Third Symposium on "Recent Trends in the Numerical Solution of Differential Equations": Preface

Luigi Brugnano* and Ewa Weinmüller†

*Dipartimento di Matematica "U. Dini", Viale Morgagni 67/A, I-50134 Firenze (Italy)
http://www.math.unifi.it/~brugnano/
†Vienna University of Technology, Wiedner Hauptstrasse 8-10, A-1040 Wien (Austria)
http://www.math.tuwien.ac.at/~ewa/

Here, we collect most of the abstracts in the third edition of the above symposium, which cover a wide range of topics related to the numerical solution of differential equations. Schematically, they can be ordered in the following way:

- numerical methods for eigenvalue problems (papers 1 and 14);
- numerical methods for highly oscillatory problems and singularly perturbed problems (papers 2 and 9);
- efficient a posteriori estimate of the local and global errors (papers 3 and 6);
- numerical methods for Hamiltonian problems (papers 4, 7, and 13);
- numerical methods for PDEs with applications to American options evaluation (papers 5 and 8);
- a new method for the automatic detection of the stiffness of a problem (paper 10);
- analysis of boundedness of general linear methods (paper 11);
- Galerkin solution of abstract DAE problems (paper 12).

In the following, we briefly describe the contents of the papers, listed in alphabetical order of the respective speakers.

Paper 1, by P. Amodio and G. Settanni. The authors study high order finite difference methods for the solution of eigenvalue problems with initial conditions. They propose an algorithm based on methods previously designed for second order IVPs and BVPs.

Paper 2, by A. Arnold and J. Geier. The authors describe asymptotically correct schemes for highly oscillatory ODEs that do not need to resolve each oscillation: indeed, with a WKB ansatz the dominant oscillations are "transformed out", yielding a much smoother ODE.

Paper 3, by W. Auzinger. In this work, the author focuses on the use of the well-known technique of defect correction as a tool in estimating local or global errors in a reliable and efficient way, also presenting a related approach for a splitting scheme for evolution equations.

Paper 4, by L. Brugnano, F. Iavernaro, and D. Trigiante. The authors present a number of numerical tests comparing some numerical methods for Hamiltonian problems. Both, constant and variable stepsize implementation of the methods are considered.

Paper 5, by B. Düring and M. Fournié. The authors present a compact high-order finite difference scheme for option pricing in the well-known Heston stochastic volatility model, which is fourth order accurate in space and second order accurate in time.

Paper 6, by by D. Hollevoet, M. Van Daele, and G. Vanden Berghe. Here, the combination of exponential fitting and deferred correction based on mono-implicit Runge-Kutta methods is investigated and compared to the classical counterparts.

Paper 7, by L. Brugnano, F. Iavernaro, and D. Trigiante. The authors describe a new class of numerical methods for Hamiltonian problems that, under suitably mild assumptions, are able to preserve both energy and quadratic invariants.

Paper 8, by T. Haentjens, K. in´t Hout, and K. Volders. The authors study the numerical evaluation of American put options under the Heston stochastic volatility model, investigating the potential of combining a splitting approach with Alternating Direction Implicit schemes.

Paper 9, by I. Kosiuk and P. Szmolyan. In this article, an introduction to some recently developed methods for the analysis of systems of singularly perturbed ordinary differential equations is given in context of a model describing glycolytic oscillations.

Paper 10, by F. Mazzia and A.M. Nagy. This paper describes a new practical strategy to detect stiffness based on explicit Runge-Kutta schemes. This strategy implements an operative definition of stiffness based on the computation of two conditioning parameters.

Paper 11, by A. Mozartova. Here, an analysis of boundedness properties is provided for the class of general linear methods. A framework for deriving optimal stepsize conditions which guarantee boundedness is presented, along with general results for linear multistep methods.

Paper 12, by M. Matthes and C. Tischendorf. The authors discuss a Galerkin approach for handling linear abstract differential-algebraic equations with monotone operators. It is shown to provide solutions that continuously depend on the problem data and converge to the unique solution of the abstract differential-algebraic system.

Paper 13, by M. Van Daele, D. Hollevoet, and G. Vanden Berghe. The authors construct an exponentially-fitted variant of the well-known three stage Runge-Kutta method of Gauss-type. The new method is symmetric and symplectic by construction and it contains two parameters, which can be tuned to the problem at hand.

Paper 14, by R.,Hammerling, O. Koch, Ch. Simon, and E. Weinmüller. The authors propose a new method for the solution of EVPs in ODEs. Rough approximations for the eigenvalues generated by a matrix method are used as starting values for an adaptive collocation method with a reliable error estimate.