

Oberwolfach Seminar: Beyond Numerical Homogenization

Date (ID)

09 – 15 June 2019 (1924b)

Organizers

Daniel Peterseim (Universität Augsburg), Houman Owhadi (California Institute of Technology)

Programme

Numerical homogenization: Identification of accurate and localized basis functions for approximating the solution space of elliptic operators (including prototypical PDEs with arbitrary rough coefficients without periodicity and scale separation).

Interpretations in the following fields and their interplay/connections: homogenization theory, variational multiscale analysis, theory of finite elements, domain decomposition methods, optimal recovery, polyharmonic splines, Bayesian/probabilistic numerics, Gaussian process regression, game/decision theory.

Beyond: Multiresolution analysis: operator adapted wavelets, fast direct multilevel solvers.

Kernels/computational statistics: compression, inversion and approximate PCA of dense kernel matrices, sparse and rank revealing representations of inverse operators and Gaussian processes, screening effect.

Uncertainty quantification: sparse compression of expected solution operators, statistical numerical approximation.

Eigenvalue problems: Anderson localization, Wannier functions, multilevel methods.

Inverse Problems/Learning: de-noising, learning kernels.

Introductory reading

D. Peterseim. *Variational multiscale stabilization and the exponential decay of fine-scale correctors*. Lecture Notes in Computational Science and Engineering, 114:343–369, 2016.

R. Kornhuber, D. Peterseim, and H. Yserentant. *An analysis of a class of variational multiscale methods based on subspace decomposition*. Math. Comp., 87:2765–2774, 2018.

H. Owhadi. *Multigrid with rough coefficients and Multiresolution operator decomposition from Hierarchical Information Games*. SIAM Review, 59(1):99–149, 2017.

H. Owhadi and C. Scovel. *Operator adapted wavelets, fast solvers, and numerical homogenization from a game theoretic approach to numerical approximation and algorithm design*. Cambridge University Press, Cambridge Monographs on Applied and Computational Mathematics, 2019.

Deadline for applications

31 March 2019 (to seminars@mfo.de)