Cognitive Radar II: The Fully Adaptive Approach

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Course Description:

Recent advances in radar front-end hardware affording unprecedented flexibility, adaptivity and waveform diversity, coupled with continued advances in high performance embedded computing (HPEC) and knowledge-aided (KA) methods, has afforded the opportunity to "re-invent" radar with a new and powerful set of tools/assumptions that include:

- Arbitrary waveform selection
- Transmit adaptivity (waveform, spatial, polarimetric, etc.)
- Environmental awareness via a dynamic database and the availability of both endogenous and exogenous sensors
- Real-time KA methods adapted from the DARPA/AFRL KASSPER project and extended to the transmitter as well as the receiver
- Radar scheduler optimization

When effectively integrated, the result is an advanced radar architecture that exhibits the key rudimentary properties of a "cognitive" system, i.e., the ability to adapt "on-the-fly" both transmit and receive functions based on both its own sensing, as well as on information from a multitude of other sources (e.g., digital terrain maps, SAR imagery, etc.) via an environmental database (EDDB) and a real-time KASSPER HPEC architecture to exploit it.
Topics covered in this tutorial include:

- Derivation of optimal and adaptive multi-input, multi-output (MIMO) transmitter equations with numerous examples of potential benefits
- Application of optimal and adaptive MIMO techniques to optimizing detection, interference cancellation, and target identification
- Introduction to knowledge-aided (KA) methods and the DARPA/AFRL KASSPER real-time HPEC architecture
- Integration of full adaptivity (transmit and receive) and KA methods