Baek, Jonghyuk; **Chen, Jiun-Shyan**; **Zhou, Guohua**; **Arnett, Kevin P.**; **Hillman, Michael C.**; **Hegemier, Gilbert**; **Hardesty, Scott**

A semi-Lagrangian reproducing kernel particle method with particle-based shock algorithm for explosive welding simulation. (English) Zbl 1467.74097

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Summary: The explosive welding process is an extreme-deformation problem that involves shock waves, large plastic deformation, and fragmentation around the collision point, which are extremely challenging features to model for the traditional mesh-based methods. In this work, a particle-based Godunov shock algorithm under a semi-Lagrangian reproducing kernel particle method (SL-RKPM) is introduced into the volumetric strain energy to accurately embed the key shock physics in the absence of a mesh or grid, which is shown to also ensure the conservation of linear momentum. For kernel stability, a deformation-dependent anisotropic kernel support update algorithm is proposed, which is shown to capture excessive plastic flow and material separation. A quasi-conforming nodal integration is adopted to avoid the need of updating conforming cells which is tedious in extreme deformations. It is shown that the proposed formulation effectively captures shocks, jet formation, and smooth-to-wavy interface morphology transition with good agreement with experimental results.

MSC:

74S99 Numerical and other methods in solid mechanics
74C99 Plastic materials, materials of stress-rate and internal-variable type
74J40 Shocks and related discontinuities in solid mechanics

Cited in **4** Documents

Keywords:

reproducing kernel particle method; kernel stability; Godunov shock algorithm; nodal integration; explosive welding; extreme large plastic deformation

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