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In memoriam Professor Miloš Zlámal

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IN MEMORIAM PROFESSOR MILOŠ ZLÁMAL

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On June 22, 1997, a prominent Czech mathematician Professor RNDr. Miloš Zlámal, DrSc., died unexpectedly at the age of seventy three years.

Miloš Zlámal was born on December 30, 1924 in Zborovice near Kroměříž. He started his studies at 3rd secondary school (gymnasium) in Brno. After his final exams he entered the Faculty of Science of the Masaryk University in Brno to study Mathematics and Physics. He received his doctorate in 1945 and became Assistant Professor at the Technical University in Brno. In the academic year 1950/51 he was a postgraduate student in the Mathematical Institute of the Czechoslovak Academy of Sciences in Prague and, after fulfilling his military service, at the Faculty of Science of the Masaryk University. After obtaining the scientific degree of Candidate of Science he remained at the Faculty till 1961, first as Assistant and later Associated Professor (Docent) of Mathematics. Since 1961 his professional career but also his life were permanently connected with the Technical University in Brno. Here he worked briefly as Associated Professor at the Faculty of Mechanical Engineering. During 1963–90 he was director of the Regional Computation Centre and in 1990–95 he acted as Professor of Mathemaics in the Institute of Mathematics of the Faculty of Mechanical Engineering. Even when retired he was unable to imagine his life without mathematics and never stopped cooperating with the Faculty.

While working at the Technical University he obtained in 1963 the degree of Doctor of Science and in 1965 was appointed full professor. In 1980 he was awarded the Bernard Bolzano Silver Medal of the Academy of Sciences, in 1984 the Brno Technical University Golden Medal and doctorate honoris causa at Technical University in Dresden. In 1992 he obtained the Charles University Memorial Medal for his significant contribution to the development and application of the Finite Elements Method. In the period 1983–92 he held the chair of the Scientific Board for Mathematics of the Czechoslovak Academy of Sciences.

Professor Zlámal spent the major part of his extremely fruitful scientific career as head of the Computation Centre of the Technical University in Brno. Starting from

its foundation, he was its director full 27 years. Originally a small computer centre developed under his leadership into one of the most important institutes within the frame of institutions of higher education in the country and played a considerable role in introducing modern computational methods and the computers themselves into practical use. Professor Zlámal lectured for a number of years for postgraduate engineering students about the most recent computational methods. More than 30 years he led a seminar for specialists in numerical methods both for Czechoslovak and foreign participants. Professor Zlámal engaged himself also in the education of a number of young scientists—most of them are now professors or researchers at various institutions of higher education.

As a young mathematician Miloš Zlámal worked in the theory of differential equations, first the ordinary and later the partial ones. Till the year 1967 he published 23 original papers from this field. Among the most important results from that period we should mention the theory of parabolic equations with small parameter at the highest derivative which became the topic of his thesis published in 1960. The essential part of this thesis was published in [13]. The most important period of his creative work started when in 1967 he became acquainted, through his collaboration with engineers, with the newly developing Finite Elements Method. He published his research concerning the method in 47 papers and his results brought him respect and fame all over the world.

Professor Zlámal was endued with an ability which is not quite common among mathematicians: he had lively interest in problems stemming from engineering practice, was able to listen to engineers, collaborate with them and use their problems as a starting point for his highly scientifically grounded research. So e.g. the topic of his thesis arose from his discussions with Professor V. Hálek, DrSc. His first information about the Finite Elements Method came from Professor J. Kratochvíl, DrSc., from the Faculty of Civil Engineering of Technical University in Brno. Professor Zlámal recognized in the procedure used by engineers certain connections with a half-forgotten paper by R. Courant (Variational methods for the solution of problems of equilibrium and vibrations, Bull. Amer. Math. Soc. *49*(1943), 1–23) and with variational methods generally. At first he intended to write only a short note on convergence of Veubecke's element, but new ideas and impulses coming in the course of work resulted in the paper [24], one of the papers most frequently cited in the Finite Elements Method.

In his seminar Professor Zlamal gradually formed a group of people fully engaged in the newly expanding Finite Elements Method. This gave rise to the Brno school of the method. It had the advantage of being directly connected with the computational practice: algorithms and foundations of software for the method were being developed parallelly with solving mathematical problems. In this direction, programmer's

erudition of L. Holuša as well as practical experience of Professor Kratochvíl with the application of the method represented a considerable contribution. The software system was being developed for many years and, besides being used for practical applications, it served also for immediate verification of theoretical results.

The period 1967–73 could be called "the elliptic period" in Zlámal's work in the Finite Elements Method. The above mentioned paper [24] started a series of 18 papers which can be considered the best textbook of the Finite Elements Method of that time. For example, Professor Raviart from Paris claimed that he had learned the method from Zlámal's early papers.

Since 1973 (except for the period 1977–79 when he analyzed the superconvergence and reduced integration in the Finite Elements Method) M. Zlámal devoted himself to evolution problems. At first he treated linear parabolic equations, paying special attention to multistep methods. Since 1976 he systematically studied nonlinear problems, first of all again the parabolic equations. The two most important papers from this period are [50] where he studied the convergence of twostep A-stable difference methods and [56] where he dealt with the equation with a nonlinearity also in the term with time derivative.

During 1979–82 M. Zlámal studied mainly the parabolic-elliptic nonlinear equation, which has many applications in the solution of nonlinear magnetic fields. In particular, the papers [61] and [63] are of principal importance.

During 1983–90 M. Zlámal studied problems related to the numerical solution of equations describing processes in the production of semiconductors and their operation. The papers [65] and [69] should be mentioned as being of the greatest significance in this field.

During the last period of his life Professor Zlámal was engaged in the box method.

Professor Zlámal always did his best to verify his theoretical results in the Finite Elements Method numerically. This led gradually to the creation of programs for the solution of thin plates, for problems of plane elasticity with various kinds of elements mutually connected by interface elements, for heat transfer equations, magnetic fields, simulation of semiconductor production and basic semiconductor equations.

He always chose problems which were then topical not only from the theoretical but primarily from the practical point of view. In his papers he solved problems of basic significance and therefore his methods and proofs can be modified and extended to related fields, as we have seen for many a time. Thus careful reading of Zlámal's papers has often become an unexpected but extremely pleasant start of further creative work.

Only when looking back at the sum of scientific, pedagogical and organizing activities of Professor Miloš Zlámal we realize how much he has left to us and how

much we will miss him. In Miloš Zlámal, Czech scientific community has lost one of its most prominent mathematicians and Institute of Mathematics of the Faculty of Mechanical Engineering his outstanding member.

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