An edge-based smoothed finite element method (ES-FEM) for electromagnetic field computation

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Abstract

In this paper, an edge-based smoothed finite element method (ES-FEM) is formulated for electromagnetic field computations. The problem domain is discretized using smoothing domains constructed based on edges. The smoothed Galerkin weak form for electromagnetic field is constructed. This paper presents the ES-FEM to nonlinear electromagnetic and eddy current problems to observe its properties using linear tetrahedral elements, in which relatively poor result is carried with standard finite element method (FEM). Numerical examples demonstrate that results obtained by the present ES-FEM are much more accurate than ones by standard FEM, and agree well with the experimental ones, which possesses potentials in the successful applications of electromagnetic problems.

Keywords: Edge-based smoothed finite element method (ES-FEM); Computational electromagnetic; Nonlinear magnetostatic; Transient eddy current.