

NUMERICAL STUDY OF BLAST EFFECTS ON A BUILDING

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Accurate simulation of blast effects on buildings is a major issue for evident safety reasons. The effective load on a structure is the result of the interaction of the incident blast wave with structural elements such as columns, floor, roof and openings. These elements cause wave diffraction/reflexion and the creation of long life vortices at edges. The peak overpressure and impulse are thus difficult to predict via simplified techniques and numerical simulation can help, mainly in 3D. Furthermore, in many reinforced concrete buildings, the response time of the structure is greater than the travelling time of the blast wave and a weak fluid-structure coupling can be used.

This study presents such a weak coupling between a second order Computational Fluid Dynamics (CFD) code and the CEA Discrete Element Method (DEM) code CeaMka3D, in the particular case of the Oklahoma City bombing. Firstly, the CFD code is used on a fine mesh to accurately simulate the blast load for a rigid building. This approach allows taking into account for negative phase effects and floors differential loadings. Secondly, the pressure history is used to apply the effective loading on the building surfaces in the CeaMka3D code. This DEM code relies on a mesoscopic description of materials and, without artificial aid, allows for the apparition of fissures and partial collapse. This method is generic and helps identifying domino effects, which is of great importance in order to improve building performance.