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”EDRIVE#5 - Resynchronization of sequential measurements using the Maximally-Coherent Reference technique”

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Remote sensing of a physical field generated by a small number of sources is limited by the size of the available array of sensors and by the array density. These limitations may lead to asynchronously measuring the field by sequentially moving a small prototype array around its facets, however at the cost of losing the phase information between every array position. Resynchronization using references, i.e. fixed sensors, can be used for phase retrieval, given that these references are of a number that is at least equal to the stochastic dimension of the field, and are not inter-correlated to the degree that hinder them from spanning the source signals' subspace. However, when the number of references largely exceeds the number of sources, the reference cross spectral matrix becomes ill-conditioned leading to the irrelevance of the least squares solution (LSS). Although the truncated singular value decomposition (TSVD) was successfully applied in the literature to solve this problem, its validity is restricted only to the case of scalar noise on the references. In this paper, a solution based on finding a set of virtual references that is maximally correlated with the field measurements, named the Maximally-Coherent Reference Technique (MCR), accompanied with a technique for estimating the number of sources, are proposed for resynchronization. The method is validated both numerically and by using real acoustical data from an e-motor, and its results was compared to those of the LSS and the TSVD when employed for the same purpose.

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