A 1D model for the nonlinear analysis of TWBs

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In a key paper [1] W.T. Koiter proposed a nonlinear theory of shells that, although disregarded for long time, has been reconsidered in recents times.

In fact, due also to the works of Ciarlet [2], as recorded by D. J. Steigman [3], it has been recognized to furnish *the best all-around theory, despite the fact that it has not been obtained either as a gamma limit or an asymptotic limit of the three-dimensional theory.*

The aim of this paper is to exploit that theory in order to obtain a 1D model apt to describe the nonlinear behaviour of slender plates assembled to form Thin Walled Beams.

The kinematics of the model obtained strongly depends on the assumptions made on the plates' behaviour. As a first step, the case in which the plate sections remain undeformed, is considered.

Moreover, removing this constraint by considering additional degrees of freedom for the plates' motion, more interesting mechanical phenomena can be captured as, e.g., the influence of the in plane deformation of TWBs on its nonlinear behaviour.

Some sample cases are then analyzed using the proposed model. The results are compared with those obtained by commercial software.

Finally a discussion on the strengths and weaknesses of the theory proposed, is given.

REFERENCES

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