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The simulation of a hydrogen-bubble reaction due to shock ignition TEMISTOCLE GRENGA, SAMUEL PAOLUCCI, University of Notre Dame — We simulate the combustion of a hydrogen bubble in air ignited by a shock wave. The three dimensional compressible model includes detailed chemical kinetics, multi-component diffusion, Soret and Dufour effects, and state dependent transport properties. The reaction mechanism involves 9 species and 19 reversible reactions. The possibility of using a reduced chemical kinetics mechanism obtained through the G-Scheme is also explored. Results are compared with other numerical and experimental studies. The simulation is challenging since the physical and chemical phenomena lead to a large multiscale problem, which we solve using the parallel Wavelet Adaptive Multiresolution Representation (pWAMR) method. The method exhibits an impressive compression of the solution when compared to other methods. The algorithm is parallelized using a domain decomposition approach based on a Hilbert space-filling curve. pWAMR is able to capture all structures of O(μm) required for an accurate solution. The method is able to capture all scales using a relatively small number of degrees of freedom by adapting refinements to local demands of the solution. In addition, since the amplitudes of the wavelet transform provide a direct measure of the local error, we are able to produce a verified solution.

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