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COMPUTATIONAL MODELING OF EXTREME-LOADING EVENTS

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MINISYMPOSIUM

This minisymposium is focused on computational methods for solids and structures subjected to extreme loads, such as shock and high-speed impact. A broad area of contributions is sought to include numerical modeling of both the prediction of severe loads and subsequent dynamic response, which may include the coupling of multiple areas of computational mechanics. Typical contributions to this forum might come from defense, construction, petroleum, mining, space, or counterterrorist and law enforcement applications. The use of numerical simulation for weapon-structural interactions has seen significant growth in recent years, primarily due to increasing computational accuracy, improvements in computing hardware, and the greater expense of testing. The development of new technologies relies on modeling impact, penetration, and explosive effects for weapon effectiveness and structural-damage evaluation to vehicles, body armor, and protective structures. Recent Lagrangian higher-order finite element, isogeometric, and meshfree methodologies enable analysts to look at old problems more easily and in new light, while Eulerian and ALE approaches remain essential to the simulation of air blast and explosive detonation. New multiscale and machine-learning approaches for constitutive modeling can provide greater fidelity for complex material responses. In addition, assessment of force protection and terrorist threats to government facilities and civilian infrastructure now frequently incorporates computational mechanics for blast-structural modeling. This is particularly true for cases, such as large buildings, dams, or bridges, where full scale testing of a threat is not feasible, but it is also important for post-event structural-integrity assessments in standard construction. Oil, mining, and construction operations such as drilling, excavation, demolition, explosive anchor driving, and disaster-protection and recovery/damage assessment can also utilize such technologies, and the modeling of impact has become important in aircraft and spacecraft design. The nature of all these applications typically involves some of the most challenging aspects in structural mechanics: nonlinear material behavior under large strains and/or high strain rates; failure and dynamic fracture; initiation, burning, and detonation of energetic materials; phase change and transition; and high-velocity contact and friction.

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