17 de Junho | 14h00 – 15h00
Faculdade de Ciências e Tecnologia
Universidade Nova de Lisboa
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palestras de ENGENHARIA CIVIL na NOVA

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Part 1. A numerical formulation of Koiter's theory for buckling and initial post-buckling analysis of shells and thin-walled structures

Thin-walled beams and shells are commonly used as primary components in structural engineering, due to their high specific strength and stiffness, which allow weight and material economy. Their load-carrying capabilities are often determined by buckling, which often occurs for loads much lower than the failure loads of materials.

As a consequence of modal buckling interaction, these structures may exhibit a very unstable post-buckling behavior and may be highly sensitive to initial geometrical imperfections. In light of this, an imperfection sensitivity analysis becomes mandatory. Standard path-following approaches, aimed at recovering the equilibrium path for a single loading case and assigned imperfections, are not suitable for this purpose because of the high computational burden of a single run.

In this lecture the principal ingredients required to implement the Koiter formulation by means of a finite element numerical method are illustrated and discussed. The Koiter method recovers the equilibrium path of an elastic structure using a reduced order model, obtained by means of a quadratic asymptotic expansion of the finite element model. Its main feature is the possibility of efficiently performing sensitivity analysis by including *a posteriori* the effects of the imperfections in the reduced nonlinear equations. In this way, a very fast imperfection sensitivity analysis, which can consider a very large number of imperfections in a reasonable computational time, is obtained. The efficiency of the method makes it possible also a stochastic optimization of the post-buckling behavior.

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