Presentation Title: Distributed Sensing and Radio Frequency Tomography

Topic / key words: Radio Frequency, Remote and Close-In Sensing, Tomography, Spatial and Spectral Diversity, Congested Spectrum Environments, Signal and Image Processing

Abstract (200 words):

Many applications require imaging, shape reconstruction and material characterization of objects in the presence of interference, including concealed weapons through the wall sensing, below ground imaging, foliage penetration, and quality control in autonomous manufacturing. Recent advances in computational science and radio frequency (RF) technology improve the potential for successful applications of RF Tomography (RFT) to these challenging problems. RFT systems are supported by a variety of technologies, but they all share one common feature in that they all require viewing of the environment from a variety of angles or geometric diversity of illumination and observation. For applications where sensing occurs using electromagnetic waves, the most common is radar. Classical imaging systems employ a single aperture that is moved to form a synthetic aperture. However, numerous simultaneous fixed or moving apertures may be used. RFT typically employs a distributed system of low-cost, reconfigurable electromagnetic transmit and receive antennas placed somewhat arbitrarily around a region of interest. RFT transmitters radiate known waveforms, but sources of opportunity may also be exploited, while spatially distributed receivers sample scattered fields and relay this information to a central processor. The distinctive attribute of RFT is high resolution: sub-wavelength, range-independent, bandwidth-independent, resolution which is a function of the carrier frequency. This tutorial will present the principles of RFT, and the relationship between classical electromagnetics, signal processing, and applications specific phenomenology. This tutorial will include results from our most recent experiments in ground penetrating radar, and trends with many different applications such as the geolocation of passive RF tags in spectrally congested environments.

Target audience: Junior and mid-career radar, remote sensing, and signal processing scientist and engineers, as well as senior scientist and engineers with an interest in Distributed Sensors and RF Tomography systems.

Learning outcomes: An understanding of the benefits and limitations to Distributed Sensors and RF Tomography systems, even as commercial communications (wireless) and computing technology makes said systems affordable and an effective alternative to classical approaches to solving close-in sensing problems.

Prior events where this topic has been presented: 2016 IEEE SysCon Orlando FL, 2015 IEEE Radar Conference Washington DC, 2015 IEEE Radar Conference South Africa, 2015 IEEE NAECON Conference Dayton OH, IEEE Sensors 2014 Valencia Spain

Other speaking experience of applicant

Keynote speaker 2015 IEEE NAECon in Dayton OH, Banquet speaker 2014 IEEE NAECon in Dayton OH, 2014 NATO Specialist meeting on Waveform Diversity in Berlin Germany, 2014 Radar Week invited lecturer at Ecole National Polytechnique

Geographical preferences/constraints (Please note countries/regions where you would be willing to travel)
None