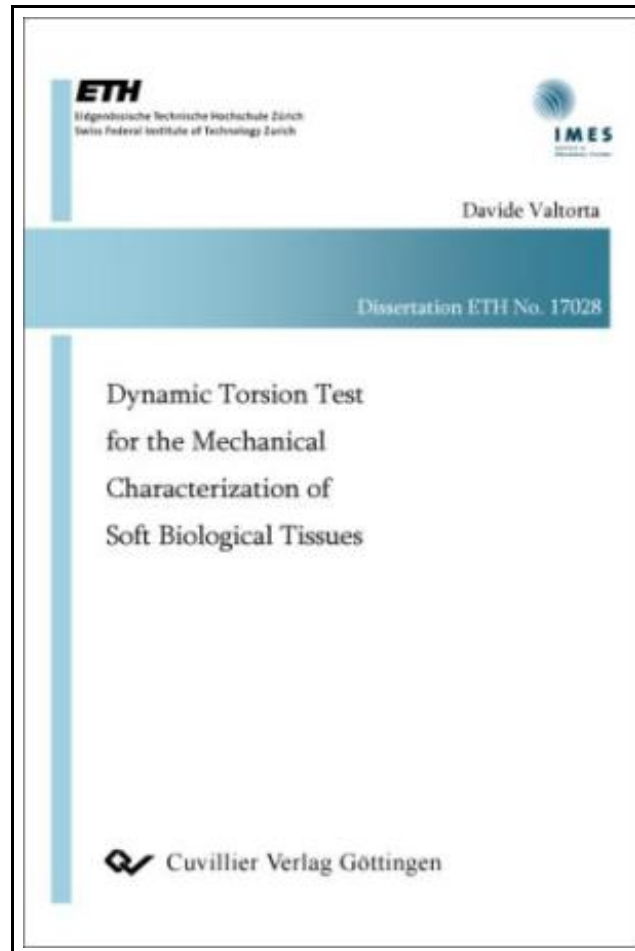


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(Abe Reichel DDS)

DYNAMIC TORSION TEST FOR THE MECHANICAL CHARACTERIZATION OF SOFT BIOLOGICAL TISSUES




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Cuvillier Verlag Mrz 2007, 2007. Taschenbuch. Book Condition: Neu. 207x144x12 mm. Neuware - In this thesis, a novel measurement method for the characterization of the mechanical properties of soft biological tissues is presented. The linear viscoelastic properties are determined through dynamic torsion tests by applying forced torsional oscillations to soft tissue samples. This work presents the definition of the measurement principle, with the design of torsional resonating sensors and the development of analytical and finite elements methods used for the inverse material characterization. The reliability and limitations of the proposed measurement technique have been assessed with experiments on soft biological materials as well as with synthetic materials. The viscoelastic response of soft materials is characterized for harmonic shear deformations at high frequencies (1-12 kHz) and small strains (up to 0.2% nominal strain for the soft biological tissues considered). Experiments are performed using a torsional resonating sensor, hereafter referred to as the torsional resonator device (TRD), which consists of a rod excited to vibrate at resonance, with one end in contact with a material sample. The resonating sensor induces shear waves in the material analyzed. Adherence between vibrating sensor and material sample is ensured by vacuum clamping in the contact area. The response of the material results in changes in the dynamic behavior of the vibrating system sensor + material sample. The damping characteristics and resonance frequency of the vibrating system are inferred from the control variables of a phase stabilization loop. These quantities are then related to the mechanical properties of the material using analytical and finite element models that describe the interaction between sensor and material sample. In this work, soft biological tissues are assumed to be homogenous, isotropic materials with a linear viscoelastic response. This assumption can be considered suitable to describe the mechanical behavior of bulky internal...

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