Enrichment of linear hexahedral finite elements using rotations of a virtual space fiber

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Authors: Ayad R, Zouari W, Meftah K, Ben Zineb T, Benjeddou A.

Abstract

The present paper deals with the enrichment of 3D low-order finite elements. The used concept is based on the idea that a 3D virtual fiber, after a spatial rotation, introduces an enhancement of the strain field tensor approximation. A consistent stiffness matrix is obtained, allowing a better approximation of the actual solution compared with that resulting from low-order finite elements. Implemented for two eight-node hexahedral elements, the performance of the space fiber rotation concept is assessed by running some classical beam, plate, and shell benchmarks, and the obtained results are compared especially with those given by linear eight-node and quadratic 20-node hexahedral elements. In particular, it is shown that the developed elements accuracy is significantly superior to that of the classical eight-node hexahedral element and close to that of the classical 20-node hexahedral element.

Keywords : 3D finite element;space fiber rotation;enrichment concepts.

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