Control and Cybernetics

vol. **35** (2006) No. 3

Book review:

NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS WITH APPLICATIONS

by

Tomáš Roubíček

The book „Nonlinear Partial Differential Equations with Applications" by Tomáš Roubíček, an outstanding mathematician in the field of partial differential equations, concerns a broad spectrum of steady-state and evolution problems in distributed-parameter systems. The analysed problems include quasilinear and semilinear elliptic and parabolic partial differential equations, variational inequalities, doubly-nonlinear problems and systems of equations.

The focus of the book is twofold - presentation of abstract methods and their application to concrete equations arising in continuum mechanics, engineering, chemistry, biology etc., with the aim of proving existence, uniqueness, stability or regularity of solutions. The addressed abstract functional–analysis approach is based on nonlinear monotone, pseudomonotone, weakly continuous, accretive and set-valued mappings. The presented direct methods of general use involve fixed point theorems, Galerkin approximation, Rothe method of discretization in time, penalization, regularization, convexity and compactness arguments.

Numerous examples of systems of equations with real-world applications, discussed in the book, include in particular buoyancy-driven viscous flow, thermo-visco-elasticity, reaction-diffusion systems, thermistor, semiconductors, predator-prey system, phase-field model, Navier-Stokes-Nernst-Planck-Poisson-type system.

Thanks to a comprehensive presentation of a broad range of abstract methods and detailed exposition of ways of their applications to concrete problems the book is a very valuable position in the field of mathematical modelling of distributed parameter systems.

Irena Pawłow

Tomáš Roubíček, *Nonlinear Partial Differential Equations with Applications*. ISNM – International Series of Numerical Mathematics. Birkhäuser Verlag, Basel – Boston – Berlin, XVIII+405 pages, 2005. ISBN 3-7643-7293-1. Price (hardcover): 178 CHF.