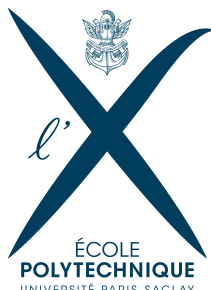




Laboratoire de Mécanique des Solides
<http://www.lms.polytechnique.fr>

Parrainé par la Chaire André Citroën



Symposium Jean Mandel

*Mécanique de la Biologie
Mechanical Biology*

Jeudi 12 juin 2014

Amphithéâtre Monge
École Polytechnique

Inscription gratuite sur simple email à symposium@lms.polytechnique.fr avant le 31 mai 2014
Free registration by email at symposium@lms.polytechnique.fr by May, 31st 2014
Contact : laurence.bodelot@polytechnique.edu

Plenary Lecture

by Alain Goriely

From microscopic anisotropy to macroscopic chirality in mechanical biology

One of the fundamental problems of mechanical biology is to understand the relationship between a microscopic structure and its overall macroscopic response. A paradigm for this problem is chirality. How does a right-handed structure behave under loads? How is chirality transferred between scales? The simplest example motivated by the study of DNA is the extension of a right-handed spring under pure axial load. Would it rotate clockwise or counter-clockwise? Similarly, many plant structures are fiber-reinforced and an outstanding problem is to connect the cell wall chirality with the chirality of the rotation induced by change in pressure. Motivated by different biological experiments on active gels, DNA, plant cell walls, and fungi, I will show that biological systems, through a combination of internal stresses and nonlinear responses offer many puzzling and often counter-intuitive chiral behaviors leading to the interesting possibility of perversion, an inversion in chirality under loads or remodeling. Based on these ideas, I will also develop a mathematical framework to understand non-monotonous response of nonlinear materials.

Alain Goriely

Professor of Mathematical Modeling

Director of the Oxford Center for Collaborative Applied Mathematics

University of Oxford, Oxford, UK



Shortly after receiving his Ph.D in mathematical physics from the University of Brussels in 1994, Alain Goriely joined the Department of Mathematics at the University of Arizona where he established a research group within the renowned Program of Applied Mathematics. In 2010 he joined the University of Oxford as the Professor of Mathematical Modeling and became the Director of the Oxford Centre for Collaborative Applied Mathematics. At the scientific level, he is an applied mathematician with broad interests in mathematics, science, and engineering. His current research includes the mechanics of biological growth and its applications to plants and physiology; the mathematical and geometric foundations of continuum mechanics; the dynamics of curves, knots, and rods; self-assembly processes, the design of proteins; the modelling of cancer, batteries, organic photovoltaics; history of mechanics, and more generally the development of mathematical methods for applied sciences.

Thursday, June 12, 2014 Program

Monge Amphitheater

- 8:45 - 9:15 am *Registration and Welcome Coffee*
- 9:15 - 9:30 am **Welcome Address** by **Patrick Le Tallec**, LMS director
- 9:30 - 10:30 am **Plenary Lecture** by **Alain Goriely**
From microscopic anisotropy to macroscopic chirality in mechanical biology
- 10:30 - 11:00 am *Coffee Break*
- 11:00 - 11:30 am **Barbara Lynch**
Multiscale biomechanics of normal and pathological mice skin
- 11:30 - 12:00 pm **Claire Dupont**
Wrinkling of deformable capsules in shear flow
- 12:00 - 12:30 pm **Pierre Recho**
Optimality of contraction driven crawling
- 12:30 - 2:00 pm *Lunch*
- 2:00 - 2:30 pm **Guido Vitale**
A mechanical perspective on vertebral segmentation
- 2:30 - 3:00 pm **Cécile Gouget**
3D cell migration modeling
- 3:00 - 3:30 pm **Raman Seshka**
Power stroke driven molecular motors
- 3:30 - 4:00 pm *Coffee Break*
- 4:00 - 4:30 pm **Loïc Tadrist**
Mechanics of leaves and biological consequences
- 4:30 - 5:00 pm **David Gonzalez-Rodriguez**
Dynamics of nanoparticle internalization in endothelial cells
- 5:00 - 5:30 pm **Giuseppe Zurlo**
Modeling of the elastic behavior of biological membranes
- 5:30 - 5:45 pm **Closing Address** by **Patrick Le Tallec**
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Jean Mandel

Founder of the Laboratoire de Mécanique des Solides



After brilliant secondary studies, Jean Mandel went on to École Polytechnique in 1927 and later to École des Mines. In 1932 he became a professor at École des Mines de Saint-Étienne and in 1948 at École des Mines de Paris. From 1951 to 1973 he was professor of mechanics at École Polytechnique.

Jean Mandel's research career was devoted mainly to the mechanics of solids and the strength of materials. In 1961 he created the Laboratoire de Mécanique des Solides, a laboratory common to École Polytechnique, École des Mines de Paris, École des Ponts et Chaussées and associated to the Centre National de la Recherche Scientifique. In October 1964 he founded and became the first president of the Groupe Français de Rhéologie. In 1980 he became "honorary member" of this group.

The scientific work of Jean Mandel covers a very wide field with a bibliography listing more than 150 articles and 5 books. He presented original ideas on the buckling of beams and shells, the finite deformations of solids, laminar flow in porous media, the bearing capacity of shallow foundations, the punch resistance of a two-layer medium, the stability of underground cavities, the plastic flow of metals, and the effect of cyclic loading on structures, as well as contributions to the fields of thermodynamics, rolling friction and homogenization.

But Jean Mandel's influence extended far beyond the field of his personal research. A good many students were trained, under his direction, in the Laboratoire de Mécanique des Solides. A fine teacher and a constant stimulus to his research group, he gave his time generously to study the details of manuscripts that were sent to him and to suggest the minor modifications he deemed necessary. Those who had the privilege of working with him were left with an impression of palpable scientific passion and moral rigor that will continue to be an example for generations to come.

Jean Mandel passed away on the 19th of July 1982, the victim of a tragic accident at the very height of his intellectual prime.

Text by Pierre Habib

The Jean Mandel Symposium is open to all students, researchers and scientists interested in the proposed topic. It combines, in an informal setting, a keynote presentation by an internationally renowned scientist and talks given by young researchers associated with the laboratory. A large amount of time is dedicated to scientific discussions.