Adaptive Mesh Generation in Large Deformation Analysis of Shell Structures with Advancing Front Method

Abstract

Finite element method is a popular and powerful numerical analysis technique used in most of engineering fields. One of the biggest obstacles to the proper use of the technique is the discretization of the general geometry into a valid finite element mesh. The mesh generation is tedious and error prone. In addition, the cost and accuracy of the numerical analysis is directly tied to the quality of the mesh.

Recently, studies on the adaptive mesh generation has been actively implemented by many researchers to guarantee a prescribed accuracy while maintaining the solution efficiency without user intervention throughout the analysis. Nowadays, there are a lot of studies on the adaptive mesh generation in the 2-D plane structures but rare in 3-D shell structures.

Effective methods leading to adaptive mesh generation to geometrically non-linear shell-type problems are studied in this paper. In particular, h-adaptive mesh refinement based on a posteriori error estimation, remeshing on each load step throughout the process of a non-linear analysis are of primary interest here. For the analysis of the structure that shows critical non-linear behavior, arc length method was adopted and it was intended to confirm that good convergence and stable searching for equilibrium path are possible. Paving method as a kind of advancing front method was adopted as mesh generator in this paper. It was known that adaptive mesh generation using contours has advantage in adaptive analysis to non-linear shell structures.

key words : adaptive mesh generation, geometrically non-linear shell structure, contour, a posteriori error estimation, remeshing, paving method

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