An Investigation of Direction of Arrival Estimation Scheme for Correlated Signals in Wireless Communication Systems

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Abstract

Over the past decades, a number of DOA estimation algorithms have been studied and the most outstanding subspace super resolution algorithms such as MUSIC and ESPRIT became favorable topics of study in estimating direction of arrival (DOA). MUSIC is the most commonly used super resolution algorithm due to its accuracy, high resolution and stability under certain conditions. However, MUSIC algorithm works on the premise that the signals are uncorrelated and can lead to degradation of the performance of MUSIC in multipath propagation of wireless communication systems that have highly correlated signals. This failure is due to loss of non-singularity property of the covariance matrix that is used in the signal model. This paper focuses on investigating a computationally efficient spatial smoothing technique using Uniform Linear Arrays (ULA) to solve the problem of correlation in wireless communication systems. The direction of arrival estimation is simulated on a MATLAB platform with a set of input parameters such as array elements, signal to noise ratio, number of snapshots and number of signal sources and the RMSE has been used to show the performance. Simulation has been conducted and the results show that forward-backward spatial smoothing (FBSS) method can achieve an accurate and efficient DOA estimation for correlated signals.

Keywords: MUSIC algorithm, DOA estimation, Uniform Linear Array (ULA), Forward/Backward Spatial Smoothing

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