

ANALYTICAL AND EXPERIMENTAL STUDY OF THE IDENTIFICATION STRATEGY IN MAGNETIC RESONANCE IMAGING

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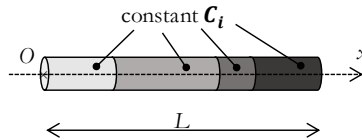
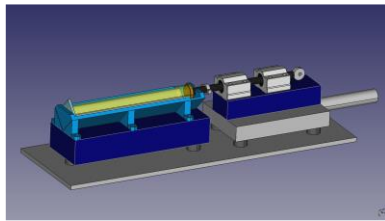
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Magnetic Resonance Elastography (MRE) is a modality that allows the mapping of the mechanical properties of soft tissues such as brain or liver from Magnetic Resonance Imaging (MRI) data. Specific MRI sequences have been developed in order to estimate the 3D displacement field in biological tissues undergoing harmonic solicitations [1].

The aim of this work consists in comparing the performance of different identification methods proposed for MRE in a situation straightforward enough –while still representative of elastography applications– to permit both analytic and experimental approaches. For the sake of simplicity, we present only the homogeneous case. The mechanical analysis of the problem illustrated in Figure 1 leads, for an adapted set of boundary conditions, to the resolution of the following usual problem:



$$\begin{cases} \frac{d\sigma}{dx} + \rho\omega^2 u = 0 \\ \sigma = C \frac{du}{dx} \end{cases}$$

u, σ and C : complex-valued

Figure 1: experimental setup, problem geometry, equilibrium equations

For a given set of experimental conditions, we determine the complex-valued solution fields. The so-obtained displacement fields can be perturbed to represent experimental noise. These modified displacements are then introduced as input for different identification methods (Finite Element Model Updating [2], Constitutive Equation Gap [3] or Modified Constitutive Equation Gap [4]) in order to characterize their different efficiencies. In parallel, experimental tests are performed on gelatin samples with “controlled” properties in order to characterize these methods using real data.

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