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Preface

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Structural protection against man-made disasters has been a critical concern for civil engineers and researchers. Blast scenarios involving suitcase bombs or vehicle-borne improvised explosive devices (VBIED) not only endanger the personnel with direct blast overpressure and debris but also induce structural damage/collapse leading to massive casualty and economic loss. In recent years, a shift in terrorist modus operandi (MO) from VBIED to a penetrative ('rammed') attack is increasingly observed. These vehicle-borne threats are intended to induce the maximum damage and casualty by gaining close proximity to the targeted structures and/or personnel. Despite great effort has been made to explore the mitigation of blast/impact effects on structures, there are still problems that need to be solved. It is important for researchers and engineers in these fields to develop numerical techniques, analytical approaches and experimental works on the relevant protection technologies.

The timely dissemination of research findings in developing protection technologies will not only benefit the professional communities but also society as a whole for effective infrastructure protection. The following papers in this Special Issue provide timely dissemination of the research finding in the field of structural protection. The first paper studies the influence of elevated strain rate on the mechanical properties of hollow structural sections. These kinds of structural components are used increasingly more in modern constructions. Dynamic tensile tests have been performed, and dynamic yield stresses of the hollow structural component are obtained at strain rates from 0.1 to $18\,s^{-1}$, which encompasses and exceeds the range recorded during far-field blast arena testing. The second paper provides detailed numerical study on projectile impact on high strength concrete-like material in which the widely used concrete model (HJC model) has been carefully investigated and improved. In the third paper, the current maximum impact force models for the collision between a vehicle and a barrier are discussed and an assessment of the applicability of these models is discussed. The fourth and fifth research papers from the same research group address the damage of RC structures under projectile impact and explosive loads. To investigate the failure characteristics of the RC slab, in the fourth paper, the impact motion of the projectile, reaction force, and strain–time history on the back surface and reinforcing bars of the RC slab are measured. In the fifth paper, an evaluation method to assess the risk of a reinforced concrete structure subjected to an explosive load is established. The sixth paper reports a series of experiments that were carried out to investigate the response of quadrangular plates to buried encased charges with a view to simulate the detonation of landmines buried in sand and compared with different loading conditions. The plate deformation and impulse imparted onto the target plate are carefully investigated and compared.

Cellular material like metal foam is known as an energy absorptive material which has been used as a protective cladding on structures to enhance blast resistance of the protective structures; in the seventh paper, an analytical model is developed to investigate the protective effect of linear density foam on response of a structure under blast loading. In the last paper of this Special Issue, a new simplified model to analyse the penetration of a rigid projectile into a concrete thick medium is presented. The concrete medium is modelled by a set of discs, responding in the radial direction under plain strain conditions. The new model enables calculations of the projectile motion time history efficiently and accurately.

Note that many of the papers in this Special Issue are derived from presentations at the 4th International Conference of Protective Structures (ICPS4), held in Beijing, China, in October 2016. Several writers seek to use simplified analytical methods and experimental approaches, whereas others incorporate nonlinear and dynamic finite element programmes. All serve to encourage researchers to explore innovative approaches on investigation of protection technologies against impact and blast loading.

Structural protection against impact and blast loading is an emerging and evolving discipline. There is a significant need for research activities covering material/structural dynamic behaviour, material innovation, old model update and new model development. Our intention is that this Special Issue will serve as a bridge to link active researchers, academics, professional communities and policy makers around the world in promoting the development of protection technologies against impact and blast loading.

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