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Three-dimensional CLEM-LES of irregular detonation propagation[1] BRIAN MAXWELL, MATEI RADULESCU, University of Ottawa — Recently, thin-channel experiments and 2D simulations have been conducted in order to investigate the effect of turbulent mixing rates on the structure of irregular detonation wave propagation. Furthermore, the dependence of the observed cell pattern, and also the reaction zone thickness, on the mixing of burned products with pockets of unburned gases, was investigated. The current work now includes 3D simulations, which are conducted to provide further validation of, and insight into, the 2D results. All simulations have been conducted using the Compressible Linear Eddy Model for Large Eddy Simulation (CLEM-LES). To date, the 3D results are found to match closely the previous 2D results. The agrreement is partly due to sufficient resolution of the large scale fluid motions, which are observed experimentally to be predominant in only two directions. Furthermore, the CLEM-LES methodology incorporates 3D mixing effects at the subgrid level. Finally, it was found that turbulent fluctuations on the subgrid were found to give rise to statistically lower than average propagation velocities on the wave front. This lead to longer ignition delays for large amounts of gas passing through the wave, giving rise to the unburned pockets of gas observed experimentally.

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Brian Maxwell
University of Ottawa

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