POLITECNICO DI TORINO

DISMA Dipartimento di Scienze Matematiche G. L. Lagrange

ECCELLENZA 2018 • 2022

Friday the 09 November 2018 at 11:00
Politecnico di Torino, DISMA, Aula Buzano (third floor)

Giulio Giuseppe GIUSTERI

Research Associate at MOX, Department of Mathematics, Politecnico di Milano

Plateau, the Cosserat, and the mechanics of shapes

Prof. Davide Carlo Ambrosi introduces the seminar

Abstract

There are numerous situations in which the mechanics of slender or thin objects manifests itself through significant shape modifications, even in the presence of small stresses. This is because small local strains can have a significant cumulative effect on the shape of a continuum. By "shape" we indicate geometric features of an object that are invariant under isometries of the three-dimensional ambient space. We name "shape energies" of continua those elastic energy functionals that depend only on such features.

In this talk, Dr Giusteri will present recent results about the mechanics of filaments, modelled by special Cosserat rods, and of liquid membranes, modelled as area-minimizing surfaces. He will first discuss how the strains defining the shape of a rod can be successfully viewed as fundamental descriptors of the system. This entails encoding the shape not in a description of what can be seen, but of how the rod can be reconstructed starting from one of its cross sections. Moreover, it leads naturally to discretisation schemes that avoid the need for interpolation procedures that introduce some arbitrariness in popular numerical schemes.

Dr Giusteri will then consider the coupled effects of the dynamics of rods and membranes that characterise the Kirchhoff-Plateau problem, in which a liquid film spans a flexible filament (with arbitrary cross-sectional shape) in the form of a closed loop. Using techniques of the calculus of variations and geometric measure theory, the shape energy of the system is minimized under the constraint of non-interpenetration of matter, but allowing for points on the surface of the bounding loop to come into contact. This problem is rich in physical modelling and challenging for the presence of non-smooth and non-convex constraints. He will finally touch upon some questions related to the modelling of structured surfaces.

1. G.G. Giusteri, P. Franceschini, E. Fried (2016), J. Nonlinear Sci. 26, 1097-1132.
2. G.G. Giusteri, L. Lussardi, E. Fried (2017), J. Nonlinear Sci. 27, 1043-1063.
3. G.G. Giusteri, E. Fried (2018), J. Elast. 132, 43-65.

Biography

Dr Giusteri is research associate at MOX, Polietcnico di Milano. He received his PhD in Pure and Applied Mathematics from Università degli Studi di Milano-Bicocca in 2012. He then held Post-doctoral positions at the University of Washington, Università Cattolica del Sacro Cuore, and the Okinawa Institute of Science and Technology. His research focuses on the development of models for structural engineering applications and fluid mechanics.

Save the date for the next event: November 13, 2018
More info on www.polito.it/disma-excellence