BIT Numer Math (2015) 55:1–3
DOI 10.1007/s10543-015-0548-y

BIT

PREFACE

Preface to BIT 55:1

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Published online: 11 February 2015

This special issue of BIT contains articles related to the Workshop on Computational Electromagnetics and Acoustics, held at the Mathematisches Forschungsinstitut Oberwolfach, Germany, in January 2013. This workshop was organized by R. Hiptmair (ETH Zürich, Switzerland), R. H. W. Hoppe (Univ. Augsburg, Germany and Houston, Texas), P. Joly (INRIA, Paris, France), and U. Langer (Univ. Linz, Austria). It was attended by 52 invited researchers in the field and had its focus on recent developments of mathematical theory and algorithms. A total of 26 presentations were given at the workshop, their topics covering major current developments in the field of Computational Electromagnetics and Acoustics. Extended abstracts of all contributions have been collected in the Oberwolfach Report 03/2013 (http://www.ems-ph.org/journals/show_issue.php?issn=1660-8933&vol=10&iss=1, doi:10.4171/OWR/2013/03).

Now, several participants of the workshop, all leaders in their fields, have heeded the organizers' call for papers for this special issue of the journal BIT. Their manuscripts provide a glimpse of current progress in the mathematical and numerical analysis of problems arising in acoustics or electromagnetics.

The contribution P. Monk and J. Chen is in the very topical area of time-domain boundary integral equation methods, and contains deep numerical analysis of a convolution quadrature based scheme for transient electromagnetics.

The article by X. Claeys, E. Spindler and myself proposes and analyses a novel boundary integral formulation for scattering transmission problems, whose Galerkin boundary discretization will always yield well conditioned linear systems

In their paper M. Dauge, R. A. Norton, and R. Scheichl study the regularity of Bloch modes in photonic crystals, which arise as solutions of eigenvalue problems. They obtain new results in elliptic regularity theory, which are important for designing good approximation spaces for numerical methods.

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The article of S. Fliss, D. Klindworth and K. Schmidt deals with new stable transparent boundary conditions for the simulation of photonic crystal wave guides.

A fast method for multiple acoustic scattering at many particles is presented by M. Ganesh and S. C. Hawkins. It relies on boundary integral equations, a compression of pair interactions, and a fast iterative solver.

Another fast algorithm for frequency-domain scattering is presented by A. Gillman, A. H. Barnett, and P.-G. Martinsson. They propose a new direct recursive decomposition solution strategy of sweeping type, amenable to large scale variable coefficient scattering problems.

The contribution of I. Graham, M. Löhndorf, M. Melenk amd E. Spence takes a closer look at the frequency dependence of the constants in the a priori error estimates for Galerkin boundary element methods for the combined field integral equation of acoustic scattering.

The article by R. Hohage and L. Nannen performs a rigorous study of absorbing boundary conditions based on both PML and novel infinite elements for joined semi-infinite waveguides.

Optimal control and adaptivity for low-frequency electromagnetic problems, and their Galerkin discretization with edge elements, is the topic of the contribution of R. H. W. Hoppe and I. Yousept.

In another article E. Spence establishes frequency dependent bounds for the norms of Helmholtz layer potentials on smooth objects. This implies coercivity of the combined field integral operator uniformly in the wave number.

On behalf of the conference organizers,

Ralf Hiptmair, special issue editor

Workshop participants, Oberwolfach workshop on Computational Electromagnetics and Acoustics, January 2013. Photo: Archives of the Mathematisches Forschungsinstitut Oberwolfach