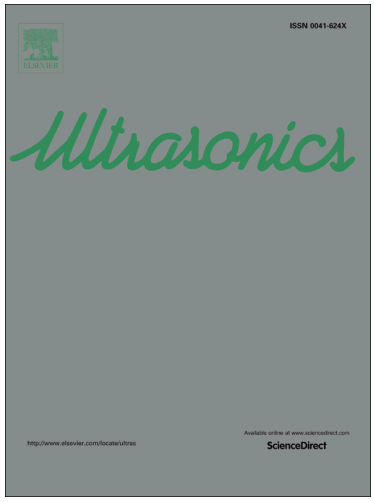

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Strain Estimation by a Fourier Series-based Extrema Tracking Algorithm for Elastography

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Abstract

In this paper, a new strain estimator using extrema tracking based on Fourier Series expansion (ETBFS) is proposed for ultrasonic elastography. In this method, the extremum is determined by solving an equation constructed by obtaining the first order derivative of the Fourier Series expansion and setting it to zero. Unlike other tracking algorithms, the ETBFS method can locate the extrema of radio frequency (RF) signals exactly between two adjacent sampling points and achieve a sub-sample accuracy without additional explicit interpolation. The correspondence between the located extrema in the pre- and post-compressed RF signal segments are constructed with a fine matching technique, with which the displacements and strains are estimated. Experimental results on a finite-element-modeling (FEM) simulation phantom show that the new proposed method can provide a more accurate displacement estimation than the standard cross-correlation(CC)-based method and the scale-invariant keypoints tracking (SIKT) algorithm. Moreover, performance analysis in terms of elastographic signal-to-noise ratio (SNR_e), elastographic contrast-to-noise ratio (CNR_e) and the real-versus-estimated strain error (RESE) also indicate that the dynamic range of the strain filter and its sensitivity can be improved with this new method.

Keywords: Elastography, Elastogram, Strain estimation, Fourier series, Extrema tracking

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