LS-DYNA® Smoothed Particle Galerkin (SPG) Method with Strain Gradient Stabilization and Thermal Effects

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Abstract

The Smoothed Particle Galerkin (SPG) method in gradient form is presented and implemented in LS-DYNA for large inelastic deformation and material failure analyses from low to moderated high speed applications. The new formulation is established following a meshfree Galerkin approach for a solving of partial differential equation in solid mechanics problem and a Strain Gradient Stabilization (SGS) scheme is adopted in linear and nonlinear applications [2-4] for the elimination of zero-energy modes and the enhancement of coercivity. The SPG method in the gradient form recovers the locality of the solution that lacks in the integral form [1]. The discretized system of equation is consistently derived within the penalized meshfree Galerkin variational framework [2] and integrated using a direct nodal integration scheme. The SPG method is also applied to thermal analysis. Several numerical benchmarks and industrial applications are provided in this presentation to demonstrate the effectiveness and accuracy of the new method.

Kerwords: Meshfree method, nodal integration, stabilization, nonlinear, thermal analysis

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