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Simulation of Oxy-Fuel Pulse Detonation using a Space-Time CESE Method[1] SHASHANK KARRA, JEREMIAH HAUTH, SOURABH APTE, Oregon State Univ — Pulse detonation system using oxy-fuel combustion can be used for direct power extraction especially when combined with magnetohydrodynamics (MHD). In the present work, we investigate use of a space-time conservation element-solution element (CE/SE) method for simulation of oxy-methane pulse detonation waves. A CE/SE method results in a consistent multi-dimensional formulation for unstructured tetrahedral meshes by providing flux conservation in space and time, and eliminating the need for complex Reimann solvers to capture shocks. As the first step, a CE/SE method solving the Euler equations is implemented and verified for standard sod shock-tube problem to show very good predictive capability. The Euler solver is extended to account for single-step as well as reduced reaction mechanisms for oxy-fuel combustion. A revised Jones-Lindstedt (JL-R) reaction mechanism accounting for radicals such as O, OH, and H is used as a reduced mechanism to simulate detonation waves from methane-oxygen combustion. Detailed verification and validation is conducted to evaluate the effectiveness of the CE/SE method. The approach is being further developed for simulation of compressible reacting flows on unstructured grids.

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