Semester project/Master thesis (RW/CSE, MATH)

Supervisor: Prof. Ch. Schwab

Sparse FEM for transport PDEs

Project description:
Transport PDEs are high dimensional PDEs stated on a five- or six-dimensional phase space. Applications range from heat transfer, climate, and geodesy to acoustics and nuclear physics. Numerical methods for the efficient solution building on sparse tensor FEM are the focus of current research at the Seminar for Applied Mathematics [1, 2, 3].

In this project, a novel approach for the solution of the radiative transfer equation is to be investigated. The tasks comprise the formulation of the discretized problem, analytic examination of stability, complexity and convergence properties, implementation of the method in an existing MATLAB program for radiative transfer, and verification of results by numerical experiments.

Satisfactory completion of the project may lead to a journal publication.

Prerequisites: Numerical methods for ODEs and PDEs
Knowledge of interpolation, probability, and/or approximation theory
Good programming skills in MATLAB

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References:

[1] Konstantin Grella, Christoph Schwab. Sparse tensor spherical harmonics approximation in radiative transfer. Technical report 2010-33, SAM, ETH Zürich, Oct. 2010.

[2] G. Widmer, R. Hiptmair, and Ch. Schwab. Sparse adaptive finite elements for radiative transfer. *Journal of Computational Physics*, 227:6071-6105, 2008.

[3] Gisela Widmer. *Sparse Finite Elements for Radiative Transfer*. PhD thesis, ETH Zürich, 2009. No. 18420.