Recent Developments on Spectral Containment of Radar Signals

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Spectral containment of active radar emissions is of growing concern due to continued erosion of allocated radar spectrum and the increasing congestion driven by consumer demand for bandwidth-gluttonous wireless video applications. Strict new emission requirements are forcing the careful consideration of how to achieve radar spectral containment within the context of the ever-present pressure for enhanced sensing performance. Consequently, it is imperative that a holistic perspective be taken that addresses the characteristics of the physical signal that is launched from the radar, inclusive of electromagnetics, systems engineering, and signal-processing attributes.

A holistic perspective for radar emission design necessitates a mathematical representation of the intended waveform that permits physical generation. This representation must be twice continuously differentiable to satisfy the underlying electromagnetic theory and relatively well-contained spectrally and should provide some means with which to parameterize the waveform for optimization of the resulting physical signal according to attributes like range sidelobes and Doppler tolerance.

Within the context of waveform diversity, radar spectrum engineering can be posed as an optimization problem in spectral containment (spectral shaping). For optimization to be meaningful, this framework must account for the transmitterinduced distortion, which may be measured with actual hardware or mathematically modeled, so that the ultimate physical emission yields the desired sensing performance while also maintaining the required spectral containment and avoidance. Ongoing work is exploring different approaches to optimize physical emissions and to develop a formulation for the joint optimization of the waveform and transmitter.

Some recent developments on the design and implementation of physical radar waveforms for spectral containment, including experimental results for various new emission schemes, will be presented.