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A Parallel Adaptive Wavelet Method for the Simulation of Compressible Reacting Flows ZACHARY ZIKOSKI, SAMUEL PAOLUCCI, University of Notre Dame — The Wavelet Adaptive Multiresolution Representation (WAMR) method provides a robust method for controlling spatial grid adaption — fine grid spacing in regions of a solution requiring high resolution (i.e. near steep gradients, singularities, or near- singularities) and using much coarser grid spacing where the solution is slowly varying. The sparse grids produced using the WAMR method exhibit very high compression ratios compared to uniform grids of equivalent resolution. Subsequently, a wide range of spatial scales often occurring in continuum physics models can be captured efficiently. Furthermore, the wavelet transform provides a direct measure of local error at each grid point, effectively producing automatically verified solutions. The algorithm is parallelized using an MPI-based domain decomposition approach suitable for a wide range of distributed-memory parallel architectures. The method is applied to the solution of the compressible, reactive Navier-Stokes equations and includes multi-component diffusive transport and chemical kinetics models. Results for the method's parallel performance are reported, and its effectiveness on several challenging compressible reacting flow problems is highlighted.

Samuel Paolucci
University of Notre Dame

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