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Analysis of operator splitting errors for DNS of low Mach number turbulent reacting flows JONATHAN MACART, MICHAEL E. MUELLER, Princeton University — A formally second-order accurate Strang splitting approach has been developed and applied to the solution of scalar transport/reaction equations for Direct Numerical Simulation (DNS) of low Mach number turbulent reacting flows. The temporal discretization errors of the scheme are analyzed in both the asymptotic and non-asymptotic regimes of convergence and compared with a formally first-order accurate Lie splitting approach in a series of one-dimensional test problems with real combustion chemistry. The Strang splitting scheme is demonstrated to achieve its theoretical accuracy when all relevant chemical time scales are resolved; however, with larger time steps representative of those utilized in practice for low Mach number DNS of turbulent reacting flows, a reduction in order is observed. Nonetheless, the Strang splitting approach exhibits a higher order of accuracy and smaller errors than Lie splitting for all time steps. Preliminary DNS results for a turbulent planar jet computed with this scheme will also be discussed.

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