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**A Highly-Parallelized Perfectly Stirred Reactor (PSR) Model Using GPU Acceleration** SUDIP ADHIKARI, ABHILASH J. CHANDY, Department of Mechanical Engineering, University of Akron, Akron — Perfectly stirred reactors (PSR), which are idealized systems, where species undergoing chemical reactions have high rate of mixing, have been found to be very useful in testing and developing chemical reaction mechanisms for combustion research. The PSR model requires solving systems of nonlinear algebraic equations governing the chemical reactions, which typically are of the order of hundreds for realistic engineering systems and also involve multiple time scales ranging over a few orders of magnitude. As a result, the equations are stiff and the solution is highly compute-intensive. In spite of dramatic improvements in central processing units (CPUs) made during the past several decades, PSR solutions, while they remain feasible are computationally very expensive. An alternative approach is the application of accelerator technologies, such as graphics processing units (GPUs) that can improve the performance of such algorithms. A highly parallelized GPU implementation is presented for the PSR model, using a robust and efficient non-linear solver. Parallel performance metrics are presented to demonstrate the capability of GPUs to accelerate chemical kinetics calculations.

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