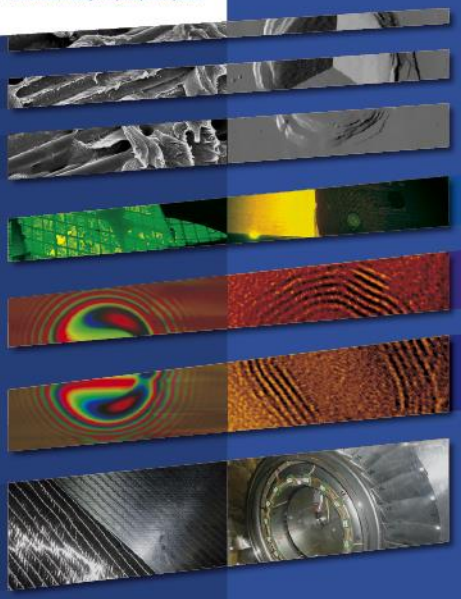

Café Scientifique invité

ECL, amphi 203

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Wave propagation in Post-Buckled Structures

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Spatially-localized solutions in solid mechanics characterize disparate phenomena such as plastic necking, brittle fracture, buckling of shells, instabilities of twisted rods, and the propagation of solitary waves [1]. While sharp discontinuities are possible, the present talk will focus on smooth local deformations in post-buckled structures. Localized solutions are possible in linear systems with imperfections (for example vibrations of mistuned turbine blades), but localization can also appear in imperfection-free nonlinear systems. This talk will demonstrate that the interaction of geometric nonlinearities and bifurcation-induced dispersion in post-buckled slender structures leads to various types of nonlinear waves, including solitons [2], describing smooth spatial localization. The level of pre-compression in particular determines whether stable or unstable nonlinear waves appear. In the low-frequency regime, where quasi-static homogenization is appropriate, and for large pre-compression, wave propagation in post-buckled structures is described the by Korteweg de Vries (KdV) equation. The soliton solution to the KdV describes waves that have amplitude-dependent velocity and wavelength. This is a trademark of nonlinear waves as opposed to linear waves where frequency and wavenumber are related by amplitude-independent phase velocity. Results from homogenized equations are confirmed by time integration of nonlinear finite-element models based on the geometrically-exact formulation. For low and moderate pre-compression, on the other hand, only unstable nonlinear waves exist owing to stiffness coupling between plane and transverse deformations. The findings indicate structured materials composed of slender internal units as equivalent materials with buckling-driven, amplitude-dependent behavior.

Bibliography

[1] A. R. Champneys, G. W. Hunt, J. M. T. Thompson, *Localization and Solitary Waves in Solid Mechanics*, World Scientific, 1999.

[2] F. P. R. Maurin, A. Spadoni, “Low-frequency wave propagation in post-buckled structures.” *Wave Motion,* In press, 2013.

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