

# Preface

The finite volume method in its various forms is a discretization technique for partial differential equations based on the fundamental physical principle of conservation. It has been used successfully in many applications including fluid dynamics, magnetohydrodynamics, structural analysis, nuclear physics, and semiconductor theory. Recent decades have brought significant success in the theoretical understanding of the method. Many finite volume methods preserve further qualitative or asymptotic properties including maximum principles, dissipativity, monotone decay of the free energy, or asymptotic stability.

Due to these properties, finite volume methods belong to the wider class of compatible discretization methods, which preserve qualitative properties of continuous problems at the discrete level. This structural approach to the discretization of partial differential equations becomes particularly important for multiphysics and multiscale applications.

The triennial series of conferences “International Symposium on Finite Volumes for Complex Applications—Problems and Perspectives (FVCA)” brings together mathematicians, physicists, and engineers interested in this kind of physically motivated discretizations. Contributions to the further advancement of the theoretical understanding of suitable finite volume, finite element, discontinuous Galerkin and other discretization schemes, and the exploration of new application fields have been welcomed.

Previous conferences on this series have been held in Rouen (1996), Duisburg (1999), Porquerolles (2002), Marrakech (2005), Aussois (2008), and Prague (2011).

The present volumes contain the invited and contributed papers presented as posters or talks at the Seventh International Symposium on Finite Volumes for Complex Applications held in Berlin on June 15–20, 2014.

The contributions in the first volume deal with theoretical aspects of the method. They focus on topics like preservation of physical properties on the discrete level, convergence, stability and error analysis, physically consistent coupling between discretizations for different processes, connections to other discretization methods, relationship between grids and discretization schemes, complex geometries and adaptivity shock waves and other flow discontinuities, new and existing schemes and their limitations, bottlenecks in the solution of large-scale problems.

As described, finite volume and related methods are of large practical value, which is demonstrated by the contributions to the second volume of the proceedings. Application fields include atmosphere and ocean modeling, chemical engineering and combustion energy generation and storage, electro-reaction-diffusion systems, and porous media.

The volume editors thank the authors for their high-quality contributions, the members of the program committee for supporting the organization of the review process, and all reviewers for their thorough work on the evaluation of each of the contributions.

The production of the proceedings was continuously supported by the Editor's team at Springer Verlag.

Without the financial contributions of the Deutsche Forschungsgemeinschaft (DFG), the Weierstrass Institute for Applied Analysis and Stochastics, the DFG Priority Program 1276 "Metström," the Westfälische Universität Münster, the Stuttgart Research Centre for Simulation Technology (Simtech), and the Czech Technical University of Prague, the organization of the conference and the production of the proceedings would not have been possible.

The Berlin Brandenburgische Akademie der Wissenschaften provided an impressive conference venue in the center of Berlin.

Finally, we have to thank the local organizers and the staff at the Weierstrass Institute for Applied Analysis and Stochastics for carrying the main organizational burden and for providing a friendly atmosphere for the conference.

March 2014

Jürgen Fuhrmann  
Mario Ohlberger  
Christian Rohde

Finite Volumes for Complex Applications VII-Methods  
and Theoretical Aspects

FVCA 7, Berlin, June 2014

Fuhrmann, J.; Ohlberger, M.; Rohde, C. (Eds.)

2014, XVIII, 468 p. 87 illus., 40 illus. in color., Hardcover

ISBN: 978-3-319-05683-8