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EDITORIAL

Preface to BIT 53:1

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This is the fiftythird volume since the start of BIT, and the eleventh that I have the honor to present to you. We get a healthy number of new contributions from all corners of the World. The papers in this issue have been published on the Springer home page since last Summer and Fall, so many of you are already working on, making new progress on the problems treated here and cultivating new directions.

Let me take this opportunity to say thank you to *Per Lötstedt*, who has been on our editorial board all since 1999, and made a great share of the work to attract good manuscripts and help authors to keep up the standard of those that get printed. I wish you good luck in your future endeavors, and hope that BIT will continue to be present in the dynamic atmosphere in the Uppsala group of Scientific Computing!

In this issue, we continue to give new contributions to the numerical solution of differential equations, approximation, and linear algebra. One paper by di Pietro *et al.* may look unfamiliar to you. It is on a programming language construction, usable in finite element computations. There is a lively research going on to put knowledge from application areas into a computer programming language. Let BIT take part in these developments!

These are the papers:

Andrea Barth, *Annika Lang*, and *Christoph Schwab* describe a multilevel Monte Carlo method for parabolic stochastic partial differential equations. They balance accuracy in following solution paths to sampling errors, by following few paths in a fine grid, and making a large sample of coarse grid solutions.

Begona Cano studies the conservation of invariants by symmetric multistep cosine methods for second-order partial differential equations. These methods give exact

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solutions to the linear part, and if stiffness is confined to the linear part, we get an explicit method solve a stiff problem in the same way as an exponential integrator does for a first order system.

Julio E. Castrillón-Candás, *Jun Li*, and *Victor Eijkhout* study how to compute a sum of radial basis functions that interpolates a large set of irregularly spaced data. They use the formulation of the interpolation as a discrete integral equation, and use a hierarchical basis to develop a fast algorithm.

Catterina Dagnino, *Sara Remogna*, and *Paul Sablonnière* give error bounds on the approximation of functions and their partial derivatives by quadratic splines on non uniform triangulations of a rectangular domain. The error bounds depend on the smoothness of the function and the characteristics of the triangulation.

Daniele A. Di Pietro, *Jean-Marc Gratien*, and *Christophe Prud'homme* develop an embedded language in C++ that can be used to describe lowest-order discretizations of a wide class of diffusive problems on general meshes. Implementations, using this tool, are compared to traditional FEM codes, that need a considerably greater effort to program.

David R. Martin and *Lothar Reichel* study the minimization of a linear functional, defined on a set of approximate solutions of a discrete ill-posed problem. They use an iterative method, which uses the connection between Lanczos bidiagonalization and Gauss quadrature.

Paul Sablonnière, *Driss Sbibih*, and *Mohammed Tahrichi* develop an algorithm for numerical integration in two dimensions, based on bivariate quadratic spline interpolants on Powell-Sabin partitions. Optimal convergence order is obtained for specific refinements of a generic triangulation.

Plamen Simeonov and *Ron Goldman* study quantum splines, piecewise polynomials where a set of finite differences agree at the knots. A basis for quantum splines, that corresponds to the B-splines basis, is described.

Gang Wu, *Yimin Wei*, *Zhi-gang Jia*, *Si-tao Ling*, and *Lu Zhang* study perturbations of a pair of dual Krylov subspaces of a nonsymmetric matrix. They construct a perturbation that is built up by Krylov residuals. Bounds for these perturbations are useful in connection to the nonsymmetric Lanczos eigenvalue algorithm and the related QMR and BiCG algorithms for linear systems.

Shuhuang Xiang and *Hermann Brunner* study efficient methods for Volterra integral equations with highly oscillatory Bessel kernels. A Filon type method gives high accuracy for increased frequency of oscillation.

Huiyan Xue and *Antonella Zanna* develop a method to solve the evolution equations of a divergence free vector field. Its divergence polynomial is expressed as a sum of monomial basis functions, whose exact solutions are known. A linear combination of these exact solutions yields a solution to the original vector field, and this is compared to using a standard numerical integrator.

I wish you all welcome to read this new issue,

Axel Ruhe