

Charles Baylis

Electrical & Computer Engineering / Engineering & Computer Science

Enabling Cognitive Radar Through Waveform Diversity and Power Amplifier Circuit Optimization

The proposed work will allow radar systems to operate in different bands, optimizing jointly the waveform and the power amplifier circuitry. This coincides with a new wireless protocol known as dynamic spectrum access (DSA), where users of wireless spectrum are allowed to use frequencies owned by other users if the primary user is not transmitting. The proposed work will benefit the ability to (1) stay within the assigned frequency range (linearity) and (2) allow efficient operation of the transmitter. The research will examine: (1) useful waveform adjustments that will optimize linearity and efficiency, (2) transmitter circuit approaches for linearity and efficiency, and (3) the creation of a new algorithm to simultaneously optimize both the waveform and circuitry. This research is interdisciplinary, as it combines advances in the areas of microwave circuit design with waveform diversity. The combination of these two fields will enable intelligent, real-time reconfiguration of circuits and waveforms in radar systems.

Undergraduate student research assistants funded through this grant will perform research toward the above stated goals through specific work in (1) algorithm and coding for waveform adjustments, (2) circuit design and nonlinear measurements (including operation of a new nonlinear measurement bench in the Baylor Wireless and Microwave Circuits and Systems Research Laboratory), and (3) mathematical analysis and algorithm coding toward an approach of joint waveform and circuit optimization. Task 3 involves significant work in the signal processing and waveform diversity areas, in addition to microwave engineering. Involvement in this research will allow undergraduate students to pioneer significant uncharted territory in radar signal and system design. This work is of significant interest to both the Naval Research Laboratory and Air Force Research Laboratory, and the work performed under this grant is expected to be used to garner external funding for a project in this area.