Ulrich Langer

Editorial

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Computational Methods in Applied Mathematics (CMAM) is not only the title of this journal, but also the name of a series of conferences that was started under the aegis of the journal in 2003. The first CMAM was held at Minsk (Belarus) followed by conferences at Trakai (Lithuania) in 2005, again at Minsk in 2007, then at Bedlewo (Poland) in 2010, Berlin (Germany) in 2012, and St. Wolfgang/Strobl (Austria) in 2014. The 7th International Conference on "Computational Methods in Applied Mathematics" is devoted to 100 years of Petrov–Galerkin method, and will be held at the University of Jyväskylä (Finland), July 31 – August 6, 2016. The CMAM7 is organized by Pekka Neittaanmaki (Jyväskylä) and Sergey Repin (St. Petersburg and Jyväskylä).

The CMAM conferences focus on various aspects of mathematical modeling and numerical methods for the approximate solution of problems arising in science and engineering. Their scope coincides with the scope of the journal: numerical methods for initial and boundary value problems for differential and integral equations appearing in applied mathematics and mathematical physics. The conferences aim, in particular, at fostering cooperation between researchers working in the area of theoretical numerical analysis and applications to modeling, simulation, and scientific computing.

This special issue contains a collection of eight excellent papers mostly arising from invited talks given at the 6th CMAM held at St. Wolfgang/Strobl, September 28 – October 4, 2014. The papers are devoted to different hot research topics in analysis and numerical analysis of partial differential equations (PDEs). E. Emmrich and D. Puhst give an overview on existence results in nonlinear peridynamics, and compare these results with those known for classical nonlinear elastodynamics. The knowledge of these results is certainly very useful for people working on the numerical solution of models in nonlocal elastodynamics. The other seven papers are devoted to the construction and analysis of numerical methods for solving PDEs. The paper by P. Chatzipantelidis, Z. Horváth and V. Thomeé studies the positivity of some finite element approximations to the unsteady heat equation. N. Chegini and R. Stevenson design and analyze an adaptive wavelet scheme for solving first-order system least squares formulations of second-order elliptic PDEs. Fast parallel solvers for domain decomposition discontinuous Galerkin (Nitsche-type) finite element equations are discussed in the paper by M. Dryja, J. Galvis and M. Sarkis. They prove that the FETI-DP solver with deluxe scaling is robust with respect to jumps in the diffusion coefficient and shows the same log-grow in H/h as it is typical for FETI methods. The paper by N. J. Ford, K. Pal and Y. Yan is devoted to the construction and analysis of an algorithm for the numerical solution of two-sided space-fractional PDEs. S. Repin's paper deals with the derivation of computable estimates for the distance between a vector-valued function in the space $W^{1,\gamma}(\Omega, \mathbb{R}^d)$, with $\gamma \in (0, \infty)$, and the subspace of solenoidal vector functions. This result is crucial for deriving a posteriori error estimates for incompressible fluid problems like the Stokes problem. H.-G. Roos and M. Stynes give a nice overview over some open questions in the numerical analysis of singularly perturbed differential equations. Last, but not least, O. Steinbach derives a priori discretization error estimates for space-time finite element approximations to parabolic initial-boundary problems. In contrast to time-stepping methods, this kind of space-time approximation enables a full adaptivity to the solution in the space-time cylinder and the efficient parallel solution of the resulting large-scale system of finite element equations on massively parallel computers.

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Editor of the Special Issue and Chair of the CMAM6

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