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**Galerkin Dynamical Modeling of Porous Medium Convection using an Eigenbasis from Upper Bound Theory** BAOLE WEN, University of New Hampshire, NAVID DIANATI, University of Michigan, GREG CHINI, University of New Hampshire, CHARLES DOERING, University of Michigan — Galerkin projection is a common strategy for generating ODE models of PDE systems, either as a means of performing highly resolved direct numerical simulation (DNS) or as a method for generating reduced-order dynamical models. Popular bases for the associated spectral expansions include Fourier and Chebyshev modes, eigenfunctions of linear stability operators about "laminar" base solutions or empirical mean flows, or modes arising from Proper Orthogonal Decomposition (POD) of numerical or experimental system realizations. Here we employ an alternative, fully a-priori spectral basis composed of eigenfunctions from upper bound theory, for both fully resolved and reduced dynamical modeling of porous medium convection – a system that is receiving increased attention owing to applications in CO2 sequestration in terrestrial aquifers. Because this new basis is naturally adapted to the dynamics at a given Ra, our DNS requires a fraction of the total number of modes used in traditional (e.g. Fourier) spectral Galerkin simulations. Moreover, for "moderate" Rayleigh numbers ($Ra \lesssim 10^3$) we demonstrate that mode slaving can be used to further reduce the dimension of the truncated dynamical systems.

Baole Wen
University of New Hampshire

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