Frequency domain-based strain estimation and high frame-rate imaging for quasi-static elastography

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Abstract— **In freehand elastography, quasi-static tissue compression is applied through the ultrasound probe, and the corresponding axial strain is estimated by calculating the time-shift between consecutive echo-signals. This calculation typically suffers from a poor signal-to-noise ratio or from the decorrelation between consecutive echoes due to a wrong axial motion impressed by the operator. This paper shows that the quality of elastograms can be improved through the integration of two distinct techniques in the strain estimation procedure. The first one evaluates the displacement of the tissue by analyzing the phases of the echo signal spectra acquired during compression. The second approach increases the displacement estimation robustness by averaging multiple displacement estimations in a high-frame-rate imaging system, while maintaining the typical elastogram frame-rate. The experimental results, obtained with the Ultrasound Advanced Open Platform (ULA-OP) and a cyst phantom, demonstrate that each of the proposed methods can independently improve the quality of elastograms, and that further improvements are possible through their combination.**