ASYNCHRONOUS SIMULATION OF HIGH-EXPLOSIVE DETONATIONS

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The simulation of the dynamic response of materials under extreme loadings poses several technological challenges to current computational capabilities. Multimillon-element meshes provide highly spatially resolved solutions, which are still evolved in time by forward integration. In these situations we need to account for a variety of physical processes with inherently different time scales, which usually makes the whole discretization run at the pace of the fastest physical process and hinders the possibility of reaching meaningful simulation times. One clear example of this situation is the propagation of a detonation front in a solid.

In this talk we will describe the application of Asynchronous Variational Integrators (AVI) to the simulation of high-explosives interacting with largely deforming solids. In this context, we will review the properties and derivation of AVIs within the discrete mechanics framework, and show some examples in structural dynamics. We will also briefly discuss the shock-capturing scheme that enables the stable propagation of shocks in largely deforming elasto-plastic solids, and finally show the remarkable computational savings AVIs provides for the simulation of the propagation of a high-explosive detonation wave inside a metallic canister.