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COMPUTATIONAL BUCKLING ANALYSIS OF THIN-WALLED STRUCTURES

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ABSTRACT

Thin walled structures, including plates and shells, are widely used in aeronautical, aerospace, civil, mechanical, industrial and automotive engineering. Typical applications in industrial processes include containment structures for the chemical industries, tanks and silos for storage of granular and fluid products, shell structures employed as architectural roof systems, metal sheets employed in the construction of industrial buildings, parts of car bodies, shells in aerospace and aeronautical vehicles, and many others. More recently, thin walled structures have become of great interest in applications at the nanoscale (nanotubes) and in bioengineering.

Engineers design structures with a well-defined shape thoughtfully chosen to fulfil some purpose. But under certain critical conditions the structure cannot withstand further load with the same shape and changes its shape in a slow or sometimes in a violent way. Because those are structures designed to resist loads with a very thin wall, then they are prone to failure by buckling under various load systems. Buckling belongs to a class of problems in mechanics for which some form of singularity occurs in an equilibrium situation.

There are several levels of theories involved in the computational buckling analysis of thin-walled structures: First, there are predictive theories at the level of computations, in which results are obtained; Second, explanatory theories, in which results make sense; and third, classification theories, in which possible solutions are classified. Computational mechanics tends to be associated only to predictive theories, but explanations and classifications are also essential components in any adequate analysis.

This Mini Symposium attempts to embrace all problems involved in the computational buckling analysis of thin-walled structures, including the development of elements with nonlinear capabilities as to address buckling problems, algorithms for tracing nonlinear equilibrium paths, understanding of buckling and post-buckling behavior with the support of computational mechanics, and the application of existing software to the solution of industrial needs. Static as well as dynamic buckling studies are welcomed.