Minera Rebulla, S., Patni, M., Carrera, E., Weaver, P., & Pirrera, A. (2017). Linearized buckling analysis of thin-walled structures using detailed three-dimensional stress fields. In *ICCS20 - 20th International Conference on Composite Structures* [407] (Structural and Computational Mechanics Book Series). Società Editrice Esculapio. https://doi.org/10.15651/978-88-938-5041-4

ICCS20
20th International Conference on Composite Structures
4-7 September 2017
Paris, France

Linearized buckling analysis of thin-walled structures using detailed three-dimensional stress fields.

S. Minera[1,*], M. Patni[1], E. Carrera[2], P.M. Weaver[1,3], and A. Pirrera[1]

[1] Bristol Composites Institute (ACCIS), Department of Aerospace Engineering, University of Bristol, Queen's Building, University Walk, Bristol BS8 1TR, UK.
[2] Department of Mechanical and Aerospace Engineering, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129, Torino, Italy.
[3] Bernal Institute, School of Engineering, University of Limerick, Castletroy, Ireland.
[*] Corresponding author:sergio.minera@bristol.ac.uk

The buckling and post-buckling behaviour of thin-walled structures can be sensitive to imperfections. Trying to strike a good compromise between accuracy and computational efficiency, critical buckling loads are usually calculated with approximated stress fields derived from plate- or shell-like models. It is hypothesised that these simplifications, and the errors that they introduce, may lead to inaccuracies in the assessment of a structures imperfection sensitivity. In this work, utilising accurate three-dimensional stress fields, we perform linearized buckling analyses of beam-like structures with generic cross section. Our objective is to assess whether common simplifications influence the prediction and mechanisms underlying a structures buckling loads and modes. To this end, finite elements are the traditional method of choice. However, the estimation of accurate, three-dimensional stress fields in thin-walled structures is impractical, because it requires fine meshes, a large number of degrees of freedom, and, consequently, long, computationally expensive calculations. To overcome this disadvantage, a new methodology, based on the Unified Formulation, is introduced. Our approach allows for speedy analyses, employing only a fraction of the degrees of freedom required in traditional finite elements for converged results. Numerical examples are presented with different structures, boundary conditions and loads.