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Generalised Beam Theory Formulation to Analyse the Post-Buckling Behaviour of Orthotropic Laminated Plate Thin-Walled Members

Nuno Silvestre, **Dinar Camotim**

Civil Eng. Dept. – ICIST/IST – TU Lisbon, Lisboa, Portugal

This paper presents the derivation and illustrates the application of a non-linear orthotropic GBT formulation, which is intended to perform post-buckling analyses of laminated plate FRP open-section thin-walled members. Different types of loading and end support conditions can be dealt with and the theory can handle the presence of arbitrary initial geometrical imperfections. One is able to determine “exact” and “approximate” (only a few modes) post-buckling equilibrium paths and the evolution, along those paths, of (i) displacements and stresses and, using the GBT unique mode decomposition feature, also of (ii) the deformation mode participation in the member deformed configuration. To validate and illustrate the application and capabilities of the formulated GBT, numerical results, concerning the post-buckling behaviour of laminated plate FRP lipped channel members exhibiting different orthotropic behaviours, are presented and discussed. Some of them are compared with values obtained from finite element analyses, performed in the code ABAQUS and adopting shell element meshes to discretise the member.

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