Biologically Inspired Radar and Waveform Design (3 Hours)

Alessio Balleri
Centre for Electronic Warfare, Information and Cyber, Cranfield University, Defence Academy of the UK, Shrivenham, SN6 8LA
Email: a.balleri@cranfield.ac.uk Tel: +44 (0)1234863867

Tutorial Content

1st Part (1.5 Hours)
1) The Radar signal model: narrowband vs wideband processing
2) The narrowband and wideband Ambiguity Functions
3) Brief recap of detection theory - Doppler tolerant waveforms
2) Estimation of target velocity and target range
3) Waveform Design vs Range and Doppler measurement accuracy
4) Linear Frequency Modulated chirps and Hyperbolic chirps: properties

2nd Part (1.5 Hours)
5) Echolocation in Bats: principles
6) Echolocation calls and their properties
7) The case of insect-feeding and nectar-feeding bats: radar comparisons
8) Other examples of echolocation in nature
9) The biosonar arms race between insects and bats: differences and similarities with Radar Electronic Warfare (EW)

This tutorial is designed for radar and sonar practitioners in academia and research, governmental and industrial organisations, engineers working in signal processing and sensing, and those with an underlying interest in the interaction between natural sciences and engineering. Previous seminars on this topic have attracted an average of 20-30 attendees.

Alessio Balleri is a Professor of radar systems with Cranfield University, at the Defence Academy of the UK, Shrivenham. He received the Laurea degree in telecommunication engineering (summa cum laude) (five legal years) from the University of Pisa, Italy, in 2004, and the Ph.D. degree in electronic and electrical engineering from the University College London (UCL), London, U.K., in 2010. From February 2010 to March 2012, he was a Research Associate in radar systems with the Department of Electronic and Electrical Engineering, UCL. From June 2004 to December 2004, he was a Visiting Research Scholar with the Department of Electrical and Computer Engineering, University of Illinois at Chicago. Dr. Balleri Guest Coedited a special issue on “Biologically Inspired Radar and Sonar Systems” for the IET Radar, Sonar and Navigation in 2012 and a special issue on “Emerging Radar Techniques” for the EURASIP Journal on Advances in Signal Processing, in 2013. He was the Technical Program Committee Co-Chair for the IET International Radar Conference 2017, Belfast, U.K. and the Technical Co-Chair of the 2020 IEEE International Radar Conference, Washington, DC, USA. He is currently serving as the Special Issue editor for the IET Radar, Sonar & Navigation journal and he is a member of the IEEE AESS Radar System Panel.