AbstractID: 8258 Title: Estimation of the Optimal Maximum Beam Angle and Angular Increment for Normal and Shear Strain Estimation

Purpose: In current ultrasound elastography, only the axial component of the displacement vector is estimated and used to produce strain images. Previously we had proposed a method to estimate both the axial and lateral components of a displacement vector using radiofrequency echo signal data acquired along multiple angular insonification directions of the ultrasound beam. In this study, we present error propagation through the least square fitting process for optimization of the angular increment and maximum beam steered angle. **Method and Materials:** Ultrasound simulations are performed to corroborate theoretical predictions of the optimal values for the maximum beam angle and angular increment. Beam steering characteristics of the linear array were simulated by selecting appropriate time delays for each element which determines the focal point and steering angle for the beam. A uniformly elastic phantom was simulated by modeling a random distribution of 50 μm polystyrene beads with an average concentration of $9.7/mm^3$ in a medium (to simulate Rayleigh scattering). After computing RF signals for each insonification angle, the phantom was deformed by a uniaxial compression (1% of the phantom height). The displacement of each scatterer in the phantom was calculated using the Finite Element Analysis (FEA) software ANSYS. The new scatterer positions were used for calculating the post compression echo signals at each insonification angle. **Results:** The theoretical prediction matches well with numerical simulations. For typical system parameters, the optimal maximum beam angle is around 10-deg for axial strain estimation, and around 15-deg for lateral strain estimation. The optimal angular increment is around 4~6 deg, which indicates that only 5~7 beam angles are required for this strain tensor estimation technique. **Conclusion:** The theory presented in this study is useful for choosing optimal parameters for the angular data acquisition process for strain tensor estimation.