

# ARRAY SIGNAL PROCESSING

Annexure

## 1. INTRODUCTION

Array geometry. Array as a space-time filter. Frequency-wave number response and beam pattern. Uniform and uniformly weighted linear arrays. Array steering. Array performance measures. Planar arrays. Beamwidth and directivity. Array manifold vectors. Rectangular arrays. Snapshot models. Space-time random processes. Array response to space-time processes. Parameter wave-number models.

## 2. OPTIMUM WAVEFORM ESTIMATION

Optimum beamformers. Discrete interference. Spatially spread interference. Multiple plane wave signals. Mismatched MVDR and MPDR beamformers. LCMV and LCMP beamformers. Eigenvector beamformers. Beamforming for correlated signals and interference. Broadband beamformers.

## 3. ADAPTIVE BEAMFORMERS

Estimation of spatial spectral matrices. Sample matrix inversion. Recursion least squares. Efficient recursive implementation algorithms. Detection of signal subspace dimension. Eigenspace and DMR beamformers. Beamspace and broadband beamformers.

## 4. MAXIMUM LIKELIHOOD PARAMETER ESTIMATION

Parameter estimation models. Cramer-Rao bounds. ML estimation. Computational aspects. Polynomial parametrization. Detection of number of signals. Spatially spread signals. Beamspace algorithms. Sensitivity and robustness.

## 5. OTHER PARAMETER ESTIMATION METHODS

Quadrature algorithms. Subspace algorithms; MUSIC, minimum-norm, ESPRIT and Propagator method. Correlated and coherent signals. Beamspace MUSIC and beamspace unitary ESPRIT. Extension to planar arrays.

### TEXT BOOK:

1. H.L.VANTREES: Optimum Array Processing (2002), Wiley.

### REFERENCE:

1. N.K.BOSE and C.R.RAO et al : Hand Book of Statistics 10: Signal Processing and its Applications (1993), Elsevier.
2. P.STOICA & J.LI: Robust Adaptive Beamforming (2005), John Wiley.