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Kinetic Energy Backscatter in Turbulent Reacting Flows and Implications for Large Eddy Simulations ARNAB MOITRO, ALEXEI POLUDNENKO, University of Connecticut — The accuracy of Large Eddy Simulations (LES) depends on the accurate modelling of the subgrid scale (SGS) closure terms. Present LES models are based on assumptions of the universality of small scales and the cascade of kinetic energy from large to small scales. It has been shown that for reacting flows, direction of kinetic energy cascade is reversed near the flame region, and is directed from small to larger scales on average. In the present work, we demonstrate this backscatter for flows with higher Mach number and Reynolds number in a realistic experimental setting. As a result, for such flows other approaches towards SGS modelling are required, one of which is to obtain the LES closures directly by simulating the small scales in an embedded direct numerical simulation (eDNS). We demonstrate a method to force such an eDNS calculation by assuming a power law function for the spectral kinetic energy density in the LES, calculating the exponent based on narrow band pass filtered velocities at various scales, and using it to obtain the energy injection rate for the eDNS. Results indicate that the embedded calculation forced in such a way gives a spectrum that is in good agreement with a full DNS simulation for temporally evolving complex unsteady turbulence.

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