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A Compressible "Poor Man's Navier–Stokes" Equation Discrete Dynamical System C.B. VELKUR, J.M. MCDONOUGH, University of Kentucky — Starting from the 3-D compressible Navier–Stokes equations we outline the derivation of a discrete dynamical system (DDS) known as the "poor man's Navier–Stokes (PMNS) equation" which we propose to use as the fluctuating component in synthetic-velocity forms of sub-grid scale models for large-eddy simulation. The DDS is obtained directly from the governing equations via a Galerkin procedure followed by decimation of all wave vectors but a single, arbitrary one that is incorporated into the bifurcation parameters; these are related to Reynolds, Péclet and Mach numbers, or the velocity gradients, and thus to flow physics. We provide computational results in the form of regime maps (bifurcation diagrams) to show that the DDS can produce essentially any temporal behavior observed either experimentally or computationally in compressible Navier–Stokes flows as the bifurcation parameters are varied over their ranges of effective behaviors analogous to results reported by McDonough & Huang (*Int. J. Numer. Meth. Fluids* **44**, 545, 2004) for the 2-D incompressible PMNS equations.

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