Preface

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This special issue of *Computing and Visualization in Science* is dedicated to Ulrich Langer and Arnd Meyer on the occasion of their 65th birthdays in 2017. Both were leading figures in Numerical Analysis at the Technische Universität Chemnitz at the beginning of the 1990s. While Arnd remained there Ulrich left Chemnitz and joined the Johannes Kepler Universität Linz in 1993.

Both Ulrich and Arnd were organising the Chemnitz Finite Element Symposium in different roles over the years, and making it to a brand. The 30th Symposium 2017 took place on tour in St. Wolfgang, Austria.

Three invited speakers of the Chemnitz Finite Element Symposium 2017 (Mark Ainsworth, Volker John, and Ricardo Nochetto) and three former PhD students of Ulrich and Arnd (Gundolf Haase, Clemens Pechstein, and Stefan Reitzinger) contribute to this special issue. They present new developments to the fields of research of the two, namely the numerical analysis of finite element methods for differential equations and eigenvalue problems including fast solvers and efficient implementation on state of the art hardware.

Volker John, Petr Knobloch and Julia Novo describe important recent results concerning finite element methods for convection-dominated problems and incompressible flow problems. They also discuss important open problems in these fields.

Fractional differential operators appeared to be a hot topic at this year's symposium. Andrea Bonito, Juan Pablo Borthagaray, Ricardo Nochetto, Enrique Otárola, and Abner Salgado present three schemes for the numerical approximation of fractional diffusion, which build on different

definitions of such a non-local process. They discuss pros and cons of each method, summarize error estimates, and document their performance with numerical experiments.

Mark Ainsworth, Ozan Tugluk, Ben Whitney, and Scott Klasky present a multilevel technique for the compression and reduction of univariate data and give an optimal complexity algorithm for its implementation. The algorithm is applied to the case of turbulence modelling in which the datasets are traditionally not only extremely large but inherently non-smooth and, as such, rather resistant to compression.

Clemens Pechstein and Stefan Reitzinger consider a non-linear eigenvalue problem originating from the finite element discretization of mechanical structures involving linear viscoelastic material. The solution method is based on the contour integral method. The numerical computation is made efficient with the reduced order model technique.

Daniel Ganellari, Gundolf Haase, and Gerhard Zumbusch discuss several massively parallel algorithms for the numerical solution of the Eikonal equation including domain decomposition concepts for tracking the moving wave fronts in sub-domains and over the sub-domain boundaries.

The Chemnitz Finite Element Symposium 2017 was a very successful meeting with about 80 participants and 60 presentations. In collaboration with the Springer International Publishing AG we will publish a volume in the book series *Lecture Notes in Computational Science and Engineering* with the title *Advanced Finite Element Methods with Applications—Proceedings of the 30th Chemnitz FEM Symposium 2017* with contributions of further participants.

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