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Verification of low-Mach number combustion codes using the method of manufactured solutions[1] LEE SHUNN, Mechanical Engineering, Stanford University, FRANK HAM, Center for Turbulence Research, Stanford University, PATRICK KNUPP, Computer Science Research Institute, Sandia National Laboratories, PARVIZ MOIN, Mechanical Engineering, Stanford University
— Many computational combustion models rely on tabulated constitutive relations to close the system of equations. As these reactive state-equations are typically multi-dimensional and highly non-linear, their implications on the convergence and accuracy of simulation codes are not well understood. In this presentation, the effects of tabulated state-relationships on the computational performance of low-Mach number combustion codes are explored using the method of manufactured solutions (MMS). Several MMS examples are developed and applied, progressing from simple one-dimensional configurations to problems involving higher dimensionality and solution-complexity. The manufactured solutions are implemented in two multi-physics hydrodynamics codes: CDP developed at Stanford University and FUEGO developed at Sandia National Laboratories. In addition to verifying the order-of-accuracy of the codes, the MMS problems help highlight certain robustness issues in existing variable-density flow-solvers. Strategies to overcome these issues are briefly discussed.

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