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Measuring the Mechanical Properties of Soft Biological Tissues

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Mechanical models for soft biological tissues are required for medical applications (e.g. diagnostics, surgery planning, surgery simulators). Special experimental techniques are needed for the mechanical characterization of soft tissues. Two novel techniques are presented: a quasi-static and a dynamic experiment. Quasi-static tests are performed by means of an aspiration experiment. Dynamic tests are performed by making the soft tissue a part of a vibrating system. Both methods are suitable for in-vivo applications. Applications of the experimental techniques on animal and human organs as well as the procedure for determining the constitutive model parameters are presented. Different types of models are evaluated for the description of the soft tissue response measured in the experiments. In particular, the quasi-linear viscoelastic model (Fung) and the elastic-viscoplastic model (Rubin–Bodner) are used. The constitutive behavior of biological tissues is characterized over a wide frequency range from the combination of quasi-static and dynamic test results.

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