Higher gradient and Micromorphic continua: some applications to composites and growing tissues

Composites and living tissues show a complex behavior related to their micro-structure.

There are similarities and differences between these two class of materials which deserve to be carefully studied as understanding them will allow a serious advancement of knowledge.

Composites and living tissues share their multiscale structure and both show at micro-level high contrast in constitutive properties.

On the other hand living tissues are able to change their constitutive equations by means of re-modelling processes.

In this talk some recent results are presented showing that fiber tissues must be modelled by means of second gradient continua (at least) and that growth of reconstructed bones can be greatly influenced by its microstructure which still can be modelled by means of second gradient models.

A digression on the concept of generalized contact forces in higher gradient continua and on the needed boundary conditionswill be needed to consistently present the obtained results.

This digression shows some of the the limits of standard continuum mechanics as conceived by Cauchy.