

MATHEMATICAL ASPECTS OF PROPER ORTHOGONAL DECOMPOSITION (POD)

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Joint work with Ulrich Matthes (Uni Hamburg), and in parts with Andreas Steinbrecher (TU Berlin), and Tatjana Stykel (Uni Augsburg)

Lecture I: POD for time-dependent PDEs (emphasis on numerical analysis)

Abstract

We will cover the construction of POD reduced order models for nonlinear PDE systems. The approximation of the nonlinearities is performed with DEIM. Emphasis will be taken on the choice of the inner product for the basis construction. Furthermore, error analysis will be sketched.

Lecture II: POD in PDE constrained optimization (with error analysis)

Abstract

This talk deals with the use of POD models in optimization with PDE constraints. Emphasis is put on the variational discretization of the controls, which is perfectly tailored to the use of POD models for the state approximation. Error analysis will be sketched.

Lecture III: MOR in applications - towards parametric MOR for nonlinear PDE systems in networks

Abstract

We propose a simulation-based model order reduction (MOR) approach for nonlinear PDE systems in networks. We show how proper orthogonal decomposition (POD) can be used to reduce the dimension of the PDE systems if snapshots of the full network simulation are available. Furthermore we discuss residual-based sampling combined with the MIT greedy approach to adaptively construct POD models which are valid over certain parameter ranges. As application we consider parametric MOR of semiconductors in integrated circuits with frequency as parameter.