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Master Thesis

Design of an experimental setup for the mechanical characterization of the **active** mechanical properties of cardiac tissue under uniaxial tensile loading

Description:

The myocardium exhibits complex mechanical behavior combining passive properties, characterized by a nonlinear stress-stretch relationship, orthotropy, and the presence of inelastic phenomena, with the active stress exerted by the myocytes. The quantification of the passive properties has been the main focus of current literature, while studies of active properties are comparatively scarce. In addition, studies combining active and passive tests of the myocardium are still lacking.

The aim of this master's project is the design of an experimental setup for the mechanical characterization of the active behavior of the myocardium. Specifically, a uniaxial tensile testing device will be used for the active tests. This device is available at the Institute of Biomechanics; however, an additional module must be developed to enable cell activation during mechanical loading. The experimental setup will include electrodes (see the figure), a control unit, a biosignal amplifier, and a trigger unit.

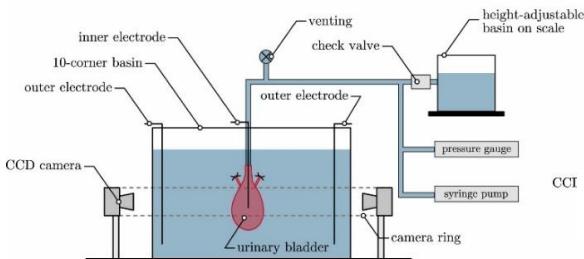


Figure: Exemplary experimental setup for the active testing of a urinary bladder with two parallel electrodes (adapted from Trostorf et al. 2022).

Objectives:

The master's project includes the following tasks:

- Gaining a general overview of the available test setups for active tests.
- Designing and realizing a first prototype of an add-on module to extend the existing uniaxial setup in order to allow to activate cardiac tissue.
- Presenting and critically documenting the results.

Qualifications:

Ideally, the applicant should have the following qualifications:

- Basic knowledge of electronics and signal processing.
- Basic knowledge of biomechanics.
- Good written and spoken English skills.

Advisors:

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