A Couple Cell-/Face-based Smoothed Finite Element Method for Fluid-structure

Problems

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The cell-based smoothed finite element method using three-node Mindlin plate element (CS-FEM-MIN3) recently has shown some excellent features in solving solid mechanics problems. In this paper, the CS-FEM-MIN3 is firstly combined with the face-based smoothed finite element method (FS-FEM) to analyze acoustic fluid-structure interaction problems. Three-node triangular elements and four-node tetrahedral elements are applied to discretize the two-dimensional and three-dimensional domains, respectively. The gradient field of the problem is smoothed using gradient smoothing operations over the cell-based and face-based smoothing domains in two-dimensional plate and three-dimensional fluid, respectively. This gradient smoothing technique can provide proper softening effect to the "overly-stiff" FEM model, and thus improve significantly the solution of coupled systems. Some numerical examples are presented to demonstrate the effectiveness of the coupled CS-/FS-FEM for structural-acoustic problems.

Keywords: Acoustic fluid-structure, Cell-based finite element method (CS-FEM), Three-node

Mindlin plate element (MIN3), Face-based finite element method (FS-FEM)