A NEW AMR/ALE-SOLVER FOR EFFICIENT SIMULATION OF DETONATIONS AND BLAST WAVES

A. Klomfass, T. Zweigle, K. Fischer

Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institute
Eckerstr.4, Freiburg, 79104, Germany

Key words: Numerical Simulation - Blast Waves – Urban Scenarios

When it comes to the analysis of detonation and blast waves the engineer is often confronted with the decision of using an excessively simplified method based on TNT equivalences and scaled distances or an overly complex and computationally expensive general-purpose CFD tool. For this reason we have developed a specialized simulation method which combines simplicity of application with versatility and computational efficiency. The method consists of a fully second order accurate finite-volume scheme for the time integration of the conservation equations. It combines globally[1] and locally[2] adapted Cartesian grids and permits mesh-embedded modeling and zone-conformal modeling of geometric configurations. Computational efficiency is achieved through a specialized data structure and the splitting of the simulation into a pre-run and a subsequent AMR run, where the fast pre-run produces the data which steer the local mesh adaption in the AMR run. In our paper we explain the concept and details of the method and present applications together with experimental validations. The examples include blast propagation in urban scenarios and internal detonations with significant afterburning.

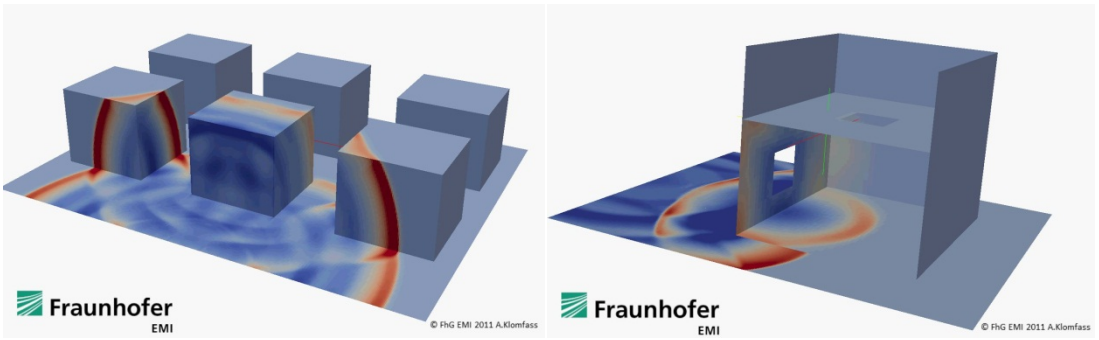

Fig.1. Example applications: Instantaneous pressure distributions obtained from simulation of external blast propagation in an urban scenario with six buildings (left) and external blast transmitted through a window into the interior of a building (cut-away view, right).

References

[1] Herzog, O., Klomfass, A., A specialized, automated solver for simulation of blast events in urban scenarios: new AMR approach, Proc. MABS 21

[1] ALE: Arbitrary Lagrange-Euler
[2] AMR: Automatic Mesh Refinement