Adaptive Antenna Arrays and Adaptive Beamforming

Authors:

Aniket Rege 14EC108

Prabhanjan Mannari 14EC135

Ritesh Waykole 14EC156

Abstract:

Adaptive array antennas use smart signal processing algorithms to allow the antenna to steer the beam to any direction of interest while simultaneously nulling interfering signals. Beamforming is the technique used to create the radiation pattern of the array by constructively adding the phases of the signals in the direction of targets and nulling the pattern of undesired/interfering targets, thus providing directional sensitivity without physically moving an array of receivers and transmitters. This can be implemented with a simple FIR tapped delay line filter, whose weights may be changed adaptively to provide optimal beamforming, which reduced the Minimum Mean Square Error (MMSE) between the actual and desired beam pattern. The most common Adaptive beamforming algorithms explored are LMS algorithm and RLS algorithm, both of which are explored in this project. The LMS algorithm is described by a recursive equation which updates filter weights in such a manner that they converge to the optimum filter weight in an inverse accordance with the gradient of the mean square error vs. filter weight curve, i.e. changing the weights in a direction opposite to that of gradient slope. We hope to explore these techniques and create our own modification to existing algorithms for a more efficient beamforming process.