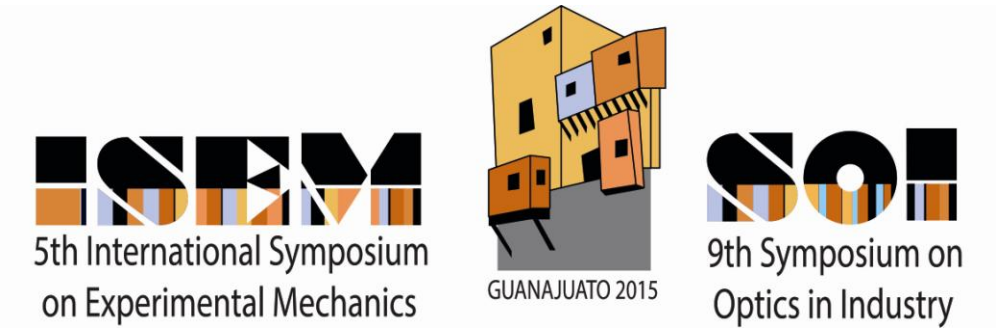

Multimodal Optical Measurement *in vitro* of Soft Biological Structures

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Recent advances in mechanobiology reveal that many cell types try to offset complexities in geometry and applied loads with heterogeneous and anisotropic material properties in order to render their local environment mechanobiologically favourable, i.e., to promote a 'mechanical homeostasis'. Hence, whereas standard testing protocols in soft tissue biomechanics seek to simplify the data analysis by focusing on regions of homogeneity, the mechanobiology demands new methods that enable potentially heterogeneous material properties to be assessed, often given the native geometry of the tissue or organ.
In this talk, we will discuss the technical challenges associated with *in vitro* measurement of overall geometry, full-field surface deformation, and regional wall thickness of complex anatomical structures in their native configurations. In particular, we will present a recently developed Digital Image Correlation (DIC) based approach, which includes standard- and 360-deg DIC to track surface geometry and deformation of the aortic arch during pressurization, and a Fringe Projection system to contour the heterogeneous distribution of the arterial wall thickness. Finally, to illustrate the potential utility of the dense set of experimental data obtainable with this approach, we will present the quantification of the regionally varying mechanical properties of a gallbladder using a membrane based point-wise inverse method to infer its full-field nonlinear behaviour under finite deformations.