# An Accurate Meshless Approach For Dynamic Fragmentation

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**Abstract**

We focus in this paper on the use of a meshless numerical method called Smooth Particle Hydrodynamics (SPH), to solve fragmentation issues as Hyper Velocity Impact (HVI) or Warhead Fragmentation (WF). Contrary to classical grid-based methods, SPH does not need any opening criteria which makes it naturally well suited to handle material failure. Nevertheless, SPH schemes suffer from well-known instabilities questioning their accuracy and activating nonphysical processes as numerical fragmentation. Many stabilizing tools are available in the literature based for instance on dissipative terms, artificial repulsive forces, stress points or Particle Shifting Techniques (PST). However, they either raise conservation and consistency issues, or drastically increase the computation times. It limits then their effectiveness as well as their industrial application. To achieve robust and consistent stabilization, we use an alternative scheme called $\gamma$ -SPH-ALE. Based on the ALE framework, its governing equations include advective terms allowing an arbitrary description of motion. Through CFL-like conditions we ensure the scheme conservativity, robustness, stability and consistency. Besides, stability intervals on the scheme parameters determine entirely the stability field preventing any parameter tuning. Its implementation on several fragmentation cases reveals that $\gamma$ -SPH-ALE manages to reproduce particularly the strain localization in shear bands, a precursor to failure. By preventing spurious oscillations in elastic waves and correcting the so-called tensile instability, both stability and accuracy are increased with respect to classical approaches.

**Keywords:** Fragmentation, Meshless, Modeling

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