

A three-dimensional finite element method with arbitrary polyhedral elements by trimming hexahedral elements

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Intending In this study, arbitrary trimmed elements are developed by using moving least square approximations with harmonic weight functions based on Wachspress coordinates. A simple block with hexahedral finite elements is cut by surfaces of computational domains, and the trimmed elements are then constructed along boundaries. The shape functions of the trimmed hexahedral or polyhedral elements satisfy the continuity, the compatibility and the completeness conditions for a convergence of solutions and seamless connection of trimmed elements and conventional finite elements. In addition, a consistent numerical integration is presented by taking triangulations of polyhedral regions as integration domains with no discontinuity. Numerical examples show the effectiveness and efficiency of the present method for problems with arbitrary shaped domains.

Keywords: Polyhedral elements; Trimmed elements; Moving least square approximations; Wachspress coordinates