20PM1C Array and Multichannel Processing

Friday, May 20, 13:20–14:40, Room C

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20PM1C-4 Nonlinear Wavelet Denoising for Improved Bearing Estimation in Ocean under Non-Gaussian Noise Conditions.

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Bearing estimation of underwater acoustic sources is an important aspect of passive localization of targets in the ocean. The performance of standard bearing estimation techniques degrades under low signal-to-noise ratio (SNR) conditions of the signal received at the sensor array. In ocean environment, the noise process is usually assumed to be a Gaussian process. However, statistical measurements of Ocean acoustic ambient noise data indicate that noise statistics may deviate significantly from Gaussian to strongly non-Gaussian in some environments. In the last few years, there has been a considerable interest in the use of the Discrete Wavelet Transform (DWT) for denoising signals. It is known that conventional wavelet transform, which is a linear, can be used for denoising signals in Gaussian noise, but this method is not suitable if the noise is strongly non-Gaussian. In this paper, we exploit the possibility of employing the nonlinear wavelet denoising to improve the performance of bearing estimation techniques in Ocean in strongly non-Gaussian noise environment. We propose the application of nonlinear wavelet denoising to the noisy signal at each sensor in the sensor array to boost the SNR before performing bearing estimation by known techniques (MUSIC and Subspace Intersection). It is shown that denoising leads to significant improvement in the performance of the bearing estimator. Computational results are presented to show that denoising leads to significant reduction in the mean square errors (MSE) of the Bearing estimates, and enhancement of resolution of closely spaced sources.