Micromechanics Research Group

Seminars

[Fri 08 Dec 14:00: Snaking, dripping, and fluttering of elastic rods](#)

[Snaking, dripping, and fluttering of elastic rods](#)

The problem of an elastic rod deforming in a plane, namely the so-called 'planar elastica', has a long history, rooting to Jacob Bernoulli (1654-1705), Daniel Bernoulli (1700-1782), Leonhard Euler (1707-1783), and Pieter van Musschenbroek (1692-1761), but is still actual and rich of applications, sometimes unexpected. Using the elastica theory, configurational or 'Eshelby-like' forces are shown to arise in elastic structures when a change in configuration is possible, with a related release of energy. This concept has been developed theoretically and experimentally in a series of recent works involving: a clamped elastic rod forced to slip inside a sliding sleeve [1], the development of the so-called 'elastica arm scale' [2], the development of an elastica in the shape of a drop [3], an example of torsional locomotion [4] and serpentine motion within a smooth channel [5]. The dynamics of an elastic rod in a cantilever configuration and subject to a tangential follower load of the 'Ziegler type' at its end (the 'Pfluger problem') is finally addressed. This structure is subject to a Hopf bifurcation, corresponding to the initiation of the 'flutter instability'. A new experimental set-up has been designed, produced and tested to realize the follower load. Experiments provide the evidence of flutter and divergence instability and provide the first proof that damping sources have a destabilizing effect on the system (the so-called 'Ziegler paradox').

From left to right: a snake in a rigid and frictionless channel, dripping and fluttering of an elastic rod

References [1] Bigoni, D, Bosi, F., Dal Corso, F. and Misseroni, D. (2014) Instability of a penetrating blade, J. Mech. Phys. Solids vol. 64, pp. 411–425. [2] Bosi, F., Dal Corso, F., Misseroni, D. and Bigoni, D. (2014) An Elastica Arm Scale, Proc. Royal Soc. A, 470, 20140232. [3] F. Bosi, D. Misseroni, F. Dal Corso, and D. Bigoni (2015) Self-encapsulation, or the 'dripping' of an elastic rod Proc. Royal Soc. A, vol. 471, 20150195. [4] Bigoni, D., Dal Corso, F., Misseroni, D. and Bosi, F.

(2014) Torsional locomotion, Proc. Royal Soc. A, 470, 20140599. [5] Dal Corso, F., Misseroni, D., Pugno, N.M., Movchan, A.B., Movchan, N.V., Bigoni, D. (2017). Serpentine locomotion through elastic energy release. Journal of the Royal So

- Speaker: Professor Davide Bigoni,Department of Civil, Environmental and Mechanical Engineering University of Trento, Italy
- Friday 08 December 2017, 14:00-15:00
- Venue: Department of Engineering - LR4.
- Series: Engineering Department Mechanics Colloquia Research Seminars; organiser: Hilde Fernandez.

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