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Multiscale entropy analysis of forced Burgers turbulence JEONGLAE KIM, SIJIE HUANG, Arizona State University, SARTHAK BHARDWAJ, BASIS Scottsdale — Scale invariance is one of the key characteristics of nonlinear fluid systems exhibiting multiscale interactions, which is often manifested by a power-law scaling in energy spectrum. The Fourier analysis is commonly employed, but its application to flows with strong inhomogeneities and spatial locality is limited due to the fundamental assumption on its basis. In this study, an information-based alternative is proposed, and its validity and physical significance are discussed. The multiscale entropy (MSE) was developed in physiological and biomedical contexts to diagnose irregularities in time-series data that sample the underlying dynamical systems, typically not governed by mathematical models. The standard MSE algorithm evaluates the average rate at which new information is created at different scales. Direct numerical simulations of Burgers turbulence (as a one-dimensional analogue of the three-dimensional Navier–Stokes turbulence) are performed and analyzed by evaluating the standard MSE. Results show that MSE provides consistent and physically meaningful descriptions of Burgers turbulence when compared to the Fourier analysis.

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