

Title: Algebraic Error in Matrix Computations in the Context of Numerical Solution of Partial Differential Equations

Author: Jan Papež

Department: Department of Numerical Mathematics

Supervisor: prof. Ing. Zdeněk Strakoš, DrSc., Department of Numerical Mathematics

Abstract: Solution of algebraic problems is an inseparable and usually the most time-consuming part of numerical solution of PDEs. Algebraic computations are, in general, not exact, and in many cases it is even principally desirable not to perform them to a high accuracy. This has consequences that have to be taken into account in numerical analysis. This thesis investigates in this line some closely related issues. It focuses, in particular, on spatial distribution of the errors of different origin across the solution domain, backward error interpretation of the algebraic error in the context of function approximations, incorporation of algebraic errors to a posteriori error analysis, influence of algebraic errors to adaptivity, and construction of stopping criteria for (preconditioned) iterative algebraic solvers. Progress in these issues requires, in our opinion, understanding the interconnections between the phases of the overall solution process, such as discretization and algebraic computations.

Keywords: Numerical solution of partial differential equations, algebraic error, spatial distribution of error components, a posteriori error analysis, adaptivity, stopping criteria, preconditioning.