



Laboratoire de Mécanique des Solides

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Parrainé par la Chaire André Citroën



Symposium Jean Mandel

*Deformation of materials
at different length scales*

Déformation multi-échelle des matériaux

Jeudi 25 juin 2015

**Amphithéâtre Gay-Lussac
École Polytechnique**

Inscription gratuite par simple email à symposium@lms.polytechnique.fr avant le 31 mai 2015
Free registration by email at symposium@lms.polytechnique.fr by May, 31st 2015
Contact : laurence.bodelot@polytechnique.edu

Plenary Lecture

by Jeffrey W. Kysar

Behavior of Metals Under Conditions of High Plastic Strain and Plastic Strain Gradient: The Inside Story

The realization of predictive physics-based constitutive models for the deformation and failure of metals under arbitrary conditions remains elusive despite several decades of intense interest and study. It is generally accepted that such models must be multiscale to account for concurrent phenomena in a hierarchical cascade of length and time scales ranging from the atomic scales to macroscopic scales. The physical phenomena at the pertinent scales have largely been identified, but progress is hindered by an insufficiently detailed experimental characterization at each scale. In this talk, we discuss a multiscale set of experiments that characterize plastic deformation at the mesoscale with spatial resolutions ranging from 20 nm to 3 mm over volumes ranging from a few cubic micrometers to a cubic millimeter. Specifically we measure the Geometrically Necessary Dislocation (GND) densities on individual slip systems within metallic crystals and bicrystals deformed under a variety of different loading states. In addition, we consider detailed analytic and numerical solutions to the idealized boundary value problems that describe the deformation states, which assist with analysis of the experimental measurements. Finally we demonstrate how these methods can be used to determine scaling relationships for the mean free path length of dislocation motion within a plastically deforming metal.

Jeffrey W. Kysar

Professor and Chair of Mechanical Engineering
Department of Mechanical Engineering
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Professor Jeffrey W. Kysar received his B.S. and M.S. in Mechanical Engineering from Kansas State University and his S.M. and PhD in Engineering Sciences from Harvard University. He began his academic career at Brown University in 1998 before joining the Department of Mechanical Engineering at Columbia University in 2001, where he established the Small Scale Mechanics Laboratory.

Professor Jeffrey W. Kysar's current research interests include understanding the fracture process from the atomic length scale to the macroscopic length scale, especially in materials that exhibit an elastic-plastic constitutive behavior such as ductile metals.

Professor Jeffrey W. Kysar has received numerous awards, among which, the National Science Foundation Faculty Early Career Development Award in 2001, the Presidential Early Career Award for Scientists and Engineers in 2006 and the International Journal of Plasticity Young Research Award in 2012.

Thursday, June 25th, 2015 Program

Gay-Lussac 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 **Jeffrey W. Kysar**
Behavior of Metals Under Conditions of High Plastic Strain and Plastic Strain Gradient: The Inside Story
- 10:30 - 11:00 am *Coffee Break*
- 11:00 - 11:30 am **Bassem Barkia**
Multiscale Study of Titanium Viscoplasticity at Room Temperature
- 11:30 - 12:00 pm **Arina Marchenko**
Multiscale Investigation of Strain Aging Phenomenon and Sustained Load Cracking of Titanium Alloys
- 12:00 - 12:30 pm **Ababacar Gaye**
Multiscale Analysis of Plastic Mechanisms and Strain in Polycrystalline NaCl by the Means of 2D and 3D Full Field Measurements
- 12:30 - 2:00 pm *Lunch*
- 2:00 - 2:30 pm **Raphaël Guerchais**
Investigation of the High Cycle Fatigue Behavior of a 316L Austenitic Stainless Steel Stent
- 2:30 - 3:00 pm **Tuan Hiep Pham**
Scale Effects on the Evolution of Cohesive Cracks
- 3:00 - 3:30 pm **Tianyi Li**
From Gradient Damage Models to Dynamic Brittle Fracture
- 3:30 - 4:00 pm **Armél Mbiakop**
A Homogenization Model for Porous Crystals Comprising General Ellipsoidal Voids
- 4:00 - 4:30 pm *Coffee Break*
- 4:30 - 5:00 pm **Guangyang Wen**
Dynamic Stability of In-plane Strained Thin Sheets Under High Loading Rate: Response to Local Perturbations
- 5:00 - 5:30 pm **Christelle Combescure**
A Group-Theoretic Approach to the Post-Bifurcation Analysis of Architected Materials
- 5:30 - 5:45 pm **Closing Address** by **Patrick Le Tallec**

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.