A new approach for estimation of the axial velocity using ultrasound

The most used estimation method for calculating the blood velocity in commercial scanners is the autocorrelation approach. The calculation of the mean velocity used in this method depends on the center frequency of the interacting ultrasound pulse which downshifts as a function of depth, introducing a bias. A new velocity estimator for the mean axial velocity is presented. The estimation principle is based on the 2D Fourier transform and the Radon transform. The input data are a sequence of RF data forming a 2D data input, one column for each pulse emission. A 2D segment is selected for a specific depth. This data segment is first transformed by a 2D Fourier transform, and the result is then transformed by a Radon transform. The center of gravity for the angles of the lines intersecting the origin of the R-theta coordinate system in the Radon domain gives the mean axial velocity for the data segment. The benefit of this method is an estimate of the mean axial velocity which is independent of the center frequency of the propagating ultrasound pulse. The estimate will only depend on fs and fprf. Results of the estimation method is presented based on both simple generated RF harmonic data for different signal/noise ratios and simulated acoustic RF responses from a 3D measurement situation with an array transducer and a tube with plug flow. The new method shows improvement with a factor of 1.5–4 on the standard deviation on the estimated mean velocity for the simulated case.

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