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Isogeometric Symmetric Galerkin Boundary Element Method for Three-dimensional Elasticity Problems

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Abstract

The isogeometric analysis (IGA) is applied for the weakly singular symmetric Galerkin boundary element method (SGBEM) to analyse linear elastostatics problems in three-dimensional domains. The background of the proposed method is to use non-uniform rational B-splines (NURBS) as the basis functions for the approximation of both geometry and field variables (i.e. displacement and traction) of the governing integral equations. Same as weakly singular SGBEM, the basic ingredient of the method is a pair of weakly singular weak-form integral equations for the displacement and traction on the boundary of the domain. These integral equations are solved approximately using standard Galerkin approximation. In addition to the advantages that IGA owned, the proposed method exploits the common boundary representation of CAD model and boundary element method. Various numerical examples of both simple and complex geometries are examined to validate the accuracy and efficiency of the proposed method. Through the numerical examples, it is observed that the IGA-SGBEM produces highly accurate results.

Keywords: Isogeometric Analysis, Symmetric Galerkin BEM, Three-dimensional, IGA-SGBEM, Weakly singular, CAD/CAE integration

1. Introduction

A smooth and efficient connection between computer aided design (CAD) and computer aided engineering (CAE) is always a target in product lifecycle management. This can be achieved by

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