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SOLID AND STRUCTURAL RESPONSES TO EXTREME LOADING

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ABSTRACT

This minisymposium is concerned with computational methods for solids and structures subjected to extreme loads, such as high-speed impact and explosive detonation, which induce highly nonlinear material response, such as shock, large deformations, fracture and fragmentation. Application of computational methods to problems of extreme loading in various industries has been enabled in three dimensions at unprecedented length and time scales by advances in computing technology. Typical applications of these methods include the defense, construction, mining, space, counterterrorism and law-enforcement industries. The use of numerical simulation for weapon-structure interactions has seen significant growth in recent years, due to improved computational methods, the expense of testing, and the aforementioned advances in computing technology. Improvements in the structural-damage evaluation of protective structures, vehicles, and body armor rely more heavily on modeling impact, penetration, and the explosive effects of weapons. New isogeometric and meshfree methodologies enable engineers to analyze old problems more easily and accurately, while the use of air-blast, explosive-detonation, and other Eulerian codes also contributes to the analysis of weapon-structure interactions. In addition, the assessment of force protection and terrorist threats to government facilities and civilian infrastructure has seen greatly increased

utilization of computational mechanics for blast-structure modeling. This is particularly true for those structures, such as large buildings, dams, or bridges, for which full-scale testing of the threat is not feasible. Mining operations and construction procedures, such as excavation, demolition, and explosive anchor driving, can also utilize these computational tools. Modeling of impact has become increasingly important in aircraft and spacecraft design. These applications typically involve some of the most challenging aspects in structural and solid mechanics, such as nonlinear material behavior under large strains and/or high strain rates, failure and dynamic fracture, burning and detonation of energetic materials, phase change and transition, and high-velocity and high-frequency contact.

The purpose of this mini-symposium is to provide a forum for technical presentation and exchange, and to establish communication and collaboration between academic, government and industrial developers of computational-mechanics software for applications to extreme loading. Papers dealing with all aspects of extreme loading are welcome, including theoretical developments, coupling of multi-spectral physics, new higher-order, isogeometric, and meshfree discretizations, numerical algorithms, implementation and parallel computational issues, exploitation of GPU programming, constitutive modeling, experimental validation, and practical applications.