URBAN CANYON BLAST LOAD CALCULATIONS WITH FLACS-BLAST AND ADAPTIVE MESH REFINEMENT

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ABSTRACT

Malicious attacks represent a serious hazard in many parts of the world. The targets are not necessarily limited to strategic infrastructure, nor are such threats restricted to high-tension regions. Blast waves from detonation of condensed explosives can cause loss of life and severe damage to property. One recent example is the car bomb that killed eight people in Oslo on 22 July 2011. From the point of view of societal risk, it is important to optimize the design of protective structures relative to realistic loads from potential explosions. The decay of an idealized blast wave can in principle be estimated from empirical correlations. However, in order to account for the effect of complex boundary conditions it is necessary to adopt more sophisticated methods, such as computational fluid dynamics (CFD). In the present work, a series of urban blast scenarios have been simulated with the finite volume CFD tool FLACS-Blast. In the experiments, charges of 0.4 or 1.6 kg PETN were detonated in various positions within a geometry consisting of four 2.3 m cubical concrete blocks, representing buildings in an urban intersection at scale 1:5. In order to simulate the propagation of blast waves generated by condensed explosives, FLACS-Blast solves the Euler equation with a conservative shock-capturing scheme, the so-called flux-corrected transport (FCT) scheme. The paper is a continuation of previous work [1]. The adaptive mesh refinement (AMR) technique is employed in the CFD code FLACS in order to resolve blast waves with adequate accuracy at a reasonable computational cost. The paper discusses various aspects of the AMR technique applied to blast simulations, with focus on performance and accuracy.