The International Conference on Computational Methods
NOVEMBER 15-17, 2010, Zhangjiajie, China

Integration of Subdivision Methods and Boundary Element Analysis

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Abstract

This work presents a unified framework for the boundary element analysis (BEA) and CAD modeling based on the subdivision method. In the traditional BEA, a geometric model is firstly built with a CAD package, the geometric model is then converted into a discrete model using a meshing tool. The information of geometry for BEA is only derived from mesh elements. Therefore, geometric errors are introduced and the link between BEA model and CAD system is often unavailable. Moreover, this conversion for complex geometries is often time-consuming and even prone to errors. To cope with the problems, we provide a new framework based on the subdivision method to implement BEA, in which both BEA and CAD models are represented identically with the same subdivision model. In this framework, the mesh for BEA is directly from the subdivision elements in subdivision model. Hence, the mesh generation is avoided and it is no longer necessary to build the complicated link between CAD system and BEA model. In this paper, the loop subdivision technique is employed to construct subdivision models in the unified framework. Numerical examples for 3D potential problems have demonstrated the integration of BEA and the subdivision method is successful and the integration framework is much more efficient than the traditional BEA in terms of mesh generation and computational accuracy.

Keywords: subdivision method, boundary element analysis, CAD modeling, loop subdivision