DANISH CENTER FOR APPLIED MATHEMATICS AND MECHANICS

The 2023 DCAMM Annual Seminar Speaker

Basile Audoly

Professor,
Institut Polytechnique de Paris
France

gives the following lecture at the

Technical University of Denmark

Meeting Room S01, Building 101, Kgs. Lyngby

One-dimensional models for highly deformable elastic rods

Wednesday, October 4, at 14:00

There will be an open discussion after the lecture
at 15:00
(Refreshments are served)

This lecture aims at popularizing mechanical science to a broad audience of interested students and staff as well as engineers working in industry

The Danish Centre for Applied Mathematics and Mechanics, DCAMM, is a framework for internationally oriented scientific collaboration between staff members at a number of departments at the Technical University of Denmark, Aalborg University, Aarhus University and University of Southern Denmark. The "DCAMM Annual Seminar Speaker" is an initiative created to disseminate mechanics to a broader audience.
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One-dimensional models for highly deformable elastic rods

Abstract

We are interested in identifying effective mathematical models describing the deformations of rods, i.e., cylindrical elastic bodies whose cross-section dimensions are much smaller than their length. Owing to the separation of scales, their equilibrium is governed by ordinary differential equations which are easier to solve than the partial differential equations applicable in 3D elasticity. These equilibrium equations are well-established as long as the strain remains small, i.e., when the cross-sections remain almost undeformed. In this talk, I will discuss the interesting case of soft rods having highly deformable cross-sections. This includes inflated cylindrical rubber balloons, elastic bars made of very soft gels deforming under the action of surface tension, and carpenter's tapes. I will present a method for deriving the one-dimensional equations governing the equilibrium of these highly deformable rods, and will show that they accurately account for the localization phenomena that are ubiquitous in these systems.

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