ABSTRACT

The Iterative Limit Analysis of Structures Using A Scaled Boundary Finite Element Method

The determination of the maximum load capacity such that the structure can sustain provides the safety assessment and design of structures involved. Elastic Compensation Method (ECM) is a robust numerical method approximating the limit load utilizing limit load theorems and a series of iterative linear elastic analyses. Implementing linear elastic analysis using finite element method is not only simple and efficient for complicated structures such as cracked structures, thin plates, and frame structures, but also practical for the use by engineers. However, the conventional finite element models often encounter some numerical problems related to an undesired characteristic of mesh-based methods. For instance, the solutions are highly sensitive to the geometry of the original mesh, particularly in the region where the stress singularities occur. Scaled Boundary Finite Element Method (SBFEM) is a relatively new method combining the advantages of finite element method and boundary element method. Reduction of spatial dimension by one, no need of fundamental solution, and the ability of handling the hanging nodes within the domain form the advantages of SBFEM. Specifically, defining the complex boundaries without excessive refinements through implementing the scaled boundary polygons which can have any number of edges and be of higher orders is one of the significant features of SBFEM. Therefore, SBFEM can offer too many advantages for linear elastic analysis which is absolutely suitable for iterative linear procedures. The current study is investigating the development of the limit analysis of structures using ECM and SBFEM. The obtained results demonstrate that SBFEM can be implemented as a robust and efficient tool for limit analysis when ECM is employed.