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Parallel Adaptive Cartesian Upwind Methods for Shock-driven Multiphysics Simulation**Ralf Deiterding***Computer Science and Mathematics Division, Oak Ridge National Laboratory**Área: Esquemas numericos adaptativos para PDE (AMR), paralelismo*Quarta-feira **Coordenador:** Sonia Maria Gomes**Sala Topázio**

16:30-17:30 h

Finite-volume-based shock-capturing methods can most easily be constructed on structured Cartesian meshes. Implementations of higher order discretizations on unstructured grids, on the other hand, can be quite cumbersome. In this talk, an approach in utilizing Cartesian schemes for real-world problems will be presented that combines the ghost-fluid idea with block-structured adaptive mesh refinement. A scalar level set function storing the distance information to the boundary surface is used to consider arbitrary geometries on the Cartesian mesh without ambiguities. Although the boundary incorporation is of first-order accuracy, several examples from compressible gas dynamics will be presented which demonstrate that the utilization of mesh adaptation makes the overall approach suitable for serious computational investigations.

The method has been implemented in the generic fluid solver framework AMROC that is part of the Virtual Test Facility (VTF) software ([_http://www.cacr.caltech.edu/asc_](http://www.cacr.caltech.edu/asc_)). A temporal splitting approach will be described that couples the adaptive Eulerian finite volume method to explicit Lagrangian finite element schemes for computational solid dynamics. Three-dimensional fluid-structure interaction simulations involving large plastic deformations and/or fracture and fragmentation will be shown that confirm the applicability of the proposed techniques to problems with heavily evolving topology. Results obtained with different solid mechanics solvers coupled to AMROC will be compared, and the parallel performance of the fluid solver and the coupled software will be addressed. Essential auxiliary algorithms and software engineering aspects will be discussed. Where they are non-standard, e.g., for gas-liquid flows or detonation waves with detailed chemical kinetics, the employed finite volume schemes and numerical flux functions will be described briefly.