Model Order Reduction for Pattern Formation in FitzHugh-Nagumo Equation

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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 [2] and by the Average Vector Field (AVF) method in time [3]. 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 finite element POD-DEIM [1]. This leads to a significant reduction of the computation cost for DG POD-DEIM in the reduced order mode (ROM).

References

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