CERIS : Civil Engineering Research and Innovation for Sustainability

GBT analysis of the linear and buckling behavior of thin-walled conical shells

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Summary

The study focuses on the buckling behavior of circular cylindrical and conical shells. A Generalized Beam Theory (GBT) based Finite Element (FE) formulation was developed to handle 1st order and linear buckling analyses with various classic bar boundary conditions and various loading (axial compression, torsion and bending).

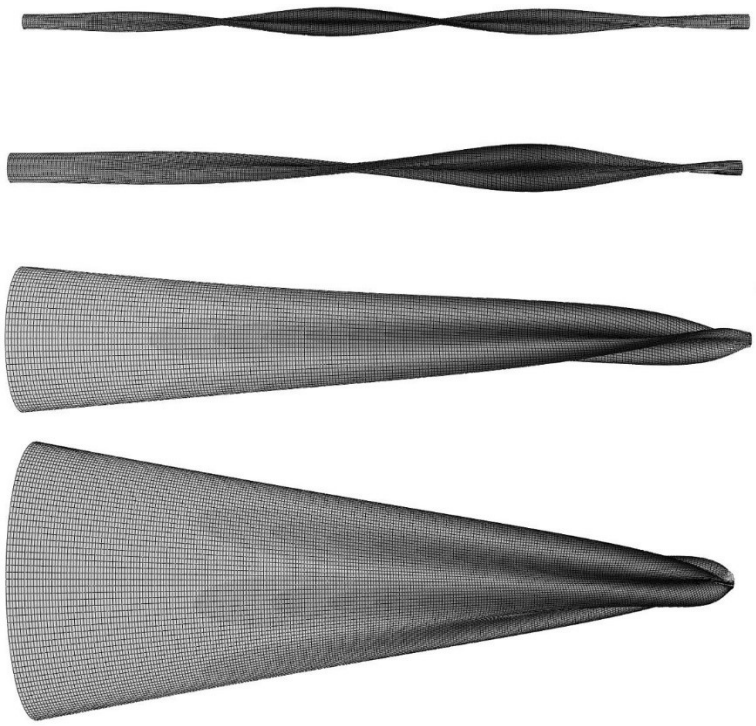
To correctly evaluate the buckling behavior of cylindrical and conical shells it is necessary to understand the buckling process of this type of structures and the GBT adapted for them. Therefore, the first step of the research was a literature review and the study of the GBT formulations for thin-walled bars with prismatic cross-section developed by Schardt, of the GBT extension to thin-walled bars with circular cross section and with variable cross-section, and of the GBT-based FE formulations, developed until the present work only for prismatic members.

The next step was the adaptation of the GBT-based FE formulation to circular cylindrical and conical shells for the following load cases: axial compression, torsion and bending. The analyses were performed using Matlab.

The final step was the validation of the proposed formulations, where several Abaqus models were created and analyzed using S4 rectangular shell finite elements. The validation of the proposed formulation consisted in a comparison with the results determined by shell finite element analyses (SFEA) in Abaqus. The proposed formulation was considered valid.

Keywords

N/A



Critical buckling modes of conical shells under torsion.