# Stable Node-Based Smoothed Finite Element Method

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**Abstract**

A stable node-based smoothed finite element method (SNS-FEM) without introducing of any uncertain parameter is proposed to cure the temporal instability of the node-based smoothed finite element method (NS-FEM) in time-dependent problems. In present method, the numerical integration domains are approximately circular or spherical regions of the node-based smoothing domains generated by NS-FEM. Four or six supplementary integration points, which are symmetrically located at the crossover points of the region and the coordinate axis, are employed for each node to form the stabilization items associated with the variance of the corresponding field variable gradient. Through this operation, SNS-FEM not only can greatly preserve the superiority of NS-FEM: high convergence and resistance to mesh distortion, but also performs better in effectiveness and efficiency than the finite element method (FEM). On this basis, SNS-FEM has been successfully applied to heat transfer problems, acoustic problems, stochastic problems, electromagnetic forming problems and large deformation problems in recent years, which also illustrates the feasibility and great potential of SNS-FEM in practical engineering.

**Keywords:** Numerical methods; Stable nodal integration; Smoothed finite element; large deformation