Investigating Pattern Reconfigurable Antennas for use in Adaptive Arrays

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Reconfigurable antennas offer dynamic behavior by being able to modify one or more of their fundamental operating characteristics (e.g., pattern, frequency, and polarization) via electrical, mechanical, or other means. As a result, pattern reconfigurable antennas, along with the other reconfigurable antenna types, possess an added degree of freedom that may enhance or expand system performance, especially when the elements are configured in an array setting. Previous investigations in the field have begun to examine the capabilities of pattern reconfigurable antennas with beam tilts. However, questions still remain about the potential benefits that these antennas can provide in phased arrays.

Currently, the work explores a scenario that utilizes pattern reconfigurable antennas with beam tilts in adaptive arrays. An adaptive array system controls its pattern in response to the signal environment. Such systems look to automatically sense and suppress the presence of interference noise sources while simultaneously enhance desired signal reception, therefore affording more flexibility, reliability, and improved reception performance compared to that of conventional arrays. Inclusion of radiation reconfigurable antennas in an adaptive array system furnishes the means to increase performance and functionality.

The work adopts a technique used for adaptive arrays which allows for relatively large element spacing while maintaining good output signal-to-interference-plus-noise ratio (SINR). Larger element spacing provides an advantage for pattern reconfigurable elements because when configured in an array with smaller element spacing, it is difficult for the elements to maintain their individual pattern characteristics due to the effects of mutual coupling. Thus, the focus of the investigation lies within utilizing radiation reconfigurable antennas not only with relatively large element spacing but with a small number of antenna elements in the adaptive array (i.e., small package scenarios). Employing relatively large element spacing can impact performance by diminishing the effects of mutual coupling. Likewise, a system package containing an adaptive array composed of a small number of pattern reconfigurable antenna elements could provide major benefits in applications requiring a small footprint (minimal size and low weight for portability). Results indicate how pattern reconfigurable antennas contribute to enhancing adaptive array performance due to their functional behavior.