Adaptive meshing in two-dimensional beam elements based on the absolute nodal coordinate formulation

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Abstract

The efficiency of finite element analysis relies not only on the correctly formulated finite elements and robust numerical solution but also on the reliable mesh creation and suitable mesh refinement. Different methods of mesh refinements for the accuracy enhancement of finite element solution at certain key locations have been studied in the finite element literature [1]. The absolute nodal coordinate formulation (ANCF) is a finite element based method developed in the multibody dynamics community to analyze structures under going large rotations and displacements. This method was originally proposed by Ahmed Shabana 1996 [2]. Substantial amount of research efforts have been directed towards creating a family of ANCF elements and applying these elements in various structure analyses [3]. On the other hand, few studies have been conducted on the meshing in the absolute nodal coordinate formulation. Yan et al. studied the effects of non-uniform mesh and distortion effects in a large deformation cantilever modeled with ANCF shell elements [4]. Hyldahl et al. recently studied the effects of element distortions with thin ANCF plate elements [5]. Valkeapää et al. conducted research on two different p-refinement strategies with two-dimensional Euler–Bernoulli ACNF beam elements [6].

The objective of this study is to analyze different adaptive meshing strategies for two-dimensional Euler–Bernoulli beam elements based on the absolute nodal coordinate formulation. More specifically, in this study investigation of goal-orientated and residual error based mesh refinement strategies is conducted.

References

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