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**Hypervelocity impact and dynamic fragmentation of brittle materials**[1] VINAMRA AGRAWAL, Auburn Univ, ALEJANDRO ORTEGA, Jet Propulsion Laboratory, DANIEL MEIRON, California Institute of Technology —
The process of hypervelocity impact and dynamic fragmentation finds application in planetary formation, satellite design for micrometeorite impact damage mitigation, armor design and crater formations. In this work, we study high velocity impact induced dynamic fragmentation processes of brittle materials. We implement ideas of Continuum Damage Mechanics (CDM) to perform fragmentation simulations on brittle materials in various geometries. The damage formulation was implemented on an existing computational framework capable of adaptive mesh refinement that operates on an Eulerian grid, thereby avoiding problems associated with grid entanglement in large deformation processes. A damage sensitive equation of state is developed for hyperelastic materials that depends on a damage variable D, the volume fraction of micro-cracks in the brittle material. The evolution of D is governed by a modified, thermodynamically consistent Grady-Kipp model that evolves damage at points of tensile eigenvalue stresses. We simulate sphere-on-sphere and sphere-on-plate impact events with ductile and brittle materials and study the resulting damage propagation. We validate our calculations with existing literature and comment on energy dissipation and optimal design.

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