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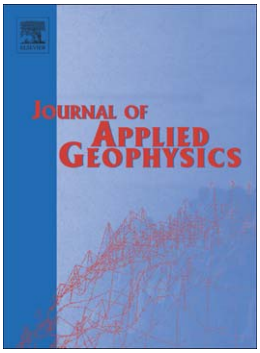

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Reza Ghanati, Mohammad KazemHafizi, Rahim Mahmoudvand, Mahdi Fallahsafari

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Filtering and Parameter estimation of Surface-NMR data using Singular Spectrum Analysis

Reza Ghanati [1] Mohammad KazemHafizi [1,3] Rahim Mahmoudvand [2] Mahdi Fallahsafari [1]

[1] ***Institute of Geophysics, University of Tehran , North Kargar Avenue, Tehran, Iran***

[2] ***Statistics Department, Bu-Ali Sina University, Hamedan, Iran***

[3] ***Corresponding author: Email: Hafizi@ut.ac.ir, Phone Number: +98 (21) 88630477***

Abstract:

Ambient electromagnetic interferences at the site of investigation often degrade the signal quality of the Surface-NMR measurements leading to inaccurate estimation of the signal parameters. This paper proposes a new powerful de-noising method based on singular spectrum analysis (SSA), which is a nonparametric method for analyzing time series. SSA is a relatively simple method and can be understood using basic algebra notations. Singular value decomposition (SVD) plays a crucial role in SSA. As the length of recordings increases, the computational time required for computing SVD raises which restricts the usage of SSA in long-term time series. In order to overcome this drawback, we propose a randomized version of the singular value decomposition to accelerate the decomposition step of the algorithm. To evaluate the performance of the proposed strategy, the method is tested on synthetic signals corrupted by both simulated noise (including Gaussian white noise, spiky events and harmonic noise) and real noise recordings obtained from surface-NMR field surveys. Our results show that the proposed algorithm can enhance the signal to noise ratio significantly, and gives an improvement in estimation of the surface-NMR signal parameters.

Keywords: Singular Spectrum Analysis, Weighted Correlation, Surface Nuclear Magnetic Resonance, Noise Reduction, Parameter Estimation..

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