Low Complexity Residual Doppler Shift Estimation For Underwater Acoustic Multicarrier Communication

Abstract:

We propose two computationally efficient residual Doppler shift estimation methods for underwater acoustic multicarrier communication. The first method is based on computing the phase of the root of a low order polynomial. The second method is a closed-form least squares estimate given the unwrapped phases of the minimal eigenvector of a small data matrix. The complexities of both estimates are significantly lower compared to the methods commonly used in underwater acoustic multicarrier communication, which result in a nonlinear least squares estimators and thus require a fine grid search in the frequency domain. Numerical simulations show that the mean square errors of the proposed methods have similar performance as the common estimation techniques, achieve the Cramer-Rao lower bounds at low noise levels, and agree with their theoretically derived variances. Pool experiments and sea trial results further demonstrate that the suggested estimates yield similar results as the common non-linear least squares estimates but at a lower complexity.