Iowa State University
Department of Aerospace Engineering

Guest Seminar

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1:10 a.m.

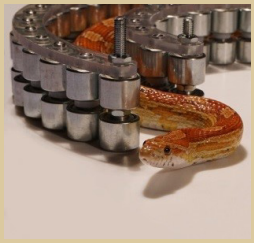
2220 Howe Hall

Iowa State University

Folding of Elastic Solids and Eshelby Forces in Elastic Rods

Folding is a process in which bending is localized at sharp edges separated by almost undeformed elements. This process is rarely encountered in nature, although some exceptions can be found in unusual layered rock formations (called 'chevrons') and seashell patterns (for instance Lopha cristagalli). In mechanics, the bending of a three-dimensional elastic solid is common (for example, in bulk wave propagation), but folding is usually not achieved. The route leading to folding is shown for an elastic solid to be couple-stress theory implemented with extreme anisotropy, a result achieved through development of two-dimensional Green's function for constrained Cosserat material.

The concept of Eshelby force, acting between dislocations in elastic solids, has been applied to elastic structures to disclosure configurational forces. This finding leads to applications such as the elastica arm scale and to models of snake locomotion and self-restabilization.



From left to right: Modeling of a Chevron folding with a Cosserat continuum; Eshelby-like forces in the elastica arm scale; snake locomotion

Davide Bigoni is a mechanician working in solid and structural mechanics and material modeling, wave propagation, fracture mechanics. His approach to research is the employment of a broad vision of mechanics, with a combination of mathematical modelling, numerical simulation, and experimental validation. From 2001 Davide Bigoni holds a professor position at the University of Trento, where he is leading a group of excellent researchers in the field of Solid and Structural Mechanics.

He has authored or co-authored more than 100 journal papers and has published a book on nonlinear Solid Mechanics. He was elected in 2009 Euromech Fellow (of the European Mechanics Society), has received in 2012 the Ceramic Technology Transfer Day Award (of the ACIMAC and ISTEC-CNR), in 2014 the Doctor Honoris Causa degree at the Ovidius University of Constanta and in 2016 the Panetti and Ferrari Award for Applied Mechanics (from Accademia delle Scienze di Torino). He has been awarded an ERC advanced grant in 2013. He is co-editor of the Journal of Mechanics of Materials and Structures and associate Editor of Mechanics Research Communications and in the editorial board of 8 international journals.