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ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

IGM COLLOQUIUM - FALL 2018
Schedule: Prof. Davide Bigoni

Tuesday, December 11th 2018

Time		Location
9:00 – 9:45	**Professor John Kolinski** Engineering Mechanics of Soft Interfaces Laboratory	MED 2 2626 (MED building)
10:00 – 10:45	**Professor Jean-François Molinari** Computational Solid Mechanics Laboratory	GC A2 474 (GC A building)
11:00 – 11:45	**Professor John Kolinski** Engineering Mechanics of Soft Interfaces Laboratory	MED 2 2626 (MED building)
12:15 – 1:15	**Seminar Prof. Davide Bigoni** *"Folding of a continuum and energy releasing or fluttering rods"*	MED 0 1418 (MED building)
1:30 – 2:30	**Lunch** *Professor John Kolinski & postdocs and students*	Espace Copernic by Novae CE 1 711.1 (CE building)
2:45 – 3:30	**Professor Tobias Schneider** Emergent Complexity in Physical Systems Laboratory	MED 2 2826 (MED building)
3:45 – 4:30	**Professor Bill Curtin** Laboratory for Multiscale Mechanics Modeling	MED 3 1026 (MED building)
4:45 – 5:30	**Professor Pedro Reis** Flexible Structures Laboratory	MED 0 1226 (MED building)
7:00	**Dinner** *Professor John Kolinski, Professor Pedro Reis, Professor Tobias Schneider and Professor Bill Curtin*	Café Romand Place Saint-François 2, 1003 Lausanne

Date: Tuesday, December 11th 2018

Title: "Folding of a continuum and energy releasing or fluttering rods"

Speaker: Prof. Davide Bigoni
Department of Civil, Environmental and Mechanical Engineering,
University of Trento

Web: http://www.ing.unitn.it/dims/ssmg/

Abstract: It will be shown that Cosserat elastic solids with extreme anisotropy may exhibit folding and faulting, the former being the process in which bending localizes into sharp corners separated by almost undeformed elements, while the latter corresponds to the formation of displacement jumps of finite size [1,2]. While faulting can be often observed in geological formations, folding is rarely encountered in nature and is difficult to be described within the realm of the Cauchy theory of elasticity, but is shown to become possible in constrained Cosserat elastic materials.
The nonlinear theory of elastic rods is a framework for describing bifurcation and instabilities of a number of interesting structures, showing for instance configurational forces analogous to those acting on dislocations in solids. Several problems influenced by configurational forces or involving elastic energy releases will be resented, including snaking of an elastic rod [3, 4].
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 so-called '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') [5].

References

[1] Bigoni, D., Gourgiotis, P.A. (2016) Folding and faulting of an elastic continuum. Proc. Royal Soc. A 472, 20160018.
[2] Gourgiotis, P.A., Bigoni, D. (2017) The dynamics of folding instability in a constrained Cosserat medium. Phil. Trans. Royal Soc. A, 375, 20160159.
[3] Dal Corso, F., Misseroni, D., Pugno, N.M., Movchan, A.B., Movchan, N.V., Bigoni, D. (2017) Serpentine locomotion through elastic energy release. J. Royal Soc. Interface 14, 20170055.
[4] Armanini, C., Dal Corso, F., Misseroni, D., Bigoni, D. (2017) From the elastica compass to the elastica catapult: an essay on the mechanics of soft robot arm. Proc. Royal Soc. A 473, 20160870.
[5] Bigoni, D., Kirillov, O., Misseroni, D., Noselli, G.Tommasini, M. (2018) Flutter and divergence instability in the Pflüger column: Experimental evidence of the Ziegler destabilization paradox. J. Mech. Phys. Solids 116, 99-116.

Bio: 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 he has received 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.

Host: Prof. John Kolinski