BOOK REVIEWS

J. Brandts, S. Korotov, M. Křížek, K. Segeth, J. Šístek, T. Vejchodský, eds.: APPLICATIONS OF MATHEMATICS 2015. Institute of Mathematics, Czech Academy od Sciences, Prague, 2015. ISBN 978-80-85823-65-3, xvi + 272 pages, soft cover.

The international conference Applications of Mathematics 2015 was held at the Institute of Mathematics of the Czech Academy of Sciences in Prague from November 18 to 21. It was organized in honor of the birthday anniversaries of the famous numerical analysts Ivo Babuška (90), Milan Práger (85), and Emil Vitásek (85). The Proceedings of this conference are available at the website am2015.math.cas.cz.

The first contribution by Karel Segeth, the chair of the Organizing Committee, is dedicated to Ivo Babuška who was the Head of the Department of Constructive Methods of Mathematical Analysis of the Mathematical Institute of the Czechoslovak Academy of Sciences from 1955 to 1968. Then he left for the USA. More details about his life and scientific achievements can be found in Czechoslovak Math. J. 46 (1996), 331–367, and Appl. Math. 41 (1996), 231–232; 51 (2006), 89–92, and 60 (2015), 469–472.

The second contribution by Michal Křížek is named "My wonderful numerical analysis teachers—Milan Práger and Emil Vitásek". This paper describes studies of Numerical Analysis at the Faculty of Mathematics and Physics of Charles University in Prague. Milan Práger taught basic numerical methods while Emil Vitásek taught numerical methods for solving partial differential equations, in particular, the finite difference method. In 1966, they wrote together with Ivo Babuška the classical monograph Numerical Processes in Differential Equations published by John Wiley and Sons in London. Emil Vitasek later wrote two more monographs in the field of numerical mathematics: Numerical Methods (1987) and Foundations of the Theory of Numerical Methods for Solving Differential Equations (1994). He also was a member of the Editorial Board of Applications of Mathematics since 1971. Unfortunately, on 28th August 2016 he died.

The rest of the Proceedings contains more than 20 reviewed papers on applied mathematics. Most of them deal with the numerical solution of problems of mathematical physics. Václav Kučera presents an interesting note on necessary and sufficient conditions for convergence of the finite element method for the Poisson problem. Kenta Kobayashi derives sharp bounds for the interpolation error constants over triangular elements. Jaroslav Mlýnek et al. present a new differential evolution algorithm for the optimization of the heat radiation intensity problem. Pavel Kůs deals with the convergence and stability of the higher-order finite element solution of the reaction-diffusion equation with Turing instability. István Faragó et al. investigate continuous and discrete maximum principles for reaction-diffusion problems with the Neumann boundary conditions. Karel Segeth examines properties of the so-called tension splines. Tomáš Vejchodský studies the quality of local flux reconstructions for quaranteed error bounds. Lucie Kárná and Štěpán Klapka describe message doubling and error detection in the binary symmetrical channel, etc.

A classic problem in mathematics has been to solve polynomial equations with rational coefficients by means of radicals, i.e. by the arithmetic operations $+$, $-$, $\times$, $:$, and $\sqrt[n]{\cdot}$ (this is the radical symbol and involves taking nth roots). Michal Křížek and Lawrence Somer in their paper *Why quintic polynomial equations are not solvable in radicals* illustrate the main idea of Galois theory, by which roots of a polynomial equations of at least fifth degree

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with rational coefficients cannot be expressed by radicals, in general. In 1830, Evariste Galois introduced a criterion for determining whether any polynomial f of degree n with rational coefficients is solvable by radicals. This criterion involves the Galois group G which is a group of permutations on the n roots of the polynomial f. It can be shown that for any $n \geqslant 5$ there exists a polynomial equation for degree n which is not solvable by radicals (e.g. the equation $2x^5 - 10x + 5 = 0$). This follows from Galois' Theorem which states: *The alternating group A_n is simple for $n \geqslant 5$.* Therefore, higher order polynomial equations are usually solved by numerical methods. For example, the Lehmer-Schur method produces guaranteed error estimates, i.e., we can find arbitrarily small

This is already the third volume of the Proceedings Applications of Mathematics. The first volume appeared in 2012 and the second in 2013.

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