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A HERMITIAN MAPPING APPROACH TO UNITARY ROOT-MUSIC ALGORITHM FOR CYCLOSTATIONARY SIGNALS

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Abstract. *By Hermitian mapping, we suggest unitary cyclic root-MUSIC algorithm to exploit the signal selective property of cyclostationary signals in this paper. To deal with correlated or coherent case, we design the forward backward cyclic autocorrelation matrix, without conjugate centrosymmetric array configurations. Compared with unitary root-MUSIC algorithm, the proposed method has a better performance for uncorrelated signals or coherent signals from the mathematical analysis of the mean square error. Finally simulation results show the effectiveness of the proposed method.*
Keywords: Array signal processing, Cyclostationarity, Direction of arrival, MUSIC, unitary root-MUSIC

1. **Introduction.** The problem of reducing the computational complexity of eigenspace-based methods via real-valued decomposition has recently drawn considerable attentions in the literatures [1]-[8]. For an array of centro-symmetric configurations, Haardt and Nossek developed the unitary ESPRIT algorithm by incorporating forward-backward averaging [5]. Pesavento *et al.* further studied the cenro-Hermitian property of the forward-backward spatial smoothing (FBSS) autocorrelation matrix [6][7], and proposed the unitary root-MUSIC algorithm for correlated or coherent signals [8].

Recently, cyclostationary properties have been widely considered for direction-of-arrival (DOA) estimation [9]-[14]. Similar to the conventional eigenspace-based methods, cyclic DOA algorithms suffer from a degradation of its performances in the presence of highly correlated or coherent signals of interest (SOIs). Since the cyclic autocorrelation matrix has the Toeplitz property, the spatial-smoothing based cyclic MUSIC algorithm can provides satisfactory performance even in the presence of strong signals not of interest (SNOIs) [12]. After studying the Hankel property of the conjugate cyclic autocorrelation matrix for the uncorrelated SOIs, Y.T. Lee and J.H. Lee presented a Hankel approximation method (HAM) in conjunction with conjugate cyclic MUSIC to cope with the coherent situation [13]. On the basis of the FBSS technique, we firstly brought forward a Hermitian-mapping based cyclic DOA algorithm, which obtains an improved resolution for both cyclic MUSIC and conjugate cyclic MUSIC [14], but the computational cost of this algorithm is still high due to the exhaustive spectral search rather than the eigendecomposition.

To avoid of this costly spectral search, we suggest unitary cyclic root-MUSIC algorithm in this paper. To deal with partially correlated or coherent case, we construct the forward backward cyclic autocorrelation matrix by Hermitian mapping, and use the real-valued decomposition to reduce the computational complexity, without conjugate centrosymmetric array configurations. Compared with the unitary root-MUSIC method, the proposed