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Linearly Conforming Variable Node Elements and Their Applications to Multiscale Problems

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Summary

In this paper, two and three dimensional linear conforming variable-finite elements including solid and shell elements, are presented with the aid of stabilized conforming nodal integration for multiscale problems. These elements meet the desirable properties of an interpolation such as the Kronecker delta condition, the partition of unity condition and positiveness of interpolation function. The necessary condition of linear exactness is fully relaxed by employing stabilized conforming nodal integration, which renders us to meet the linear exactness in a straightforward manner. This novel element description extends conventional finite elements space to ration type function space, and also give the flexibility on the number of nodes of element which are fixed in the conventional finite elements.

Several examples in relation to multiscale problems such as modeling of composite material, global/local analysis and contact mechanics are provided to show the convergence and the accuracy of the proposed elements

keywords: variable-node finite elements, stabilized conforming nodal integration, composite material, global/local analysis, contact mechanics

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