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(Research Article)
DOA estimation using time-frequency distributions

H. Solati, M. Karimi*
School of Electrical and Computer Engineering, Shiraz University

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Abstract

This paper addresses the problem of direction of arrival (DOA) estimation for nonstationary signals using time-frequency distributions (TFDs). The averaging method is used for selecting the time-frequency points. For this purpose, a strength indicator is used to remove the points with more noise. The method of obtaining the strength indicator is described and numerical simulations are used to show its effect. In addition, the DOA estimation method using time-frequency distributions when the number of sources is more than sensors is described and simulated. In addition to the narrowband model, the broadband model is also used for the output signal of the sensor array, which increases the accuracy of the performance evaluation of DOA estimation methods. The effect of time-frequency kernels, number of snapshots, number of sensors, signal-to-noise ratio (SNR), bandwidth and signal type are investigated in simulations. The effect of window length and window type in the Wigner-Ville kernel is also examined. The computational complexities of both conventional and time-frequency DOA estimation methods are also compared. The results show that as the strength indicator increases, the estimation error decreases, but with a large increase in the strength indicator, the number of averaging points also decreases, which increases the error. Simulation results show that for low SNRs, the TFD based DOA estimation methods perform better, while for high SNR values, both conventional and TFD based approaches have similar performances.

Keywords: Array processing, Time-Frequency Distributions (TFD), DOA estimation, Nonstationary signals.

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* Corresponding author E-mail: karimi@shirazu.ac.ir