COMPUTATIONAL FRAMEWORK FOR SIMULATION OF URBAN AIRBLAST AND STRUCTURAL INTERACTIONS

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Key words : Urban airblast – shock capturing – adaptive mesh - FSI

Efficient and accurate simulation of explosions in large urban areas and damage to structures remains an important and challenging task. This work discusses the development of a computational framework, *muSICS*, to satisfy the need for such simulations. This framework utilizes an unstructured mesh methodology for discretization of the 3D computational domain representing complex geometries such as urban environments. The high-speed flow phenomena resulting from explosions is simulated using a computational fluid dynamics (CFD) code which employs a compressible flow solver based on the HLLC method. The ability for accurate shock capturing is achieved through 2^{nd} order schemes and further enhanced with an automatic mesh adaptivity procedure. Simulations using these techniques are validated against experimental data for cases of air blast in urban scenarios. To meet the demand for fast-running simulations, the CFD codes are parallelized to run large problems on High Performance Computing (HPC) systems.

Another essential part of the urban explosion scenario is assessment of the dynamic response and damage to structural components due to the blast loading. This presents a fluid-structure interaction (FSI) problem which is approached by coupling the CFD solver with the open source structural finite-element code CALCULIX. The FSI coupled methodology is demonstrated for some validation cases such as blast loading of a flat plate.