Seminar Announcement

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Model Order Reduction in Pattern Formation

Abstract

There has been significant progress in past decades in the development, analysis, and efficient implementation of Model Order Reduction (MOR) for the numerical simulation of dynamical systems (systems of ordinary differential equations (ODEs) and partial differential equations (PDEs). MOR can effectively reduce computational costs for simulation of dynamical systems. Parametrized ODES and PDES are used in mathematical models in many applications. Since the dimension of these systems can be huge, high computational costs could occur. Efficient numerical methods are needed in order to reduce the computational cost of the simulations. MOR methods represent a valid and effcient approach in this respect. We investigate the formation of Turing patterns in excitable media described by the diffusive FitzHugh-Nagumo (FHN) equation. Different set of parameters satisfying Turing condition lead to labyrinth or spot like patterns. The FHN equation consisting of one activator and one inhibitor is discretized in space by the discontinuous Galerkin (DG) method and by the Average Vector Field (AVF) method in time. Applying the POD-DEIM to the full order model (FOM) we show that using few POD and DEIM modes, the dynamical behavior of the FHN equation and Turing patterns can be detected accurately. Due to the local nature of the DG discretization, the POD-DEIM requires less number of connected nodes for the nonlinear part of the FHN compared with the continuous nite element POD-DEIM. This leads to a significant reduction of the computation cost for DG POD-DEIM in the reduced order mode (ROM).

Joint work with Murat Uzunca, Tuğba Küçükseyhan, IAM & Mathematics, METU

DATE: June 25, 2015
TIME: 15:00
PLACE: Cengiz YENERİM Conference Hall

All interested people are cordially invited.
After the seminar, some cookies and soft drinks will be served.