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## Colloquium No 563 Scientific Report

Date: 17-21 March 2014

Place: Cisterna di Latina, Italy

Organizer: Francesco dell'Isola

Co-organizer: Samuel Forest

The main purpose of this colloquium was to provide a forum of experts in generalized continua to exchange ideas and get informed about the latest trends of the research in the domain. Keeping in mind the application of macroscopic models to the development of newly and especially designed technological artefacts, many open problems need to be confronted. The most important of these involves the identification of macroscopic constitutive parameters in terms of microscopic properties of considered systems: the homogenization procedures proposed up to now present serious theoretical drawbacks and need to be refined. The impact of the underlying microstructure on macro-crack formation and propagation is investigated in porous metals for ductile fracture but also in quasi-brittle materials. There is still

no consensus for the determination of higher order elastic or nonlinear properties from the detailed geometry of the unit cell of composites. Techniques are competing in this endeavor and their efficiency may be decisive to convincingly address instability and fracture problems of heterogeneous materials.

The colloquium has been a great success in terms of participation and quality of featured presentation and discussions. There were altogether about 70 participants, from 13 countries, among them five keynote lectures, namely Gerard A. Maugin (Université Pierre et Marie Curie, Paris-6, France), Reinhold Kienzler (University of Bremen, Germany), Angelo Luongo, (University of L'Aquila, Italy), Stelios Kyriakides (University of Texas at Austin, USA), Roger Fosdick (University of Minnesota, USA) and one junior keynote lecturer, Ali Javili (University of Erlangen-Nuremberg, Germany); see also the list of participants and the full programme.

The framework of a small town like Cisterna encouraged discussions and exchanges during the colloquium week, even outside the official schedule, and most of all during lunch breaks and social events.

The main key points discussed were the following:

- General concepts for second and higher gradient media
- Phenomenology of existing and designed composites and metamaterials
- Homogenization techniques and related numerical and mathematical problems
- Beams and plates constituted by metamaterials
- Strain and stress localization phenomena
- Dynamic behavior of metamaterials and composites
- Acoustic properties of metamaterials and composites
- Generalized continua in Biomechanics and mechanics of growing tissues
- Damage and fracture in generalized continua

Several of the addressed topics are still very open, and the discussions provided a good push in what the organizers believe it is the right direction for their solution and their complete understanding. Numerous papers and preprints stemmed from the discussions and debates of this colloquium, and this is an evidence of how the meeting has been successful in terms of scientific exchange and production. The community planned to regularize this event to a yearly basis.

Cisterna di Latina, 11 June 2014

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