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Automated tracking of solar coronal loops and detection of their oscillations

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Abstract

Identification and tracking of solar coronal loops is key to understanding solar magnetic field. Slow and fast Magnetohydrodynamic oscillation of tracked loops from sequence 171Å extreme ultra – violet images was detected. The method was demonstrated using 171Å images taken by SDO/AIA on 14 August 2010 and 20 January 2012. Two dimensional continuous wavelet transform (CWT) was used to clarify images of loops and to eliminate additional noises. Applying OCCULT method, the loops were labeled and their widths were determined. The Zernike moments of loops as an invariant property (transformation, scale and rotation) of loops were calculated. Then, the Probabilistic Neural Network (PNN) was used for identification of the same loops from sequence images. Slow longitudinal Magnetohydrodynamic oscillations were extracted by averaging pixels intensities perpendicular to tube axis. Fast oscillations in distinguishable tubs were observed observable by averaging pixels' intensities in direction of tube axis. Also, periods, phase velocity, and damping time of oscillations were computed.

Keywords: sun, loop, Wavelet transform, wave, magnetohydrodynamic, Zernike, neural network

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