Abstract Submitted
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Observable Divergence and Observable Euler Equations for Shocks and Turbulence[1] KAMRAN MOHSENI, University of Colorado at Boulder — Both turbulence and shock formation in inviscid flows are prone to high wave number mode generations. This continuous generation of high wavemodes results in an energy cascade to ever smaller scales in turbulence and/or creation of shocks in compressible flows. This high wavenumber problem is often remedied by the addition of a viscous term in both compressible and incompressible flows. A regularization technique for the Burgers equation (Norgard and Mohseni 2008) was recently reported. This inviscid regularization was extended to one-dimensional compressible Euler equations in 2010 (Norgard and Mohseni 2010). This investigation presents a formal derivation of these equations from basic principles. Our previous results are extended to multidimensional compressible and incompressible Euler equations. We define a new *observable divergence* based on fluxes calculated from observable quantities at a desired scale. An *observable divergence theorem* is then proved and applied in the derivation of the regularized equations. It is shown that the derived equations reduce to inviscid Leray flow model in the limit of incompressibility. It is expected that this technique simultaneously regularizes shocks and turbulence for compressible and incompressible flows. Finally, numerical simulations are presented for the compressible one-dimensional observable Euler equations.

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