English summary

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Error analysis of computational methods for plate structures and adaptive finite element methods

Jarkko Niiranen

Summary. This study gives an overview of the fundamental principles of computational analysis for plate structures. The paper deals with general error components of computational methods, asymptotic analysis of the most common plate models, mathematical error analysis of finite element methods and adaptive finite elements. Basic results of finite element error analysis and adaptive remeshing are illustrated by numerical examples as well.

Key words: modeling error, discretization error, finite element method, error analysis, plate structures, adaptive remeshing

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Basic principles and examples for finite element analysis of plate structures

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Summary. This paper considers finite element analysis and applications of simple plate structures. The aim of the study is to present a series of test cases demonstrating the effect of geometry, boundary conditions and element type to the accuracy of finite element solutions. In addition, the basics of Kirchhoff-Love and Reissner-Mindlin plate models and finite elements as well as the corresponding features of the finite element software Abaqus are recalled.

Key words: finite element method, FEM, plate structures, computational accuracy, Abaqus software

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Adaptive finite element mesh refinements in plate structure analysis

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Summary. This paper deals with applications of adaptive mesh refinement methods of the finite element sofware Abaqus for plate structure analysis. The focus of the study is in the comparison of results obtained by adaptively and uniformly refined meshes. In particular, the accuracy of the results with respect to the number of degrees of freedom is the main interest. Deformation energy, maximum deflection and maximum von Mises stress are used as reference quantities for comparisons. The eight test cases studied include various types of geometries, boundary conditions and loadings as well as different values for thickness and stiffness parameters. Hence, representatives for different types of stress fields are present. According to the results, the benefit of adaptive mesh refinements is related to the problem type factors listed above and the reference quantity used as well as the error indicator and the refinement method applied.

Key words: finite element method, FEM, adaptive mesh refinements, error indicators, plate structures, Abaqus software