Chi, Baotao; Guo, Qianjian; Zhang, Liguo; Yuan, Wei; Zhang, Yaoming
An adaptive binary-tree element subdivision method for evaluation of volume integrals with continuous or discontinuous kernels. (English) [Zbl 07440014]

Summary: This study presents an adaptive binary-tree element subdivision method (BTSM) to evaluate the volume integrals with continuous or discontinuous kernels to facilitate automatic and high-quality patch generation. The BTSM, an essential technique implemented in boundary integral formulations, was proposed to guarantee a successful well-shaped element subdivision under any circumstances, improve integration accuracy, and reduce the sensitivity of integration calculation to element shape. In addition, the BTSM can be adopted to evaluate singular integrals and nearly singular integrals due to its high availability and reliability for arbitrary shape volume element subdivision. If the kernel function is discontinuous, a minority of sub-elements around the source or breakpoints need to be regenerated. The geometry-adaptive projection cavity construction algorithm and several comprehensive cavity projection techniques are implemented for facilitating patch generation. The improved cavity projection algorithms can unify the element segmentation to evaluate singular integrals and nearly singular integrals simultaneously. Numerical results demonstrate the efficiency and accuracy of the proposed method.

MSC:
65-XX Numerical analysis
76-XX Fluid mechanics

Keywords:
boundary element method; singular volume integrals; nearly singular volume integrals; continuous or discontinuous kernels

Full Text: DOI

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