Department of Electrical Engineering & Computer Science
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Experimental Investigation of Temporal and Spatial Coherence Length of Under Water Sound Waves

ABSTRACT - Masterthesis

Cross Correlation Method is devoted solely in this work to investigate temporal and spatial coherence of under water acoustics. This project addresses Time Delay Estimation technique using the conventional Cross Correlation Method to compute delay between signals received at two spatially separated hydrophones in the presence of uncorrelated noise which are real and jointly stationary random processes. The time argument at which the correlator achieves the maximum is the delay estimate. Nevertheless, since the sampling frequency of the received signal is usually kept as low as possible in order to reduce computational complexity, the true location of the maximum correlation coefficient is not constrained to discrete increments, yet it may fall between the discrete sampling points that resulting in estimation inaccuracy. Therefore, interpolation techniques to the cross correlation function are proposed in this work to improve estimation accuracy. The model of the physical phenomena presumes stationarity, which means signal and noise remain stationary in finite observation time T and therefore estimator is constrained to operate an observation of a finite duration. Simulation part plays important role to perform analysis of interpolation techniques performance based on how the interpolated delay estimates converges to the actual delay values in various SNR conditions. Finally, an automated system with best time delay interpolation technique is developed, ready to compute time delay estimates in practical measurement, provided with optimum memory utilization in accordance to reduce computational complexity by computational engines.