Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Multi-core/GPU accelerated multi-resolution simulations of compressible flows BABAK HEJAZIALHOSSEINI, DIEGO ROSSINELLI, PETROS KOUMOUTSAKOS, Chair of Computational Science, ETH Zurich, CH-8092, Switzerland — We develop a multi-resolution solver for single and multi-phase compressible flow simulations by coupling average interpolating wavelets and local time stepping schemes with high order finite volume schemes. Wavelets allow for high compression rates and explicit control over the error in adaptive representation of the flow field, but their efficient parallel implementation is hindered by the use of traditional data parallel models. In this work we demonstrate that this methodology can be implemented so that it can benefit from the processing power of emerging hybrid multicore and multi-GPU architectures. This is achieved by exploiting task-based parallelism paradigm and the concept of wavelet blocks combined with OpenCL and Intel Threading Building Blocks. The solver is able to handle high resolution jumps and benefits from adaptive time integration using local time stepping schemes as implemented on heterogeneous multi-core/GPU architectures. We demonstrate the accuracy of our method and the performance of our solver on different architectures for 2D simulations of shock-bubble interaction and Richtmeyer-Meshkov instability.

Petros Koumoutsakos
Chair of Computational Science, ETH Zurich, CH-8092, Switzerland

Date submitted: 07 Jul 2010 Electronic form version 1.4