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Professor Ivo Babuška is seventy

PROFESSOR IVO BABUŠKA IS SEVENTY

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Though it may seem rather unbelievable, always agile and active Professor Ivo Babuška celebrated his seventieth birthday in March. His immense and permanent vigor can serve as a prime example for many younger scientists. Let me recall several data and events from his fruitful life fully devoted to science.

Ivo Babuška was born on March 22. 1926 in Prague (Praha), Czechoslovakia. After World War II, he studied civil engineering at the Czech Technical University in Prague, and received the Ing. degree in 1949 and the Ph.D. degree in Technical Science (Dr. tech.) in 1951. In the period 1949–1952, he studied mathematics at the Central Mathematical Institute in Prague as a graduate student and since 1951 he was a research fellow at the Institute. The Institute changed its name to the Mathematical Institute of the Czechoslovak Academy of Sciences in 1953.

In 1955 Babuška received the Ph.D. (CSc.) degree in Mathematics and in 1960 the D.Sc. (DrSc.) degree which was in Czechoslovakia (and still is in the Czech Republic) awarded for highest scientific achievements. From 1955 to 1968 he was head of the Department of Constructive Methods of Mathematical Analysis of the Mathematical Institute of the Czechoslovak Academy of Sciences. The main emphasis of Babuška's group was on the theory of partial differential equations with applications to mechanics, and on numerical analysis.

In the period 1953–1956, he was the leader of a computational group that analyzed technology of the building of Orlík Dam on the Vltava River. It is a gravitational concrete dam 91 m high. The group, consisting of civil engineers, material scientists, mathematicians, and desk calculator operators, concentrated on the technology without artificial cooling, which is usually used to remove the heat created during the hardening of concrete. All the computations were carried out on mechanical desk calculators.

Most technological problems were formulated mathematically by Babuška and then analyzed mathematically and numerically. The problems treated provided re-

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search topics for 5 graduate students and initiated the establishing of a general theory of numerical stability of algorithms.

In 1956, Babuška established the journal Applications of Mathematics (formerly Aplikace matematiky) in Prague. He was also one of initiators of international scientific meetings that still take place up to now. The first international EQUADIFF Conference on Differential Equations was held in Prague in 1962 and the first international Conference on Basic Problems of Numerical Analysis in Liblice in 1964. In addition to writing scientific papers, Babuška published his first books, books on elasticity and the numerical treatment of differential equations. He was appointed professor at the Charles University in Prague in 1968.

In 1968, he arrived in the United States and was a visiting professor at the Institute for Fluid Dynamics and Applied Mathematics (IFDAM) at the University of Maryland at College Park, MD. In 1969, he became a research professor at IFDAM (now called the Institute for Physical Science and Technology) and later also at the Department of Mathematics. His interest in applied and numerical mathematics brought him to the finite element method. He has achieved numerous bright results in the method itself, in its reliability, a priori and a posteriori estimations, and adaptive approaches, which are recognized all over the world and belong to the fundamentals of the method.

For example, the well-known Babuška-Brezzi condition (developed independently by Babuška in the United States and Brezzi in Italy) has become the fundamental theoretical tool for the analysis of various mixed finite element methods that have profoundly influenced both the theory and practice of computational mechanics.

Another field, where Babuška has laid its foundations and contributed substantially to wide-spread applications, is the a posteriori error estimation. Various forms of a posteriori error estimates have become the core of efficient adaptive computation as well as numerical analysis in partial differential equations.

Last but not least, let us mention the p-version of the finite element method pioneered, developed, and cultivated by Babuška. It has become the basis for both very extensive research activities and, at the same time, for engineering software packages including the very successful commercial ones.

Babuška, along with others, is a founder and leader of the Finite Element Circus, an informal meeting which, for more than 25 years, takes place twice a year.

His name is inseparably connected with the development of the finite element method and his scientific results have become a solid part of the fundamentals of the method. His results are widely used, directly or indirectly, in engineering practice. Though his work is heavily influenced by practical needs of engineering computations it always bore and bears a pronounced mathematical orientation. Let us mention, in

addition, the maximum angle condition in the finite element method, the Babuška Paradox in the theory of plates, or the mathematical theory of homogenization.

After leaving Prague, Babuška remained in scientific contact with his colleagues in Czechoslovakia. Since 1990, he resumed visiting Czechoslovakia (later Czech Republic) and in 1994, he established the Prize for Young Czech Scientists in the field of numerical analysis and computational mechanics that is awarded anually.

In 1995, Babuška became a senior research scientist and Robert Trull Professor at the Texas Institute for Computational and Applied Mathematics at the University of Texas at Austin, TX.

He has been involved in the education of several tens of graduate students, along with his other scientific activities. He gave his students a lot of his bright scientific ideas and was always very happy when the students were able to follow these ideas, to exploit and develop them, and to transform them into mathematical results.

He is the author or co-author of 6 monographs and he contributed to further 13 books with fundamental chapters. Altogether he published 180 original papers in recognized international mathematical as well as engineering journals and further 70 papers in various proceedings. The reception of his work is excellent, the acceptance is lasting, and the response is numerous. He belongs to a small group of a few scientists who make the real top of the world research in the finite element method.

He has received recognition and various awards for his scientific work, among them the Czechoslovak State Prize (1968), Humboldt Senior U.S. Scientist Award of the Federal Republic of Germany (1976), Medal of the Charles University in Prague (Czechoslovakia, 1992), Medal of the Czech Society for Mechanics (1993), G. Birkhoff Prize of the American Mathematical Society and Society for Industrial and Applied Mathematics (1994), Honorary Doctor of Science at the University of Westminster in London (England, 1994), Distinguished University Professor at the University of Maryland at College Park, MD (1995), J. von Neumann Medal of the U.S. Association for Computational Mechanics (1995), and B. Bolzano Medal of the Academy of Sciences of the Czech Republic (1996).

He has been invited to a lot of lectures at conferences all over the world and he is a member of editorial boards of numerous mathematical and engineering journals.

I am convinced that Professor Ivo Babuška deserves our congratulations, and our sincere wishes of good health and optimistic mind. The Mathematical Institute of the Academy of Sciences of the Czech Republic, the Faculty of Mathematics and Physics of the Charles University, the Institute of Computer Science of the Academy of Sciences and the Union of Czech Mathematicians and Physicists, in cooperation with the Patriae Foundation, will organize a Prague Mathematical Conference in honor of the 70th birthdays of Professor Ivo Babuška and his colleagues, Professors Miroslav Fiedler, Jaroslav Kurzweil, and Vlastimil Pták on July 8–12, 1996. This

will be an opportunity to congratulate him personally in Prague and to wish him
many further scientific achievements.

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