Seminar Title: Radar Systems for Homeland Security Applications

Time: 3:00-4:00 PM, Friday, March 28, 2014
Location: ECE 101 Lankford Lab

Speaker:
Ram M. Narayanan
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Abstract:
This talk will introduce the science and technology considerations for radar towards homeland security applications. These include through-wall detection and imaging of humans, detection of weapons concealed beneath clothing, detection of buried mines and improvised explosive devices (IEDs), detection and imaging of hidden contraband in containers, and border and perimeter surveillance. Each application is unique requiring the optimum choice in frequency, bandwidth, polarisation, and processing considerations. Imaging needs are met using techniques such as synthetic aperture radar (SAR) and radar tomography. Low frequency signals are best for penetrating building walls and vegetation cover, while higher frequency signals at millimetre wavelengths are able to penetrate cloth materials and low-loss barriers. To achieve fine range resolution, short pulse or wide bandwidth signals are called for.

The talk will commence by reviewing different approaches to radar phenomenological modelling and hardware architecture implementations, and discuss their operation and performance. Different types of radar waveforms in general use will be discussed, both conventional and emerging. These will include pulsed, impulse, dual-frequency, FMCW (linear and stepped), noise (random and pseudorandom), and noise-like (chaotic), with special reference to the unique requirements for through-the-barrier imaging applications. We will then discuss how specific waveforms are affected by the EM environment and assess the limitations of current techniques. The tutorial will conclude by showing the results provided in several open literature publications on the versatile applications of radar in practical applications related to homeland security. Unique features associated with individual applications will be discussed in detail.

Speaker Bio:
Professor Ram M. Narayanan received his B.Tech. from IIT Chennai in 1976 and his Ph.D. from University of Massachusetts in 1988. He was a Design Engineer in BEL Ghaziabad (1976-83) and a faculty member at University of Nebraska (1988-2003). He is currently Professor of Electrical Engineering at Pennsylvania State University. He serves as Member of the IEEE Standards Committee for Ultra Wideband (UWB) Radar, Associate Editor for Radar for the IEEE Transactions on Aerospace and Electronic Systems, and Editor for Antenna Characterization and Measurements, Microwave System Design and Development, and Radar Remote Sensing Theory and Applications for the IETE Journal of Education. His interests are UWB radar systems and applications, radar networking, radar tomography, and RF tags. He is a Fellow of IETE, IEEE, and SPIE. He has published over 110 journal and 300 conference papers.