A Smoothed Implicit Gradient Reproducing Kernel Particle Method for Extreme Event Modelling

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ABSTRACT

High strain rate events such as projectile penetration and blast often result in fragmentation, complex contact conditions, and severe material damage. The Reproducing Kernel Particle Method (RKPM) relies on nodal integration to yield a pure point-based method for effective simulation of these events, however stability of nodal integration is difficult to achieve without upsetting computational efficiency or introducing user-tuneable parameters. In this work, a naturally stabilized nodal integration [1] method is introduced under a strain-smoothing framework for extreme event simulation. Taylor expansion of nodal strains in conjunction with implicit gradients yields high computational efficiency, with stabilization constants naturally arising as moments of inertia of nodal domains. The method is cast under a strain smoothing framework [2] to achieve additional stability in extreme event modelling, with the benefit of further enhancing computational efficiency. Simulation of blast and penetration events will be presented to demonstrate the effectiveness of the proposed method.

REFERENCES

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