Abstract Submitted
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A poor man's compressible Navier–Stokes equation J.M. MCDONOUGH, J.P. STRODTBECK, University of Kentucky — We outline derivation of a "poor man's compressible Navier–Stokes" (PMCNS) equation, a discrete dynamical system (DDS) extending analyses of McDonough and Huang (Int. J. Numer. Meth. Fluids 44, 545, 2004) for the 2-D incompressible Navier–Stokes (N.–S.) equation to the 3-D compressible counterpart, and we indicate a method for computing bifurcation parameters of the DDS directly from those of the original differential equations, along with known physical parameters such as transport properties. We briefly provide a mathematical characterization of the PMCNS equation, in particular noting an approximate relationship to micro-local analysis of a pseudo-differential operator of the compressible N.–S. equation. We then investigate time series, power spectra and bifurcation diagrams of this DDS for various combinations of bifurcation parameters, including those most closely corresponding to homogeneous, isotropic turbulence; and we present comparisons of PMCNS calculations with extant experimental and DNS compressible flow data. We conclude by discussing application of this discrete dynamical system to construction of subgrid-scale models for LES of compressible flows within a synthetic-velocity/multi-scale framework.

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