USING POLARIZATION RECONFIGURABLE ANTENNAS IN A SMARTPHONE-ENABLED DIRECTION OF ARRIVAL SYSTEM

E. S. Foster, R. D. Haley, Q. E. Manley, R. D. Moore,
J. D. Barrera, G. H. Huff, and J.-F. Chamberland
Department of Electrical and Computer Engineering
Texas A&M University
College Station, TX 77843-3128

Providing estimation for the direction of arrival (DOA) has been studied in signal processing for several decades. Many algorithms have been proposed for this purpose and their performance has been studied in a variety of ways and using a variety of systems and estimation techniques. The multiple signal classification (MUSIC) algorithm remains quite popular for this since it provides a very robust Eigen-based decomposition of the signal space. The analysis is often limited to periodic or rotationally symmetric (circular) element distributions, but these periodic element distributions have demonstrated the effectiveness of the MUSIC algorithm and provide very good resolution. However, there are some unavoidable drawbacks (namely aliasing) that may present significant challenges when the spacing among elements is large with respect to a wavelength so a number of non-periodic configurations have also been investigated.

This work studies the use of reconfigurable antennas (at the system level) to address some of these artifacts of the MUSIC algorithm and other subspace methods by developing a versatile direction finding system using polarization reconfigure antennas. In addition to this, the use of Android smartphones and cloud-based (remote) processing are examined to provide a more flexible system which can be adapted and controlled remotely. This concept follows the general framework used by the Android-controlled phased array system in, but it interfaces different subsystems and has programming requirements so the final system remains quite different. The process for this begins with the phone app subsystem; it selects the configuration of the antenna array being used and sets the polarization of each antenna on the array. From there, the control system reads in the data sent from the phone app and sends the current configuration to the data processing subsystem. The control subsystem then takes the current configuration sent from the phone app and polarizes the antenna array, and the data processing block takes in the phase difference between each antenna in the array and calculates the transmitting antenna's direction of arrival. Altogether, it provides a modular and expandable framework for remotely handling the biasing and control of the antenna array, and provides visual feedback from the data server on the performance of the array.