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Reduced order description of diffusion flames with inertial manifold theory MARYAM AKRAM, VENKAT RAMAN, University of Michigan, Ann Arbor — Resolving all dynamical scales in reacting turbulent flows with direct numerical simulation (DNS) is intractable even for simple fuels and geometries. Further, the complexity of engineering applications escalates the cost of DNS for their predictive analysis. Modeling is, therefore, inevitable to control such systems. Reacting turbulent flows are modeled mostly by methods developed for turbulence, where there is a forward cascade of energy, and statistical quantities of small scales are universal. While statistically stationary flows are modeled successfully with these methods, they fail to predict extreme events. A dynamical system approach can be more insightful on describing the small scale features. One such approach is based on the inertial manifold (IM) theory. The existence of IM has been proven for many dissipative systems. However, the theory does not provide an explicit form for the IM, and an approximation is necessary. The dynamical system is split into resolved and unresolved scales, where the information of the resolved scales approximates the small scales. The model has been tested on turbulent flows. In this work, the approximate IM is applied to diffusion flames in homogeneous isotropic turbulence.

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