





EUROMECH COLLOQUIUM 510 UPMC, Paris, France, May 13-16, 2009

# Mechanics of Generalized Continua: A hundred years after the Cosserats

### **General informations**

#### Acting chair :

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International Scientific Committee: Elias C.Aifantis (GR), Denis Caillerie (F), René de Borst (NL), Marcelo Epstein (Canada), Samuel Forest (F), Jean-François Ganghoffer (F), A.Ian Murdoch (UK), Martin Ostoja-Starzewski (USA), Franco Pastrone (Italy), Miles B.Rubin (Israel), Paul Steinmann (G).

#### **Object of the Colloquium**

The centenary in 2009 of the publication of the much cited, but very little read, monograph by the Cosserat brothers on the "Theory of deformable bodies" offers a timely opportunity to examine the strong influence of, and the progress and innovation in, the mechanics of so-called generalized continua., Cosserat continua providing one example of such generalized continua. The actuality of such a subject matter is enhanced by the recognized physical fact that in virtually all physical natural or man-made materials and systems, interactions exist between mechanical processes at different spatial scales.

Nowadays, generalized continua facilitate the development of new metallurgical procedures as well as the production of artificial materials with a controlled microstructure. They help predict the failure of heterogeneous brittle materials such as concrete and ice. Several non-destructive testing techniques are based on the averaged material properties predicted by the generalized continua. The rapidly advancing nano-technologies are seeking

for appropriate modelling approaches of which the one based on the concept of generalized continua is considered to be very promising.

Generalized continua such as micropolar or oriented materials, micromorphic continua, strain-gradient materials, bodies with weakly or strongly nonlocal interactions are also emerging as an integral part of the multi-scale numerical techniques. These techniques aim at coupling different spatial scales in one numerical scheme. Starting from the quantum-mechanical description, the simulations proceed into the atomistic, molecular, micro and then to the continuum scale. The latter scale is often broken into two sub-scales: the generalized and the classical continuum. The latter is then considered as representative of the averaged properties of the generalized continuum.

The short discussion above shows that generalized continua are of interest both theoretically and practically and deserve to be discussed by theoreticians and experimentalists representing various fields of mechanics and physics. This will be done in the framework of this Colloquium, the aim of which is to discuss advances in the theory, experimental identification, numerical implementation and applications of the generalized continua. Particular topics to be addressed during the Colloquium could be

- Phenomenology of generalized continua,
- Derivation techniques (homogenization, crystal-lattice dynamics, etc),
- Generalized continua versus discrete models,
- The energy, momentum and moment of momentum in generalized continua,
- Causality and waves in generalized continua,
- Experimental identification of parameters of the generalized continua,
- Numerical implementation of the generalized continua,
- Classical and emerging applications of the generalized continua: nanomechanics, biology, life sciences, earth sciences, civil and mechanical engineering, etc,
- Technological advances facilitated by the generalized continuum theories,
- Non-destructive testing techniques based on the generalized continuum properties.

The time devoted to the Colloquium allows only for about 40 oral presentations of 20-30 minutes.

The possibility to publish the full text of the contributions in book form is under consideration.

**Local organization**: IJLRdA-UPMC-Paris 6: Gérard A.Maugin (Chair), Daniel Lhuillier, Joël Pouget, Martine Rousseau, Cécile Baron, Ingrid Masson, Simona Otarasanu

This Colloquium is under the auspices of the *EUROMECH Society*, the Association Française de Mécanique, the Engineering UFR of the UPMC, the STII Scientific Department of CNRS, France; It is locally organized by the MPIA (Modelling and Propagation) Team of the Institut Jean le Rond d'Alembert.

**NOTE** : The Colloquium organizers do not arrange for travel to Paris or hotel stay in Paris. There is no social program for accompanying persons as Paris offers so many opportunities (monuments, museums, shops, etc).

**General Schedule**: The registration desk will open at 9:00 in the morning of May  $13^{th}$ , and the Colloquium will officially close on Saturday May  $16^{th}$  at 12:00. (if some lecturers are missing, we may well finish in the evening of Friday May  $15^{th}$ ). The opening of the Colloquium is at 10:00 on May  $13^{th}$ ; The first lecture starts at 10:30.

The **venue of the Colloquium** is the Jussieu campus (Metro station: Jussieu, Paris, 5<sup>th</sup> Arrondissement/District) of the Université Pierre et Marie Curie, Bâtiment/Building "Esclangon", Lecture room/Amphitheatre "Durand" (Coffee breaks and May 13 reception at 7:00pm in the

basement of the same building, in the original caves of the "Halle aux Vins" (Wine Cellar) on which place the UPMC was built in the 1960s. Lunches will also probably be served in this Wine cellar. (Interested people can also use the University restaurant –medium/low quality) The social dinner will take place at 8:00pm at Restaurant "Amore Mio", 13 rue Linné, 75005 Paris at a few minutes walk from the meeting place.

## **UPMC-** Campus map



#### EUROMECH 510 : Access to Lecture room :

Arrival by Place Jussieu (Metro station) Enter on Campus by gate between Towers 46 and 56 Walk to the right passing Towers 56 and 66. Beyond Tower 66, you arrive then at Bâtiment/building ESCLANGON Lecture room "Durand" is first inside on the left in ESCLANGON. Here: registration. Cave (cellar) accessible by stair case (coffee breaks, reception on May 13 evening) Restaurant for lunches is at the corner of rue Cuvier and Quai Saint Bernard. Accessible from inside the campus only.

**Registration fee**: It is uniquely fixed to 200 EURO (it includes distributed colloquium material, coffee pauses, three lunches, one reception on May 13 evening, one social dinner on May 14 evening) if paid before April 1<sup>st</sup> 2009. Accompanying persons, if any, are asked to pay 50 EURO per person entitling them to coffee breaks and social dinner. After April 1<sup>st</sup> participants have to pay 250 EURO.

Payment of the registration fee **must be made on line** using a credit card (see link to **Payment**). If you meet difficulties concerning this point, please tell us by e-mail.

A signed receipt as well as a participation certificate in the colloquium will be delivered at the Registration desk on May 13<sup>th</sup>.