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# Chaotic Sequence Noise Reduction and Chaotic Recognition Rate Improvement Based on Improved Local Geometric Projection

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**Abstract :** A chaotic time series noise reduction method based on the fusion of the local projection method, wavelet transform, and particle swarm algorithm (referred to as the LW-PSO method) is proposed to address the problem of false recognition due to noise in the recognition process of chaotic time series containing noise. The method first uses phase space reconstruction to recover the original dynamical system characteristics and removes the noise subspace by selecting the neighborhood radius; then it uses wavelet transform to remove D1-D3 high-frequency components to maximize the retention of signal information while least-squares optimization is performed by the particle swarm algorithm. The Lorenz system containing 30% Gaussian white noise is simulated and verified, and the phase space, SNR value, RMSE value, and K value of the 0-1 test method before and after noise reduction of the Schreiber method, local projection method, wavelet transform method, and LW-PSO method are compared and analyzed, which proves that the LW-PSO method has a better noise reduction effect compared with the other three common methods. The method is also applied to the classical system to evaluate the noise reduction effect of the four methods and the original system identification effect, which further verifies the superiority of the LW-PSO method. Finally, it is applied to the Chengdu rainfall chaotic sequence for research, and the results prove that the LW-PSO method can effectively reduce the noise and improve the chaos recognition rate.

**Keywords :** Schreiber noise reduction, wavelet transform, particle swarm optimization, 0-1 test method, chaotic sequence denoising
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