An adapted tensorial decomposition for simplifying constitutive modelling of skeletal muscles

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Abstract:
The mechanical response of skeletal muscles is influenced by their microstructural organisation, characterised by fibre arrangements that give rise to anisotropic mechanical properties. Capturing this complex behaviour is essential for biomechanical applications. However, the development of constitutive models for muscular tissue is often obstructed by the numerous material parameters involved, which in most cases lack a clear physical meaning and are hence challenging to determine from standard measurements.

In this talk, we will discuss a general formalism designed to facilitate the experimental identification of material functions for their constitutive characterisation within the context of Cauchy elasticity. Specifically, I will present a theoretical framework for anisotropic nonlinear elasticity based on the decomposition of strain and stress tensors on a tensorial basis adapted to the local microstructure of the material [1]. This decomposition aims at organising the degrees of freedom involved into a mathematically clear and mechanically motivated scheme, which may support theoretical comprehension and experimental investigation.

We will focus on materials which exhibit transversely isotropic behaviour with respect to a reference configuration and discuss the practical advantages of this approach by examining the passive elastic response of skeletal muscles.

Reference:
1. S. Galasso, G. G. Giusteri. "Adapted and objective Voigt representations in anisotropic nonlinear elasticity", submitted to MEMOCS.