

Interference Mitigation via Phase Only Transmit Nulling: Preliminary Experimental Results

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The increasingly crowded RF spectrum necessitates development of techniques that foster coexistence between multiple RF users. Radar systems can typically mitigate received interference using sidelobe cancellation and adaptive beamforming. In the future, radar systems could possibly use similar techniques to produce nulls in the transmit beampattern further reducing RF fratricide. However, transmit nulling is difficult due to the constant modulus constraint associated with the waveforms transmitted by high power radar systems. Several algorithms have been developed that attempt to determine phase only (PO) weights capable of inducing a transmit null. In this talk, the re-iterative uniform weight optimization (RUWO) algorithm is used as a means to produce PO weights from a measured interference covariance matrix.

The Radar Division of the Naval Research Laboratory (NRL) is currently developing a coherent eight-channel X-band radar testbed to investigate waveform diversity and multiple input multiple output (MIMO) techniques. The testbed consists of eight independent transmit and receive channels as well as an X-band antenna array. The transmitter is composed of two four-channel vector signal generators (VSG) capable of producing a signal with 100 MHz of bandwidth anywhere between 9 and 10 GHz. The receiver contains eight dual-stage down-conversion analog receivers and a 16-bit eight-channel analog to digital converter. The system also contains receiver protection and blanking circuitry to allow the transmitter and receiver to share a common antenna. The X-band antenna is composed of 18-cards each containing 32 vertically polarized corporate fed dipoles.

A preliminary four-channel open-air experiment has been conducted to explore the ability of adaptive transmit nulling schemes to produce nulls below the sidelobe error floor of the antenna. Interference was recorded from four channels of the X-band array using a digital oscilloscope. The RUWO algorithm was used to construct a set of PO weights that were applied to a single four-channel VSG and transmitted from the array. Results indicating the performance of the four-channel experiment will be presented. Challenges and future research questions will be discussed.