Adaptive and Reconfigurable Radar for Optimum Sharing

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The wireless spectrum is a crucial resource that is shared between both civilian and military applications. It has become an essential dimension of everyday life as well as warfighting technologies. Radar systems have been challenged to share this spectrum with other wireless users because of their unique needs: "listening" time, directional transmission, high-power reconfiguration, and high receiver sensitivity. To effectively operate in a congested wireless environment, the radar of the future must be *adaptive* and *reconfigurable*. It must *adapt* to the surrounding wireless environment in real-time, sensing and responding to the presence of wireless devices in the spectrum. It must be able to *reconfigure* its circuitry, transmission pattern, and waveform to most effectively use spectrum and energy resources to accomplish its objectives in collaboration with other wireless devices in the area.

Our fundamental research supporting the construction of an adaptive radar capable of collaboration has been focused in the following areas: (1) secure wireless communication with surrounding wireless devices, (2) creation of radar spectral mask and transmit pattern based on harmful interference power levels and locations of surrounding wireless devices, (3) fast circuit and array reconfiguration techniques for high-power radar transmitter amplifier matching circuitry based on the spectrum mask and transmit pattern, (4) high-power reconfigurable matching circuits for tuning radar performance to facilitate real-time changes in operating frequency and transmit mask requirements, and (5) integration with presently ongoing spectrum management platforms for both military and civilian communications. Initial research results are described and presented demonstrating feasibility of addressing challenges in directional communication, dynamic spectral and spatial mask construction, fast circuit and array reconfiguration algorithms, high-power reconfigurable matching circuits, and state-of-the-art spectrum and spatial resource management platforms. The presentation concludes by describing next steps in the research path toward the development of a frequency and spatially agile adaptive radar.