11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

Influence of the GBT deformation modes for a rack section in linear and linear buckling analysis

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Key Words: *GBT, Rack upright, Finite element analysis.*

The Generalised Beam Theory (GBT) allows the analysis of thin-walled sections taking into account several effects that the classical beam elements cannot handle, such as distortion of the cross-section. In recent years, the GBT has been improved in order to solve more complex analysis (linear, nonlinear, different type of cross-sections, etc).

This paper presents the analysis of rack uprights by using a GBT beam element. First of all, the influence of the different type of deformation modes, -conventional, natural shear, transverse extension and local shear modes-, for a rack column under pure compression load in a linear buckling analysis, is studied. After that, the study has been extended to any type of applied load for linear and linear buckling analysis. The results obtained through the GBT formulation have been compared with finite element analysis with shell elements in ANSYS (Fig 1, 2).

The main goal of this paper is to present a basic guideline for the selection of the principal deformation modes involved in the rack upright analysis depending on the applied load and to study the influence of the GBT beam element discretisation.

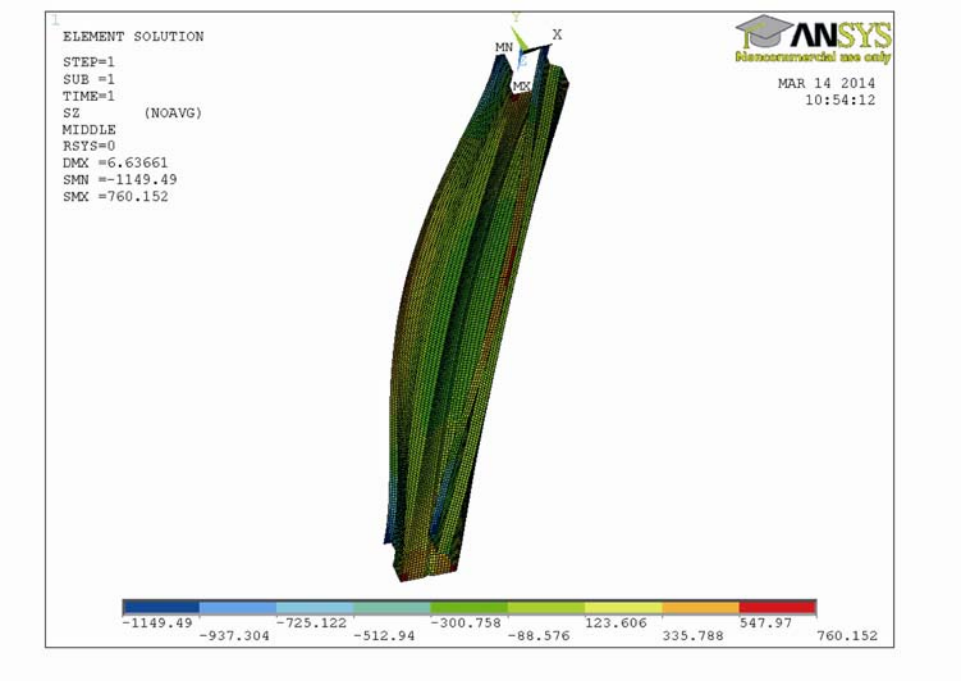

Figure 1 – Analysis of a rack upright using Shell elements in ANSYS (Membrane longitudinal stress)

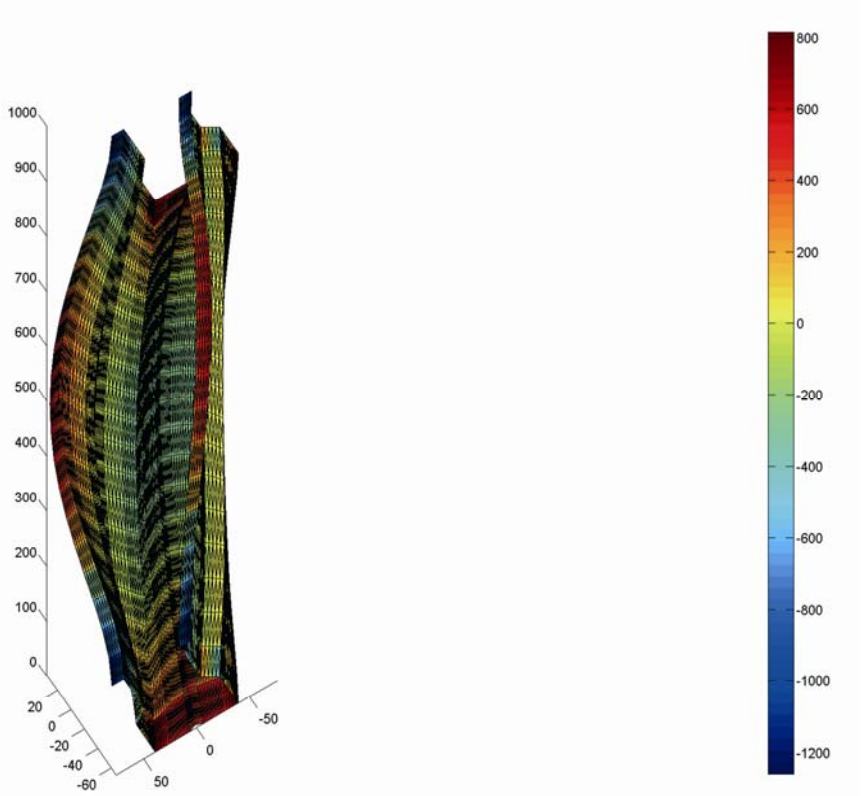

Figure 2 – Analysis of a rack upright using GBT (Membrane longitudinal stress)