Introduction to the contents of issue 52:2

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We continue with another issue in the BIT tradition. It has two contributions to our old mainstay, algorithms for initial value problems of ordinary differential equations, ODE, and three to its later outgrowth, stochastic differential equations, SDE. There are five papers in numerical linear algebra and three on approximation and numerical quadrature. These are the papers:

A. Abdi and John C. Butcher establish bounds for the order of Runge Kutta methods for ODEs that involve second derivatives. A rational approximation to the exponential function describes their stability properties. Order arrows are shown to be a tool to find the barriers.

Ciara E. Dangerfield, D. Kay, Shev MacNamara, and Kevin Burrage describe an algorithm for an Itô SDE for the Wright Fischer model for genetic drift with mutation, that gives solutions that stay in the unit interval. This is compared to the standard Euler-Maruyama algorithm with resampling.

Marco Donatelli, Stefano Serra-Capizzano, and Debora Sesana show how to analyze the convergence of multigrid for Toeplitz matrices in cases where the quotient between the successive step lengths is g instead of 2. Symbols and g -circulant matrices are used.

Tobias Lindstrøm Jensen, Jakob Heide Jørgensen, Per Christian Hansen, and Søren Holdt Jensen give an implementation of an algorithm for total variation minimizing regularization due to Nesterov. It includes a way to determine the parameters μ and L used in this algorithm. Different algorithms are compared on a 3D tomographic reconstruction application, and the importance of the choice of the convexity parameter μ is demonstrated.

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Juan Carlos Jimenez and *Hugo de la Cruz Cancino* analyze the convergence of local linearization schemes for SDEs, with additive noise. SDEs with jumps are given a special study.

Marianna Khanamiryan develops methods for ODEs with highly oscillatory solutions. She uses asymptotic and Filon type algorithms for linear systems with time dependent matrices and handles nonlinear differential equations with waveform relaxation.

Georges Klein and *Jean-Paul Berrut* describe quadrature rules based on linear barycentric rational interpolation. Orders of convergence are given and it is shown how a quadrature with equidistant nodes behaves on the notorious Runge test function.

Frances Kuo and *Henryk Woźniakowski* study the convergence of Gauss-Hermite quadrature on analytic functions from a reproducing kernel Hilbert space with a Gaussian kernel. This is complicated by the fact that polynomials are not included in this class of functions. It is proved that the quadrature rules have an exponential rate of convergence if the integrand is flat enough.

Dominique Küpper, *Anne Kværnø*, and *Andreas Rößler* describe how to solve a differential algebraic stochastic system driven by a scalar Wiener process. A special Runge Kutta method with strong accuracy of order one is developed. Its behavior is illustrated on two specially developed test cases.

Akil Narayan and *Jan S. Hesthaven* study connection coefficients used to transform orthogonal polynomials when the measure is changed. If the measures are transformed by a polynomial, the connection coefficients are sparse. The stability of these connections is also established and exemplified on sets of Jacobi polynomials.

Hassane Sadok and *Daniel B. Szyld* study the CMRH algorithm. It is built upon a LU factorization of the Krylov basis instead of the QR factorization used by Arnoldi or GMRES. It is faster by a constant factor and they show that its behavior is closely related to that of GMRES, when it comes to solving a linear least squares problem.

Alicja Smoktunowicz and *Iwona Wróbel* consider direct algorithms for the Moore-Penrose pseudoinverse of a matrix. They show that an algorithm based on the Golub-Kahan bidiagonalization is mixed forward-backward stable under natural assumptions.

Huiqing Xie describes an iterative method to compute partial derivatives of eigenvectors of quadratic eigenvalue problems with respect to system parameters. Convergence is studied and numerical experiments demonstrate its use to get bounds for dominant eigenvalues.

I wish you all a pleasant and rewarding read,

Axel Ruhe