

KOITER ASYMPTOTIC ANALYSIS IN TECHNICAL APPLICATIONS

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Key words: *Koiter asymptotic approach, instability problems, thin walled structures, geometrically nonlinear analysis, corotational formulation, mixed finite element.*

During the years, many researchers tried to make operative the asymptotic analysis initially proposed by Koiter [1] from numerical point of view. The method is considered very attractive for its advantages with respect to path-following approach. Mainly, these consist in an accurate post-buckling analysis, with low computational cost, specially in the case of modal interaction and in an efficient imperfection sensitivity analysis. The main difficulties arise in the availability of geometrically coherent (almost until fourth order) structural model and in an accurate evaluation of their high order energy variations.

The use of corotational formulation, decomposing the geometrical nonlinearity from the elastic response, within a mixed formulation, allows to have a general, efficient and robust finite element implementation of Koiter analysis [2, 3]. Our more recent technology [4, 5], in terms of numerical implementation, is discussed and extended to a large scale analysis of structures of technical interest. The academic context in which Koiter approach is often traditionally confined are overcome and the accuracy and reliability of the method are shown in real technical contexts.

REFERENCES

- [1] W.T. Koiter. 'On the stability of elastic equilibrium'. Thesis, Delft, 1945. English transl. NASA TT-F10, 883 (1967) and AFFDL\TR70-25 (1970).
- [2] Garcea G, Madeo A, Casciaro R. The implicit corotational method and its use in the derivation of nonlinear structural models for beams and plates. *Journal of Mechanics Material and Structures*; Vol. **7** (6) 509–538, 2012.

- [3] Garcea G, Madeo A, Casciaro R. Nonlinear FEM analysis for beams and plate assemblages based on the implicit corotational method. *Journal of Mechanics Material and Structures*; Vol. **7 (6)** 539–574, 2012.
- [4] G. Garcea, A. Madeo, G. Zagari, R. Casciaro. Asymptotic post-buckling FEM analysis using corotational formulation. *International Journal for Solids and Structures*, Vol. **46**, 377–397, 2009.
- [5] G. Zagari, A. Madeo, R. Casciaro, S. de Miranda, F. Ubertini. Koiter analysis of folded structures using a corotational approach. *International Journal for Solids and Structures*, Vol. **50 (1)**, 755–765, 2013.