修士論文題目　A Study of Reactance based Uniform Circular Array Antenna for DOA Estimation
(DOA推定のためのリアクタンス装荷円形アレーアンテナに関する研究)

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Antenna arrays are becoming increasingly important in wireless communications. Arrays of antennas are used to direct radiated power towards a desired direction. Many studies have shown that when an array system is appropriately used, it helps in improving the system performance by increasing channel capacity and spectrum efficiency. It also reduces multipath fading, and system complexity. Thus, estimating the directions of arrival (DOAs) of electromagnetic waves impinging on antenna arrays is an important issue in array signal processing for wireless communication.

In this thesis, a new technique of estimating DOAs is proposed for the Reactance based UCA antenna. This technique called Active Ports Reactance Domain MUSIC (APRD-MUSIC) algorithm. In order to estimate DOAs efficiently, optimal reactance values are used. By optimizing the reactance values, the proposed system has good performance in estimating DOAs in terms of resolution, and estimation errors. We simulate the DOA estimation by using APRD-MUSIC, furthermore, we analyze statistical performance of APRD-MUSIC estimator with Cramer-Rao Lower Bound. The results shows that the APRD-MUSIC estimator provides good performance in resolution and precision. With its larger size, this antenna system achieves low mutual coupling between the antenna elements. This estimator therefore, is efficient, and estimate the DOAs better as compared to ESPAR Antenna and conventional UCA since it also has few number of antenna elements.

The first chapter provides an introduction and the background of adaptive array antenna systems, including a historical perspective on mobile communications and related antenna technologies. The second chapter provides a discussion on Direction-of-Arrival (DOA) estimation, different types antenna arrays. The third chapter discusses Reactance based UCA antenna theory, impedance matrix and reactance value calculation in order to find the optimum reactance for the RB-UCA antenna using the Hamiltonian algorithm for optimization. The fourth chapter gives a detailed understanding of APRD-MUSIC algorithm; with the help of simulation results obtained using MATLAB and performance analysis. The fifth chapter discusses the experimental implementation and DOA estimation in a practical setting. Finally, the sixth chapter concludes the thesis with a summary of the Reactance Based Uniform Circular Array Antenna (RB-UCA).