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In-Situ Adaptive Manifolds: Enabling simulations of complex turbulent reacting flows CRISTIAN E. LACEY, ALEX G. NOVOSELOV, MICHAEL E. MUELLER, Princeton University — Reduced-order manifold approaches to turbulent combustion modeling traditionally involve precomputation of manifold solutions and pretabulation of the thermochemical database versus a small number of manifold variables. However, additional manifold variables are required as the complexity of turbulent combustion processes increases, for example, multi-modal combustion or combustion featuring multiple and/or inhomogeneous inlets. This increase in the number of manifold variables comes with an increase in the computational cost of precomputing a greater number of manifold solutions, most of which are never actually utilized in a CFD calculation. The memory required to store the pretabulated high-dimensional thermochemical database also increases, limiting the complexity of reduced-order manifold combustion models. In this work, a new In-Situ Adaptive Manifolds (ISAM) approach is developed that overcomes this limitation by combining 'on-the-fly' calculation of manifold solutions with In-Situ Adaptive Tabulation (ISAT), enabling the use of more complex manifold-based turbulent combustion models. The performance of ISAM is evaluated via LES calculations of canonical turbulent flames.

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