Università degli Studi di Pavia

Dipartimento di Ingegneria Civile e Architettura

in collaboration with

Centro di Simulazione Numerica Avanzata – CeSNA

Istituto Universitario di Studi Superiori

SHORT COURSE

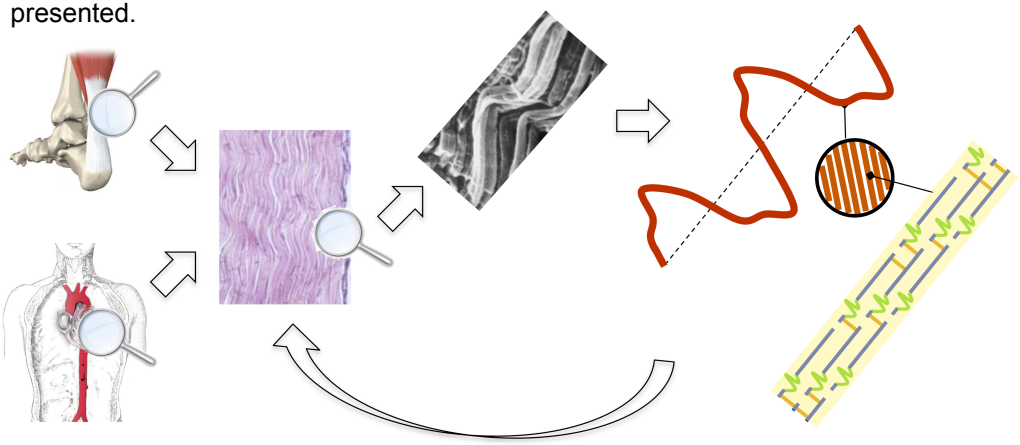
Mechanical modeling of soft biological tissues

Lesson 1: The multiscale structural approach: the case of tendons

The biomechanics of human locomotion and movements strongly depends on the mechanical behavior of tendinous structures connecting muscles to bones. An effective characterization of tendon mechanical response open to the better understanding of physio-pathological functional processes affecting the overall muscle-tendon unit response.
To this aim, a refined model for tendon constitutive description is presented taking into account for the elastic non-linearities, both at the nano and the microscale. The hierarchical arrangement (from molecules up to the fibers) of collagenous structures within the tissue is explicitly modeled in the framework of a multiscale structural approach. The model is coupled with a Hill-type muscle description reproducing well-established experimental data and the benefits deriving from training-induced tendon remodeling.

Lesson 2: Multiscale modeling of aorta mechanics and damage mechanisms

The multiscale structural approach is applied to arterial walls allowing for a refined description of aortic mechanics. Each model parameter is related to a measurable tissue feature and the effects of age-related remodeling (consisting in the variation of both histological arrangement and biochemical composition) are straightforwardly investigated. Accordingly, well-established age-related alterations in arterial mechanics are reproduced. Moreover, histo-chemical tissue properties in diseased condition are addressed opening to the assessment of aortic rupture risk and to the analysis of the systemic effect of blood flow alterations. Finally, the generalization of the proposed elastic multiscale constitutive description to damage mechanisms occurring in biological structures is presented.



Dr. Michele Marino
DiCII, University of Rome "Tor Vergata"

Tuesday, December 10, 16.00-18.00

Thursday, December 12, 9.00-11.00

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