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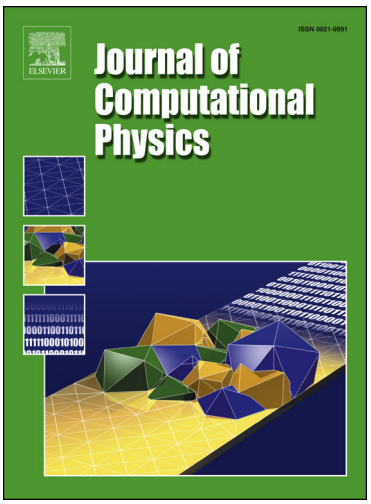

A stable nodal integration method for static and quasi-static electromagnetic field computation

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A stable nodal integration method for static and quasi-static electromagnetic field computation

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Abstract

A stable nodal integration method (SNIM) is presented to solve static and quasi-static electromagnetic problems in this paper. The analysis domain is firstly discretized into a set of triangular or tetrahedral elements, and linear interpolation is adopted within each element. A weakened weak formulation based on the nodes is further considered, framing the so-called node-based smoothing domains. Equivalent smoothing domains are then acquired as circular or spherical regions, where the gradient of shape function is expanded as the first order Taylor form. Subsequently, four or six temporary integration points on the region are picked to obtain items of the stiffness matrix and the external load vector. By simplifying the equations, the stiffness matrix can be received in quite concise form with one point integration and stabilization terms, which are calculated on original node-based smoothing domains. The implementation of SNIM on electromagnetic problems is thus realized. The proposed formulation is validated against both analytical solutions and traditional methods, and its effectiveness and potentialities can be well represented and clarified by numerical examples.

***Key words*:** Stable nodal integration method; Computational electromagnetics; Node-based smoothed finite element method; Linear triangular or tetrahedral mesh.

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