Title: Communication and Radar Sensing using Pulsones

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Abstract: 6G presents an opportunity to reflect on the fundamentals of wireless communication, as it becomes more and more difficult to estimate channels in high-mobility/high-Doppler environments when information signaling and signal processing are carried out in the traditional time-frequency (TF) domain. Also, the convergence of communication and radar sensing in 6G and beyond (inspired by the developments in intelligent transportation systems) has focused research attention on the design of waveforms that can simultaneously support both communication and radar sensing. This talk will focus on new research on communication and radar sensing using pulsones, a promising family of waveforms for this purpose. Pulsones are time domain realizations of quasi-periodic pulses in the delay-Doppler (DD) domain, parameterized by the delay period of the waveform with Zak theory providing the formal mathematical framework. Zak theory is to linear time-varying (LTV) systems as Fourier theory is to linear time-invariant (LTI) systems. As a communication waveform, pulsones offer the beneficial attributes of non-fading and predictability of input-output relation, leading to their robust bit error performance in rapidly time-varying channels. They are also natural waveforms for radar sensing as they provide good localization characteristics in the delay-Doppler domain. The optimum operating regime for both communication and radar sensing turns out to be the same, i.e., when the delay period and Doppler period of the waveform are larger than the delay spread and Doppler spread of the channel, respectively, a condition referred to as the crystallization condition.

Speaker bio: A. Chockalingam received the B.E. (Honors) degree in ECE from P.S.G. College of Technology, Coimbatore in 1984 and the M. Tech degree in E & ECE from IIT, Kharagpur in 1985. In 1993, he obtained the Ph.D. degree in ECE from IISc, Bangalore. From Dec.1993 to May 1996, he was a Postdoctoral Fellow and an Assistant Project Scientist with the Department of ECE, UC San Diego. From May 1996 to Dec. 1998, he was with Qualcomm, San Diego, as a Staff Engineer/Manager. He joined the faculty of IISc in Dec. 1998 as an Assistant Professor in the Department of ECE, where he is currently a Professor working in the area of wireless communications.