Convex Array Vector Velocity Imaging Using Transverse Oscillation and Its Optimization - DTU Orbit (08/11/2017)

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A method for obtaining vector flow images using the transverse oscillation (TO) approach on a convex array is presented. The paper presents optimization schemes for TO fields and evaluates their performance using simulations and measurements with an experimental scanner. A 3-MHz 192-element convex array probe (pitch 0.33 mm) is used in both simulations and measurements. A parabolic velocity profile is simulated at a beam-to-flow angle of 90°. The optimization routine changes the lateral oscillation period λx as a function of depth to yield the best possible estimates based on the energy ratio between positive and negative spatial frequencies in the ultrasound field. The energy ratio is reduced from −17.1 dB to −22.1 dB. Parabolic profiles are estimated on simulated data using 16 emissions. The optimization gives a reduction in standard deviation from 8.81% to 7.4% for 16 emissions, with a reduction in lateral velocity bias from −15.93% to 0.78% at 90° (transverse flow) at a depth of 40 mm. Measurements have been performed using the experimental ultrasound scanner and a convex array transducer. A bias of −0.93% was obtained at 87° for a parabolic velocity profile along with a standard deviation of 6.37%. The livers of two healthy volunteers were scanned using the experimental setup. The in vivo images demonstrate that the method yields realistic estimates with a consistent angle and mean velocity across three heart cycles.

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