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Preface to BIT 54:2

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1 Introduction to the contents of BIT 54:2

Now we are back with a set of contributions from the regular stream of incoming BIT manuscripts. We note that several contributions deal with algorithms for time propagation, where the system is linear and the linear algebra is crucial for the success of a numerical algorithm for propagation in time, see the papers by Arnold, Bodendiek and Freitag. The last paper by Yan, deals with propagation governed by a fractional derivative. The papers by Novati and Sun deal with regularization of ill posed problems, while those of Goda, Kressner and Ling treat empirical approximation problems. We have the two papers by Juntunen and Lamichhane that handle finite elements, and the one by Barreras on high relative accuracy issues in numerical linear algebra.

These are the papers:

Andreas Arnold and *Tobias Jahnke* study a system of ordinary differential equations, where the unknown is a multidimensional tensor, represented in the hierarchical Tucker format. This way, the time propagation can be described in fewer dimensions than for general tensors. It opens up for handling some practically interesting models in physics chemistry and economics.

Álvaro Barreras and *Juan Manuel Peña* describe a subtraction free algorithm for LDU decomposition of an almost diagonally dominant Z-matrix. It is marginally more expensive than Gaussian elimination and expands the class of linear systems that can be solved with high relative accuracy.

André Bodendiek and *Matthias Bollhöfer* describe an adaptive-order rational Arnoldi method for moment matching model reduction of a descriptor system, coming from time dependent Maxwell equations in computational electromagnetism. Crucial

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is the choice of expansion points and the preservation of matrix structure in the reduced model.

Melina Freitag and *Alastair Spence* show how to compute the real stability radius of a matrix, i.e. the smallest real perturbation that makes a stable real matrix unstable. It is a Newton type method, where linear systems are solved in each step. It is studied how to establish whether a global solution has been obtained.

Takashi Goda studies how to compute a lattice of points in a high dimensional unit hypercube with small mean square weighted discrepancy. Such lattice points give a quasi Monte Carlo quadrature with better accuracy.

Mika Juntunen and *Jeonghun Lee* present new second order rectangular mixed finite elements for a linear elasticity problem, where the symmetry condition on the stress is imposed weakly with a Lagrange multiplier.

Daniel Kressner, *Michael Steinlechner*, and *Bart Vandereycken* describe an algorithm to fill in the missing elements of a tensor of known low rank. It solves a Riemannian optimization over the set of low rank tensors by a nonlinear conjugate gradient algorithm. Results from specially devised test problems and from an applied problem of image reconstruction are reported.

Bishnu Lamichhane describes a non-conforming finite element method for the approximation of the biharmonic equation with clamped boundary conditions. It is based on a gradient recovery operator. Optimal a priori error estimates are given.

Bo Ling and *Yongping Liu*, give asymptotic estimates for optimal recovery of isotropic classes of several times differentiable multivariate functions defined over a convex body. The covering properties of the point set is crucial.

Paolo Novati and *Maria Rosaria Russo* solve a regularization problem with an Arnoldi-Tikhonov method, coupled with generalized cross validation for the computation of the regularization parameter at each iteration. Its suitability, under the hypothesis that a Picard condition is satisfied, is discussed. Numerical experiments on classical test problems and on an application to image restoration are presented.

Li Sun and *Ke Chen* describe a total variation minimization algorithm for denoising an image. It uses an augmented Lagrangian formulation with a special linearized fixed point iteration, combined with a nonlinear multigrid method. Special emphasis is given to the recovery of sharp edges.

Yubin Yan, *Kamal Pal*, and *Neville J. Ford*, describe two methods for solving a fractional differential equation. One is based on a direct discretization of the fractional differential operator, the other on an integral form that leads to a fractional Adams-type method. Numerical tests on specially devised examples are reported.

That was all! I wish you all a rewarding read,

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