

## Preface

### *Special Issue – Weizmann Workshop 2013*

The "Weizmann Workshop 2013 on Multilevel Computational Methods and Optimization", that took place at the Lopatie Center of the Weizmann Institute of Science in Rehovot, Israel, from April 30 to May 02, 2013, was a great scientific event that stimulated many contributions in the field of multilevel methods for simulation and optimization. This special occasion offered also the opportunity to celebrate the 40th anniversary of Achi Brandt's seminal paper on multi-level techniques. With all special issues dedicated to the Weizmann Workshop 2013, this journal 'Numerical Mathematics: Theory, Methods and Applications (NMTMA)', provides a unique opportunity to remember this event and to give an overview of some of the highly interesting achievements that were presented during this workshop.

The workshop aimed at bringing together world-class experts from many different countries to present and discuss recent research on multilevel computational methods and optimization in a wide variety of topics and applications. The talks addressed classical problems, such as the solution of partial differential equations, and modern tasks such as web search and data mining, with applications ranging from diverse disciplines including physics, biology, chemistry, economics, environment and earth sciences, computer science and engineering.

In the contribution "*Using discrete and continuous models to solve nanoporous flow optimization problems*", Boggs, Gay, and Nash discuss the problem of optimizing channels in nanoporous materials. A key feature of the model is that the edges of the finite element grid represent the locations of the channels and this model is embedded in an efficient multilevel algorithm.

In the paper "*Algebraic theory of two-grid methods*" by Notay, the algebraic theory of two-grid methods initiated by Achi Brandt in 1986 and its numerous improvements and developments are reviewed, highlighting the influence of the smoothing scheme on the convergence estimates. Some new results are introduced together with a collection of new proofs of known results.

In the contribution "*Multigrid methods with Newton-Gauss-Seidel smoothing and constraint preserving interpolation for obstacle problems*", Wu and Wan propose a multigrid algorithm based on the FAS scheme for solving membrane constrained obstacle problems and minimal surface obstacle problems in the formulations of HJB equations. A Newton-Gauss-Seidel smoother and a special coarse grid operator are proposed that result in a fast convergent multigrid scheme.

In the paper "*Diffuse interface methods for multiple phase materials: An energetic variational approach*" by Brannick, Liu, Qian, and Sun, a diffuse interface model for describing the dynamics of mixtures involving multiple (two or more) phases is discussed. This model reflects a balance among various conservative and dissipative forces and governs the evolution of velocity and phase fields. The large applicability of this model is illustrated with many application examples.

In the contribution "*A multigrid solver based on distributive smoother and defect correction for Oseen problems*", Chen, Hu, Wang, and Xu present an efficient multigrid solver for the Oseen problem discretized by Marker and Cell scheme on staggered grids. A least-squares commutator distributive Gauss-Seidel relaxation is developed for the Oseen problem and overweighing and defect-correction techniques are applied to further improve the performance of the resulting multigrid scheme.

In the paper "*A FEM-multigrid scheme for elliptic Nash-equilibrium multiobjective optimal control problems*" by Rahman and Borzi, a finite-element multigrid scheme for elliptic Nash-equilibrium multiobjective optimal control problems with control constraints is investigated. This scheme implements a FAS strategy with an appropriate projected collective smoothing method.

In the paper "*Review of methods inspired by algebraic-multigrid for data and image analysis applications*", Galun, Basri and Yavneh provide a surveys of recent extensions of the algebraic multigrid strategy to solve data and image analysis problems, such as clustering, segmentation, quantization and others.

The Weizmann Workshop 2013 was kindly supported by the Technical University of Delft and CWI, the University of Würzburg, Microsoft, the National Science Foundation, and the Weizmann Institute of Science.

We are particularly grateful to NMTMA and its Editor-in-Chief Zhiming Chen for hosting all the special issues dedicated to this event.

We wish you a very enjoyable reading.

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