VIII International Conference on Computational Plasticity
COMPLAS VIII
E. Oñate and D.R.J. Owen (Eds)

ON THEORETICAL FORMULATION AND FINITE ELEMENT IMPLEMENTATION OF 3D-SHELL MODEL

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Key words: 3D Shell model, Constitutive Relations.

Summary. *Behavior of a shell-like structure under static and/or dynamic loading can be modelled with a higher-order shell model, further called a 3D-shell model. The model of this kind treats a shell geometry form the point of view of a two-dimensional body and the shell geometry can still be described in a conventional way, by its middle surface and by shell director field. However, the model builds the stress and the strain state in a shell as fully three-dimensional ones, which requires no special treatment for adapting different constitutive models to shells. As shown in [1] and [2], there are several possibilities to construct one such shell model.*

In this work, two different studies, related to 3D-shell models, are performed. The first one tries to give the answer to the following two questions: "How accurate are predictions of three-dimensional stresses in shells obtained by using 3D-shell models?", and "What kind of differences in the three-dimensional stress prediction one may expect by using different 3D-shell models derived in [1] and [2]?". To get a partial answer to those two questions, we compare analytical solutions for stresses (for several linear and non-linear examples) with the stresses predicted by different 3D-shell models. The second study is oriented towards the model adaptivity of plate and shell structures. By setting up a hierarchy of plate models (Kirchhoff model, Reissner-Mindlin model and higher-order 3D-shell model) and corresponding family of finite element formulations, we seek to define a natural model error estimation criteria. Several numerical examples will be presented in order to illustrate the performance of the proposed methodologies. The examples treat both linear and nonlinear problems.

REFERENCES

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