On implementation of the boundary integral equation method

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Abstract

The Boundary Integral Equation (BIE) provides high accuracy without continuity requirements for interpolation functions and computational grid. The Boundary Face Method (BFM), which combines the BIE with Computer Graphics and is a truly isogeometric analysis method, can perform CAE analysis on a CAD model directly and realize a truly seamless integration of CAD and CAE. The Double Layer Interpolation Method, which combines the traditional element interpolation and meshless approximation, inheriting advantages and avoiding disadvantages from both, will completely liberate CAE analysis from the cage of meshing. The simplified binary tree meshing method can realize the entirely automatic meshing into discontinuous grids for arbitrarily complex structures, not even need to fix the geometrically 'dirty' part of their CAD models. Therefore, the coupled Double Layer Interpolation Boundary Face Method is able to perform automatic analysis with high accuracy for complex structures, providing a shortcut for domestic CAE software to catch up with the international advanced levels. The research content includes: the BFM coupling with the double layer interpolation; Automatic grid generation method based on binary tree; Parallel Fast algorithms based on CPU/GPU. The ultimate goal of our research is to develop a novel set of software that can perform automatic CAE analyses making direct use of CAD models of real industrial product structures, and thus able to solve large-scale engineering problems with arbitrarily complex geometry and material composition.