; although technically he was only a *primus inter pares* among the governors of the remaining provinces, in practice, after other several years of civil wars and conflicts with Britain and France, he had an almost absolute power in Argentina. Because of the crises and wars, and because of the fact that he was very distrustful of intellectuals in general, in 1838 he eliminated the salary of the professors of the University of Buenos Aires and free education at the Province of Buenos Aires. The scientific activity in Buenos Aires was reduced to almost nil.

In 1852 Rosas had to resign and fled to Southampton, England, because the Provinces of Entre Ríos and Corrientes, backed by Brazil, rose up against him and defeated him at the battle of Caseros. The civil war continued, intermittently, between Buenos Aires and the other provinces. Anyway, in 1861 the Governor of the Province of Buenos Aires, Bartolomé Mitre, appointed Juan María Gutiérrez as President of the University. He served until 1874. Gutiérrez considered that science and technology were important for the development of the country, and in 1865 he created the Department of Exact Sciences "comprising the teaching of pure and applied mathematics and of natural history", in order to "educate engineers and professors, promoting the enrollment of students in these careers with so much future and importance for the country" [1].

4. The first full-time professors and their impact

The creation of the Department of Exact Sciences at the University of Buenos Aires was a turning point of the University, although it was not as successful as Gutiérrez had planned: with extraordinary vision (shared with other - but not all - members of the Argentinean ruling class of that time), Gutiérrez wanted a tool to develop science (pure and applied) and technology in our country, and so under his administration the degree of engineer began to be offered at the University. It requires a long analysis, not appropriate for this paper, to discuss why he was in a sense successful - many very good engineers were educated and trained at the University - but in other sense he failed: the University permitted the social climbing of a new middle class, and trained good professionals, but it never was a real scientific university as the great American and European universities became. There were isolated nuclei of scientific excellence but not a culture of scientific research in all the University. Anyway, the actions taken by Gutiérrez to carry out his goals were amazing: in 1865 began the war against Paraguay, which was complicated with a civil war. In the middle of this extremely difficult situation, that of course included an economic crisis, Gutiérrez entrusted the Italian physician and writer Paolo Mantegazza the mission of hiring the first three full-time professors in Argentina. Mantegazza hired three Italian scientists: Bernardo Speluzzi (pure mathematics), Emilio Rosetti (applied mathematics) and Peregrino Strobel (natural history). Strobel, after some time (and after having carried out a scientific expedition that included crossing the Andes) returned to Italy; Speluzzi and Rosetti remained in Buenos Aires until their retirement.

The Department of Exact Sciences began its activities in 1866, and in 1869 the first twelve Argentinean engineers ("the twelve apostles") got their degrees. Among them was Valentín Balbín (1851–1901), who in 1876 obtained his Ph. D. degree in mathematics in Oxford, so that he was the first Argentinean with a doctorate in mathematics. Balbín was a hydraulic and sanitary engineer, professor at the University (he succeeded Speluzzi in his chair); besides serving in several technical positions during different Argentinean administrations, he published the first journal of mathematics in Argentina (*Revista de Matemáticas Elementales*) as well as textbooks in mathematics.

5. The Universities of Córdoba and La Plata

Besides being the oldest University in Argentina (it was created in 1623), the University of Córdoba was the first national University: after the independence, from 1820 on, the University belonged to the Province of Córdoba; in 1856 it became a national University, whose authorities and faculty were appointed by the President (the University of Buenos Aires was nationalized only in 1881, after the city of Buenos Aires became the capital of the nation and the Province of Buenos Aires had to search another capital). The introduction of studies of sciences in Córdoba was due mainly to President Sarmiento. During his administration (1868–1874) he created in Córdoba in 1873 the National Academy of Science (that was biased to natural sciences, and had some conflicts with the University at its beginnings) and the Astronomical Observatory in 1871. To direct the Observatory he appointed Benjamin Gould, a distinguished American astronomer. Both actions, and especially the creation of the Observatory, had a certain influence in the development of applied mathematics in Córdoba. By the way, the creation of the Observatory is one of the most impressive acts of Sarmiento, who was probably the politician-statesman who best understood the importance of science and technology in all our history: it requires a clear idea of what science means for a country, and a strong will, to create an astronomical observatory in a small city of around 30,000 inhabitants, in a country populated by two million people, 80% of which were illiterate, and to appoint a distinguished foreign astronomer to direct it.

A new "feeling" began to permeate the University of Córdoba after these changes, and from 1875 on Oscar Doering was professor of mathematics and physics. He carried on many meteorological, magnetic and hypsometric observations.

On the other hand, the Province of Buenos Aires decided to create its own University in 1897. The University was nationalized in 1905 (in the history of Argentinean Universities in the first half of the twentieth century we can observe this pattern several times: a Province creates a University, and eventually the University is nationalized. It is apparent that no Argentinean Province has enough resources - economic and perhaps political - to manage a University). Its first President was Joaquín B. González, a personality as lucid as Juan María Gutiérrez with regard to the importance of sciences. The degree of doctor in mathematics appeared in La Plata and a very important institute of physics was created in 1906; the astronomical observatory, created by the Province in 1883, was incorporated to the University when it was nationalized.

6. Julio Rey Pastor

In 1917 the Spanish mathematician Julio Rey Pastor (1888–1962) arrived in Argentina, and the history of mathematics, and of applied mathematics, in our country, changed. Rey Pastor, who came invited by the Spanish Cultural Institute, had got his Ph. D. in 1909, and had been a postgraduate researcher in Germany. He was also one of the founders of the Spanish Mathematical Society. The impact of his sojourn in Argentina was so great that he was eventually hired in 1921 by the University of Buenos Aires to teach courses and organize a doctorate in

physical and mathematical sciences. He fell in love with an Argentinean lady, married her, and remained in our country for the rest of his life, without losing his contact with Spain. When he died, already retired, he was professor emeritus. It was an interesting time both for Spain and Argentina: in Spain there was a kind of "Renaissance" of science (although some authors speak of "Birth", arguing that Spain had never before developed science); let us remember that Ramón y Cajal was awarded a Nobel Prize in Medicine in 1906. On the other hand, the University of Buenos Aires had began, after many years, a project that slowly supported science: besides Rey Pastor, in 1917 Bernardo Houssay had won (with much opposition, exactly because he was a scientist) the chair of physiology at the Faculty of Medicine; in 1927 the Faculty of Philosophy and Literature hired the distinguished linguist Amado Alonso.

The impact of Rey Pastor should not be underestimated: he practically created a school of mathematics in Argentina. He was above all a teacher, interested also in history of mathematics, professor at the Universities of Cuyo, La Plata and Sur, and wrote an impressive amount of books, among them the famous treatise with Pi Calleja and Trejo, the "red brick" (there is an interesting commentary thereabout in [12]) with which many cohorts of students learned mathematics in Argentinean (and Latin American) Universities during many years. A short biography of Rey Pastor may be seen in [2]; a description of his noble personality in [14]. Rey Pastor had also a very active and prominent rôle in the foundation in 1936 of the Argentinean Mathematical Union.

The influence of Rey Pastor had an interesting antecedent: in 1910, the year of the Centenary of the Revolution, among the many celebrations there was an International Scientific American Congress in Buenos Aires, and two eminent applied mathematicians assisted: the Spaniard Leonardo Torres Quevedo and the Italian Vito Volterra. In fact (and we shall see other examples) Spanish influence in Argentinean mathematics is probably much stronger than in any other science.

7. José Babini - Carlos Dieulefait

Anyway, although Rey Pastor created modern Argentinean mathematics, most of his many distinguished (direct and indirect) disciples were pure mathematicians, in the sense that they in general oriented their research towards theoretical and abstract subjects. An interesting exception was José Babini. Babini (1897-1984) was a historian of science, engineer and mathematician. He got a degree of high-school teacher of mathematics and cosmography from the Institute for High School Teachers (Instituto Superior del Profesorado) in 1919, and graduated as civil engineer from the University of Buenos Aires in 1922. Before getting his degree of civil engineer he was appointed professor of mathematics at the National University of Litoral, in Santa Fe; this University had been founded in 1919 based in the Santa Fe Provincial University, which existed since 1889. Babini collaborated in the foundation of the Argentinean Mathematical Union, he was professor and Dean of the Faculty of Industrial and Agricultural Chemistry of the University of Litoral — now the Faculty of Chemical Engineering — in Santa Fe, and as professor

he strongly backed the use of numerical and graphical methods in mathematics. During many years Babini was the most important Argentinean specialist in numerical mathematics (we must remember that this happened in a "pre-computer" context). Besides, he became the most important specialist in history of science of our country (activity in which he had a profitable collaboration with Rey Pastor).

After around thirty years in Santa Fe, Babini returned to Buenos Aires (where he had been born) and eventually was the Dean of the School of Exact and Natural Sciences at the University of Buenos Aires after President Perón's fall in 1955. In that position he began the reforms that converted this Faculty in an important center of research and modern teaching in sciences: the creation of positions of full-time professors, the organization of the Departments at the Faculty and the appointment of professors after very exigent competitions in which research activity was very important. Babini was also the President of EUDEBA, the University of Buenos Aires Press, which became during the sixties, until the coup d'état that overthrew President Illia in 1966, the most important scientific publishing house in Spanish language.

While Babini worked in applied mathematics in the city of Santa Fe, statistics began its development in our country in another city of the Province of Santa Fe: the statistician Carlos Dieulefait (1901–1982) was the founder and first director (from 1932 to 1956) of the Institute of Statistics in Rosario. The National University of Litoral had Faculties in Santa Fe, Rosario, Paraná and Corrientes, and the Institute founded by Dieulefait belonged also to the University of Litoral, through the Faculty of Economics. Dieulefait was also the first President of the Argentine Society of Statistics; the career of statistics was created in 1948 in Rosario, and was the first in Latin America.

8. Evolution

Meanwhile, during the 1930's several important European mathematicians arrived in Argentina, and contributed to solidify the mathematical tradition. Mischa Cotlar (1913–2007) had arrived in Uruguay from the Soviet Union with his family, fleeing the Russian civil war and the revolution; he had no degree whatsoever until getting many years later a Ph. D. degree from the University of Chicago. Luis A. Santaló (1911–2001) and Manuel Balanzat (1912–1994) fled from Spain after the fall of the Republic in 1939, and Beppo Levi (1875–1961) and Alessandro Terracini (1889–1968) fled Italy after the racial laws against the Jews that Mussolini approved in 1938, under Nazi pressure. Terracini was the only one of them that returned to his country after the Second World War.

Other applied mathematician that stayed in Argentina during the Spanish Civil War was Esteban Terradas e Illa (1883–1950), a very interesting character. He had a doctorate in exact sciences and in physical science, he was also highway engineer, industrial engineer, member of the Real Spanish Academy of Language and of the Real Academy of Exact Sciences, he designed the construction of the Transversal Metropolitan Railway of Barcelona, which was inaugurated in 1926, and other railway lines in Catalonia. He was also President of the National Telephonic Company

of Spain. During the Spanish Civil War he searched a refuge in Argentina, at the Astronomical Observatory in La Plata, and returned to Spain after the end of it. But while he worked mainly in La Plata he also taught in Buenos Aires a course on probability in 1937 and a course on applications of mathematics to fluids and aerodynamics in 1938. He had already been in Buenos Aires in 1927, when he had offered a course on stability.

9. Manuel Sadosky

Terradas's most important disciple in Argentina was Manuel Sadosky. Sadosky (1914–2005), see [9], got his doctoral degree in 1940 in applied mathematics under his supervision. During his years as graduate student Sadosky worked at the La Plata Astronomical Observatory. His teachers were Rey Pastor, González Domínguez and Terradas. In 1946–48 he was at the Institut Henri Poincaré (Paris) and in 1948–49 at the Istituto per le Applicazioni del Calcolo (Rome). He very soon understood the possibilities that had appeared with the first electronic computers. In 1949–52 he worked at the Radiotechnical Institute of the University of Buenos Aires, until he was fired because he opposed the Perón administration. In 1952 he published *Cálculo Numérico y Gráfico*, first book on numerical analysis in Latin America. It is amazing that he published this book before the first computer arrived in Argentina, and the book was many times reprinted, many of them after the installation of computers (the last printing was in 1973, and there were computers in Argentina since 1960). In 1955, after Perón's fall, he returned to the University as Professor at the Faculties of Exact and Natural Sciences and of Engineering, and from 1959 on as full-time professor at the Faculty of Sciences. From 1959 to 1966 he was Deputy Dean of the Faculty, and from 1960 to 1966 Director of the Instituto de Cálculo, a sort of Institute of Applied and Computational Mathematics. He brought the first computer to an Argentinean University, which arrived in Buenos Aires on November 24, 1960, and at the Faculty of Sciences on December 12, 1960.

10. Institutionalization of science

In 1950 the National Agency for Atomic Energy (CONEA) was created; afterwards, the National Institute for Agricultural Technology (INTA), the National Institute for Industrial Technology (INTI) and the National Council of Science and Technology (CONICET) were founded in 1956, 1957 and 1958, respectively. In that sense, the creation of national agencies to promote research, in general or specific areas, was a worldwide phenomenon, related to the necessity (which, after the second World War, was felt in most countries) of using science and technology both to support the development and to support defense activities; in particular, science had then a considerable prestige and sometimes was considered a tool for development in a naïve way, that is, as if science alone could assure that a country would become developed.

In this atmosphere, we may remember that President Perón maintained a very serious conflict with the majority of the faculty and students of all national universities, so that many distinguished scientists could not have university positions during his administration; after Perón's fall, in 1955, overthrown by a military coup d'état in a very polarized society, the professors returned (or were appointed for the first time) and in many schools and Faculties of most national universities an environment of enthusiasm could be felt: research was reborn (or born), full-time positions were created for professors, many researchers were appointed fellows of the CONICET. The decade 1956-1966 could be fairly called the golden age of science in Argentina. Anyway, we must not forget that the polarization of Argentine society during and after Perón's administration damaged also science: in mathematics, the Department of Scientific Research (DIC) of the National University of Cuyo was dissolved, and its valuable journal of mathematics, that had published articles of international level, the *Revista Matemática Cuyana*, was closed. Its crime was having been created during Perón's administration.

In that time the definite institutional separation between mathematics and physics took place. This separation was of course inevitable, but had some consequences that I do not think were convenient for mathematics, and above all for applied mathematics: at the University of Buenos Aires, for instance, degrees began to be different in 1956, basic courses on physics ceased being compulsory for students of mathematics, and the credits assigned to them for mathematics degrees were more and more reduced. The message was clearly understood by students of mathematics: it is better not to become too involved with physics.

11. The first computer at an Argentinean University

On the other hand, simultaneously the most important modern tool for developing applied mathematics, namely the computer, was introduced in Argentina: as we have already mentioned, after Perón's fall Manuel Sadosky was appointed professor at the Faculties of Science and of Engineering of the University of Buenos Aires, and eventually remained as full-time professor and deputy Dean of the Faculty of Exact and Natural Sciences. As he was interested in applied mathematics and computer science, he strongly emphasized the necessity of founding an Institute for Applied and Computational Mathematics (the Instituto de Cálculo) and eventually the Institute was created in 1961, with Sadosky as Director. Besides, he convinced the CONICET to financially support the purchase of a computer, the Mercury Ferrante which began to work in 1961, and convinced the University to create the first undergraduate program in computer science in Argentina in 1963, that offered the degree of "computador científico", a shorter program than the traditional "licenciatura" degrees.

The Mercury II from Ferrante (which cost £152,099) had a 1024 40-bit words memory, an auxiliary memory initially consisting of 16,384 words, data input through punched paper tape, data output through punched paper tape and teletype; later a line printer was annexed, and Jonas Paiuk, an engineer that worked there, built an appliance that converted punched cards into punched paper tape, so

that a card puncher could be used, and a graphics machine was annexed. Mercury II needed a very large special air-conditioned room.

By the way, besides the Mercury II, four computers (see [3]) were imported in 1960, so that in a sense that year marks the beginning of "informatization" of Argentinean society.

12. The Instituto de Cálculo of the University of Buenos Aires

Since its foundation in 1961 until the 1966 military coup d'état that overthrew President Illia after which almost all its members resigned, the Instituto de Cálculo carried on an impressive activity in applied mathematics, both as research projects and contracted by third parties, see for instance [10]. There were seven groups of research at the Institute, namely on mathematical economy, directed by Oscar Varsavsky, on operations research, directed by Julián Aráoz, on statistics, directed by Sigfrido Mazza, on applied mechanics, directed by Mario Gradowczyk, on numerical analysis, directed by Pedro Zadunaisky, on programming systems, directed by Wilfredo Durán, and on computational linguistics, directed by Eugenia Fischer. The services to other institutions allowed financing the research and the scholarships. Eventually around 100 people worked at it.

It is interesting to see the diversity of subjects on which the Institute was interested. For instance, there was a model of Andean rivers, by means of numerical simulations, through a contract with the Federal Council of Investments (CFI) and the Economic Comission for Latin America and the Caribbean (ECLAC); fluvial hydrodynamic models of rivers with mobile beds; the macroeconomic models MEIC, a mathematical model of Thomas More's Utopia. Clients were all the Departments of the Faculty of Exact and Natural Sciences of the University of Buenos Aires, many scientists all over the country, the CONEA and other national agencies (Argentine Railroads, etc.). Besides, there was a very fruitful collaboration with the University of the Republic, at Montevideo, Uruguay.

Meanwhile, two academic societies were almost simultaneously created in 1960 related to areas which could be considered included in applied mathematics: the Argentinean Society of Operational Research (SADIO) and the Argentinean Society of Computing (SAC) — this one, meaning scientific computing. SAC decayed and eventually disappeared (in a sense it was annexed by SADIO). In the 1970's SADIO began to include informatics among its interests and became more and more the academic society of computer scientists.

13. The period 1966-1983

After the 1966 military coup some former members of the Instituto de Cálculo began to work as private consultants, and they participated in or directed some interesting mathematical models; for instance, the ACT consulting firm carried on between 1967 and 1971 the mathematical model of the Río de la Plata basin and models using operations research; since 1971 Estudio Gradowczyk y Asociados carried on hydrodynamic mathematical models, forecast models, models of dams and reservoirs operations, etc. In Bariloche the Bariloche Foundation interdisciplinary

staff designed and implemented the Latin American World Model (see [8]), that in a sense was an influential global model alternative to the Meadows model (see [11]) prepared for the Club of Rome; let us not forget that then the interdisciplinary global models were extremely popular.

In 1975, without any official encouragement, the Argentine Association of Applied Mathematics (ASAMA) was founded. Due to the political situation, this association had a very short life; in 1976 its President, Hugo Scolnik, had to flee the country into exile. But in some Universities far from Buenos Aires there was an interesting activity; for instance, the National University of Litoral created the first "licenciado" degree in applied mathematics in Argentina in 1972; the first cohort graduated in 1977. The program is offered by the Faculty of Chemical Engineering. In 1995 the University of Litoral created the Ph. D. program in applied mathematics.

Before that, at the brand new University of Rosario (based on the Rosario branch of the Litoral University), in 1969 was created the Center for Applied Mathematics and Computing. Its director was Edmundo Rofman, that signed agreements with European institutions, specially the INRIA (Institut de Recherche en Informatique et Automatique). Eventually Rofman emigrated to France, and the Center in a sense disappeared because of lack of continuity.

Also in La Plata, during these years, the authorities of the Department of Mathematics at the Faculty of Sciences were interested in applied mathematics; convinced by the enthusiasm of Miguel Herrera, who joined an outstanding capability as mathematician with a global vision of mathematics, and who understood perfectly well the importance of interaction between pure and applied mathematics, the Department of Mathematics hired some applied mathematicians, specially the young Hugo Folguera, engineer and mathematician, and the distinguished astronomer–mathematician Pedro Elías Zadunaisky, to teach courses on numerical analysis. By the way, Zadunaisky had studied engineering in Rosario and had begun his career in celestial mechanics in the La Plata Observatory, under the direction of the brilliant German astronomer and applied mathematician Alexander Wilkens, who lived in Argentina and worked at the National University of La Plata while the Nazis governed Germany; in 1957 Zadunaisky was in Columbia University with a Guggenheim fellowship working in matrix iterative methods using a IBM 650 computer, being (to the best of my knowledge) the first Argentinean citizen who used the computer in his scientific research. Eventually both Zadunaisky and Folguera resigned in 1975 due to the difficult political situation. Zadunaisky continued his outstanding career at the National Agency of Spatial Activities and (after the return of democracy in 1983) at the University of Buenos Aires, and Folguera, terminally ill, died untimely in 1979.

I don't want to finish this section without mentioning again Miguel Herrera. Herrera became interested in applied mathematics, and in optimization in particular, during the 1960's, and besides teaching the first course in Dynamic Programming in La Plata, and contributing to the development of applied mathematics in La Plata, he involved himself seriously in concrete applications, as may be seen in [6].

14. Since 1983

In spite of the severe shock that Miguel Herrera's untimely death in January, 1984, signified for both the communities of pure and applied mathematicians, applied mathematics began a slow process of consolidation from the return of democracy in 1983 on. In 1983 (still during the military dictatorship) the first National Encounter of Researchers and Users of the Method of Finite Elements (First ENIEF) took place in Bariloche. In 1985, in Paraná, took place the First Argentine Congress on Computational Mechanics (First MECOM), and in that occasion the Argentine Association of Computational Mechanics (AMCA) was created by an enthusiastic group of young researchers, mainly engineers, interested in finite elements. The main figure behind the creation and growing of AMCA (and President of AMCA during many years) was Sergio Idelsohn. In a sense, AMCA replaced ASAMA as the society for applied mathematics in Argentina. Finally, in 2006 the Argentinean Section of the Society for Industrial and Applied Mathematics (AR-SIAM) was created, as one of only four institutions similarly related to SIAM all over the world. Next year, from 2 to 5 October, 2007, the first Congress of Applied, Computational and Industrial Mathematics (I MACI, 2007) took place in Córdoba, jointly with the XVI ENIEF, organized by AMCA. It is very likely that the first MACI will be a milestone in the history of applied mathematics in Argentina.

15. Problems

Applied mathematics suffers in Argentina of several problems; it is not the object of this work to analyze the causes of them, and any opinion is controversial, so that I shall formulate very briefly my opinion, that of course is as controversial as any other, namely that the reasons of applied mathematics weakness is due to two main factors: on the one hand, to the fact that an underdeveloped economy such as ours does not require a strong school of applied mathematics, and on the other hand that from the decade of 1950's on teaching of and research in mathematics at the universities had a strong bias on "pure" mathematics; applied mathematics, as well as computer science, was regarded by many mathematicians with a certain diffidence. In this regard, the attitude was not particularly different from the attitude in other countries. The existing problems may be individualized as

- lack of tradition in solving concrete problems formulated by non mathematicians;
- scarce interdisciplinarity, that causes, besides, difficulties in understanding languages of other disciplines;
- competition with undergraduate programs in informatics. In fact, sometimes courses in applied mathematics are offered in Departments of Computer Sciences. Besides, many bright students with a clear interest in mathematics sometimes decide (and their reasoning is sound) that perhaps it is better for them to enroll in computer science, so that if there is no academic position for them, or if they are not very interested in an academic career, the possibilities of being hired by a firm are greater if they have a degree in computer science than if they have a degree in mathematics.

- scarce economic interest in careers in applied mathematics (very poorly paid scholarships, compared with private salaries);
- lack of understanding, both in public and private firms, of usefulness of solving problems in a mathematically efficient way. Often only the computational efficiency is taken into account.

Anyway, there are reasons to be optimistic vis-à-vis the future of applied mathematics in Argentina. On the one hand, the tradition of research in mathematics in our country is solid, so that there are many people, and above all many young people, from the mathematical community, that are able to successfully work in applied mathematics if they become interested; on the other hand, the economic recovery of Argentina requires for its continuity a significant scientific and technological contribution, and the importance of applied mathematics in this contribution should not be underestimated.

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