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MENDEL HAIMOVICI AND THE MATHEMATICAL SCHOOL OF IAȘI

The city of Iași, a renowned cultural centre, comprises some well-known scientific schools in the fields of mathematics, chemistry, biology, geography, and others. They have lent this city further brightness and increased the confidence of the people of Romania in the value of its achievements and in its capacity to keep up with the developments of mankind.

The mathematical school of Iași, founded in 1910 within the framework of the Mathematics Seminar by the scholar A. Myller, was developed and consolidated through the fruitful work of some great personalities, like Octav Mayer, Mendel Haimovici, and of some of their brilliant students and followers.

The department of mechanics of this school was the creation of Professor Mendel Haimovici, member of the Academy of Sciences. Continuing a long tradition in the teaching and research of mechanics, he succeded, through permanent endeavour, in determining a great number of young people to focus their talents towards deciphering the mysteries of pure and applied mechanics. The remarkable scientific results obtained by his scientific circle are the roots of what would be called later on the School of Mechanics of Iași.

I shall try to briefly analyze the social and political background on which this scientific school developed.

Professor Mendel Haimovici, who might have been 75 this year, devoted four decades of his life to the development of science and higher education at the „Al. I. Cuza" University of Iași. His qualities as a man, scholar and professor, untiring fighter for Justice, brought him the admiration of public opinion, of his colleagues, collaborators and students.

He was a renowned mathematician, with original contributions of great insight. He made continuous efforts for the better training of future researchers and teachers in the difficult but rewarding field of mathematics. His contribution to the development in Iași of modern mathematical ideas, to the discovery of new concepts and methods is outstanding.

His whole activity bears the mark of his personality, characterized by intelligence, scientific curiosity, creativity, a vast culture and professional ethics.

Mendel Haimovici was born in Iași, in 1906, November 30. He was educated at Liceul Național. *His aptitude for mathematics had developed since his school years. He continued his education at the Faculty of Sciences, the department of mathematics. He took his degree in 1930. After graduating from the University of Iași, he was offered an assistantship and became a collaborator of his former professors.*

After a while, he left for Rome, Paris, and London, where he specialized himself. In July 1933 he passed his Ph. D. in Italy with a valuable thesis on fluid mechanics, written under the guidage of Levi-Civita.

Back in Romania, he reasumed his work as an assistant. A few years later, he was to pass through the nightmare of the fascist terror. In 1940, after the promulgation of racial laws, he was removed from the University.

After the liberation of the country, he was appointed to a professorship at the University. He also became head of the chair of mechanics. He heade this chair untill his death, i.e. for 28 years.

As a professor, he taught courses of mechanics, partial differential equations, elasticity. Still alive in my memory are his attractive lectures, rich in revealing ideas and of a high scientific level.

In 1948, due to his scientific merits, professor Mendel Haimovici was elected a correspondent member of the Academy of Sciences. A few years later he became a full member.

When the Iași Branch of the Academy was founded, he was appointed director of the Institute of Mathematics. He headed this Institute until the end of his life.

He was invited and took part in many international conferences. He himself organized in Iași some highly regarded scientific meetings.

A man with a vast culture, he endeavoured all his life to disseminate science and culture.

As an old Party member he permanently championed for the noble ideals of socialism.

He died on March 31, 1973, leaving behind a lasting and influential work and the bright figure of a remarkable scholar.

In the following I shall mention some of the scientific achievements of Mendel Haimovici. His research had in view three main branches of mathematics: geometry, the theory of partial differential equations, and mechanics.

Despite the strong influence exerted by Myller and Mayer in the field of geometries with fundamental group, Mendel Haimovici approached a new subject of the geometry of that time. After Elie Cartan's visit to Iași in 1931, he became strongly bound to the ideas of the French mathematician. Within a short time he became a follower of Cartan and elaborated important works on some difficult problems inspired by his theories.

In this respect, he approached many subjects on Finsler spaces, passing from their local structure to the investigation of some subtle global properties. He discovered remarkable classes of Finsler spaces. Later on the Japanese Makoto Matsumoto, an expert in this field, incorporated them in his celebrated monograph on the fundamentals of Finsler geometry. Prof. Matsumoto considers prof. Mendel Haimovici as one of the few great geometres in the world who put the foundations of this important chapter of differential geometry.

We shall soon celebrate 50 years since the publication of the first paper in Romania of Finsler geometry, written by the geometer Mendel Haimovici. This event will be surely marked by the organization of some national scientific meetings and probably by a Romanian—Japanese symposium on Finsler geometry.

Another interest of Mendel Haimovici was the geometrization of some integrals. He solved some problems enforced by the unitary field theories of physics. In his treatise „The Ricci Calculus", *J. A. Schouten quotes and praises the results of Mendel Haimovici in the theory of generalized spaces.*

For our country, Mendel Haimovici was a pioneer in the field of integral geometry. He discovered a formula which remarkably generalizes a result of Crofton.

The career of this celebrated mathematician is characterized by geometric intuition, capacity of abstraction, and ingenuity. These qualities allowed him to be in advance of the time when be created his work. This can be best seen in the case of quasigroups. He discovered the concept of differentiable quasigroup and developed a unitary and complete theory. Among other developments, he proved that these objects behave with respect to Lie groups in the same manner as flat manifolds behave with respect to curved manifolds.

Nowadays, the notion of quasigroup, from the algebraic and topological points of view, is studied by renowned mathematical schools in the Soviet Union and the United States. This subject is represented in Iași by works which generalize many of Mendel Haimovici's results.

For a long time, professor Mendel Haimovici had dealt with the geometry of nonholonomic manifolds. The main reason for this interest is the fact that it leads to the most adequate model for the description of the movement of nonholonomic mechanical systems. Since the discovery of the notion of nonholonomic space, 55 years ago, by Gh. Vrănceanu, it had been investigated by celebrated mathematicians, like Schouten, Horak, Cartan, Vagner, and by geometers of Bucharest, Iași, Cluj and Timișoara. Without underestimating the contributions of other researchers, it can be asserted that the intrinsic geometry of nonholonomic manifolds in Riemann spaces is the creation of Mendel Haimovici. At that time he discovered a method which, later applied to the problem of geometrization of nonholonomic mechanical systems, allowed the determination of the general solution, just where Elie Cartan had committed an incredible error which was believed to be irreparable.

There followed extended studies in the theory of systems with involution, out of which the rigorous proof of the well known theorem of Cartan is worth being mentioned. His achievements in this chapter of the theory of differential and partial differential equations have become classic. At present, intensive research is being continued in the United States of America.

It is a regrettable fact that the Academy of the Socialist Republic Romania has not found the means to publish the two volumes of his collected works yet, although they have been prepared for publication for a long time.

We have to underline that the impressive scientific activity of Mendel Haimovici was part of the general effort of the researchers of the mathematical school of Iași to complete the results of the established scientific centres of the world. We must not forget the fact that well-known mathematicians like Myller, Mayer, Stoilov, Pompeiu, Vâlcovici, Sanielevici, Moisil, Vrănceanu, had worked here in Iași, followed by a group of gifted young men. Their scientific achievements had since long passed the borders of the country.

This brief survey of some discoveries of professor Mendel Haimovici clearly reveals the dimensions of his personality. It also points out the new and attractive ways of research which were brought into light. The paths paved by him were to be followed by many of his students even a quarter a century ago.

Professor Mendel Haimovici was a geometer by vocation. For those who are not familiar enough with his personality, it might seem curious the way he became a specialist in mechanics. The explanation of this fact has roots which are deeper than they might appear at first sight. In order to illuminate this aspect, I shall take the liberty to survey the history of mechanics at the University of Iași, as suggested by a revealing study on this matter written by professor Gheorghe Gheorghiev.

The Faculty of science of the University of Iași was founded in 1860, as one of the initial faculties of the University. The chair of mechanics was one of the initial chairs of this faculty. The first course of mechanics, entitled „Elementary and Rational Mechanics", was tought by Nicolae Culianu. In 1865, the head of the chair was Ioan Malik. Four years later, Miltiade Tzony, a graduate from the Sorbonne University, became the head of the chair. Tzony published the first collection of problems of mechanics in „Recreații științifice". It is worth mentioning that the manuscript of his course of rational mechanics has come down to us. He also made efforts to organize a laboratory. It seems that the first apparatus were bought with a donation made by Catinca Vogoridi, the wife of the former Caimacan *and daughter of the poet Costache Conachi. Tzony headed the chair until 1898. Although he left no original works of mechanics, by his clear, scholarly, rigurous lectures, Tzony remained one of the creators of the higher education in mechanics in our country. At the beginning of this century, due to him and to other personalities, the University of Iași acquired the status of a high cultural and scientific institution. Against this background, the „Annals" of the University of Iași appeared in 1900. The outstanding achievements of the 19th century determined the organization of the first „Romanian Scienfitic Congress" in 1902.*

In 1907, Dimitrie Pompeiu, doctor in mathematics who had defended his brilliant dissertation in Paris, became the head of the chair of mechanics. A renowned mathematician, with an excellent training in analysis, Pompeiu is the first in Iași to do original research in mechanics. He had no time to train specialists, because after five years of professorship at the University of Iași he was called to Bucharest to take up the chair left vacant after Haret's retirement.

In 1913, Victor Vâlcovici, a graduate from Göttingen, with a dissertation written under the guidance of Prandtl, became the head of the chair. A well-known scientist, with a serious interest in mechanics, Vâlcovici had great projects regarding the future of mechanics.

Both Vâlcovici and Pompeiu had formulated a clear outlook about the place and task of the course of mechanics in the formation of the future teachers. With respect to the relationship between abstract and applied science, they took the view of a maximal formalization, so that mechanics should become a deductive science. At the same time, experiment and modelling had to become the practical criterion in verifying the laws of mechanics.

These ideas were not singular with the members of the Faculty of science. The leadership of the faculty came to the conviction that higher technical education was necessary. In 1913, the Electrotechnical Institute, associated with the Faculty of Science, was founded. The role played by the chair of mechanics in this respect is easy to realize. But Vâlcovici did not succeed in reaching his goals concerning the scholarly education of his students. After five years of teaching in Iași, in 1918, during the first World War, Vâlcovici interruped his activity. Two years later he would become Rector of the Politechnic Institute of Timișoara.

After Vâlcovici, Simion Sanielevici, a doctor in mathematics from Paris, a former student of Goursat and author of valuable works in the theory of integral and integro-differential equations, was appointed head of the chair of mechanics. He left behind his course of mechanics in two volumes. This work was well appreciated for its clear exposition, its rigour and consequent use of the vector method. Even after Sanielevici's retirement, in 1938, many generations of students studied mechanics from his books.

In 1938, Ioan Plăcințeanu, a doctor from Göttingen, was appointed head of the chair of mechanics. He kept this office for six years. He wrote few original works and had no reputed followers.

In 1945, professor Mendel Haimovici succeeded to the leadership of the chair. A remarkable specialist in his field, he had begun his scientific activity with the disertation guided by Levi-Civita. He has continued this activity with well appreciated works in mechanics. Possessing vast knowledge in geometry, differential and partial equations, mathematical fields to which he had brought valuable contributions, he now had the opportunity to materialize in mechanics a synthesis of the advanced experience of his forerunners and of his own teaching and scientific experience.

A clear and well-founded conception on the fundamental notions of mechanics gave him the possibility to orient his didactic and research activity, from the very beginning, by connecting it with life and with the needs of society.

He directed his efforts towards updating the courses, the organization of research, the creation of a modern laboratory, and the formation of young specialists. Against the background of the late fourties, the post-war period, when the material possibilities were scarce and education was in a process of reorganization from its very roots, the program of Mendel Haimovici was not easy to accomplish. Despite all diffeculties, his administrative potential, his scientific authority and the high goal he had in view, led him to the final victory.

He was able to teach various courses: mechanics, hydrodynamics, mechanics of continuous media. However, he did not neglect his scientific activity. He published a course on elasticity and organized special seminars and national conferences. He himself delivered informal reports, led the group of mechanicians of the Institute of Mathematics and organized weekly sessions for updating and improving the knowledge of his collaborators. He supported the journals „Studii şi Cercetări Ştiinţifice" and „Analele Ştiinţifice ale Universităţii din Iaşi". The extension of the laboratory of mechanics and the reorganization of the astronomical observatory are his merits too.

His collaborators and the young researchers who were working for a doctoral degree under his guidance approached large themes on continuous media, hydrodynamics, magneto-hydrodynamics, isotropic and nonisotropic elasticity in homogeneous and nonhomogeneous media, termoelasticity, plasticity, continuous media with microstructure and analytical mechanics. During the same time, the construction of the first radiotelescope in our country began at the astronomical observatory. We witnessed the flourishing of new branches of mechanics. Ten dissertations were defended under his guidance. Other ten dissertations were in their final stage at the time of his death. Seven textbooks and monographs were published by his students and collaborators. Some prizes of the Academy were awarded to specialists of Iaşi for their valuable contributions to mechanics.

This intensive activity led to the creation of a genuine school of mechanics, which, no doubt, is the result of professor Mendel Haimovici's life time endeavour. Unfortunately, his tireless work, his total self-devotion to the advancement of science in Iaşi, and his permanent effort to satisfy all exigencies contributed to his premature death.

His devotion to science is materialized in two of his many achievements: the School of Mechanics of Iaşi and the Institute of Mathematics.

All these make us add a sign of gratitude, a symbol of our love and deep appreciation to the homage paid to the memory of the Romanian mathematician Mendel Haimovici through the organization of the National Colloquium of Mechanics and Geometry.

Radu Miron

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SOME TENSORIAL FINSLER STRUCTURES ON THE TANGENT BUNDLE

BY

MIHAI ANASTASIEI

To the memory of Professor Mendel Haimovici

In a joint paper with R. Miron (see [7]), we gave a free of coordinates definition of the fields of Finsler geometric objects. Particularly, the fields of Finsler tensor were obtained as cross-sections of a differentiable fibre bundle. In this paper, a „model" of that bundle is given (the Theorem 2.1). This means that every Finsler tensor field appears as a cross-section of a vector bundle obtained by taking the tensor product of some copies of vertical bundle V and of its dual V^*.

The prolongation of Finsler tensor fields to tensor fields on the manifold TM is usefull in various problems of Finsler geometry. Two remarkable prolongations are pointed out.

Using the first, a subalgebra of the tensorial algebra on TM isomorphic to the algebra of Finsler tensor fields is obtained.

The second allow us to find some tensorial structures (almost product, almost complex, almost Hermitian and others) on the manifold TM. Here and above TM means the total space of the tangent bundle to a differentiable manifold M.

1. Let M be a n-dimensional manifold, differentiable of class C^∞ and let $\pi : TM \to M$ be its tangent bundle. Let us denote by $d\pi : TTM \to TM$ the differential of π. The subbundle $V = \ker d\pi$ is called the vertical bundle over TM. Its fiber in the point $y \in TM$ will be denoted by V_y.

Every local chart (U, φ) on M induces a local chart $(\pi^{-1}(U), \Phi)$ where $\Phi : \pi^{-1}(U) \to \varphi(U) \times R^n \subset R^n \times R^n$ is given by $\Phi(y) = (\varphi(\pi(y)), d_x\varphi(y))$. Here $d_x\varphi$ denotes the tangent map in x of the diffeomorphism $\varphi : U \to R^n$.

If one puts $\varphi(x) = (\tilde{x}^1(x), \dots, \tilde{x}^n(x))$, then $\left(\frac{\partial}{\partial \tilde{x}^1}\right)_x, \dots, \left(\frac{\partial}{\partial \tilde{x}^n}\right)_x$ is the natural basis of T_xM defined by the local chart (U, φ). So, every $y \in T_xM$ can be expressed as $y = y^i \frac{\partial}{\partial \tilde{x}^i}$. Thus $(y^1, \dots, y^n)$ are the coordinates of $d_x(y)$ with respect to the canonical basis of R^n. It follows that $x^i = (x^i \circ \pi, y^i)$, $i = 1, \dots, n$ are the local coordinates on TM defined by the local chart $(\pi^{-1}(U), \Phi)$.

A vector field X on TM can be locally written as $X = X^i \frac{\partial}{\partial x^i} +$