Inversion methods for strain and stiffness in quantitative optical coherence elastography

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Abstract

In this talk, we consider inversion methods for strain and stiffness reconstruction in quantitative optical coherence elastography (OCE). Mathematically, we deal with two inverse problems - a reconstruction of the mechanical displacement and a reconstruction of the Young's modulus (stiffness) from optical coherence tomography (OCT) data of a sample which undergoes a static compression. Our main goal is to conduct a quantitative multi-faceted analysis of key factors such as data quality and properties of reconstruction methods required for the successful application of quantitative elastography. We propose, analyse and compare three reconstruction methods for the Young's modulus: uniaxial analysis, strain map based reconstruction facilitating a particle tracking improved optical flow (EOFM), and a novel image-based inverse reconstruction method (IIM). The quality of the proposed reconstruction methods with respect to samples of different mechanical properties is investigated by comparing their performance on twelve silicone elastomer phantoms with inclusions of varying size and stiffness.

This is a joint work with Lisa Krainz[2], Simon Hubmer[3], Wolfgang Drexler[2], and Otmar Scherzer[1].

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