Applied Multiple-Input Multiple-Output Radar

G. J. Frazer
ISR Division, DSTO
Edinburgh, SA 5072
AUSTRALIA

TUTORIAL SYNOPSIS

The tutorial is an introduction to the general topic of multiple-input multiple-output (MIMO) radar and then a case study on the application of MIMO radar techniques to designing a skywave over-the-horizon radar (OTHR) optimised for detection of slow-moving targets. The emphasis is on attendees gaining understanding of the theoretical and practical factors involved in designing a real-world MIMO radar.

COURSE OUTLINE

Introduction to MIMO radar
- What is MIMO radar?
- Interpretations
  - Statistical/Diversity
  - Localisation
  - Track state estimation
  - Synthetic aperture
  - Spatially-coded phased array
- History + Daum’s Snake-Oil
- MIMO radar vs. MIMO comms
- Applications
  - Enhanced target detection
  - GMTI
  - Distributed Aperture Radar
  - Indoor Environments
  - OTHR
- Conclusions

Case Study: Mode-Selective Radar
- Introduction to OTHR
- What role MIMO in OTHR?
  - Mode-Selective OTH-Radar
  - Experimental Examples
  - Waveform Design
    - Fundamental constraints
    - Scatterer environment
    - Waveform set selection
    - Element, sub-array, and beamspace
    - Design example
  - Transmitter Issues
    - Waveform set cardinality
    - Non-physical beamspace
    - Peak/Avg power
    - Calibration
  - MIMO Processing
    - Radar processing
    - Adaptive processing
  - Aperture Design
    - Scatterer environment
    - Joint TX/RX properties
    - Skew-fire aperture
- Conclusions

AUDIENCE

The material is aimed at radar practitioners and graduate students with limited prior knowledge of either MIMO radar or skywave HF radar, those with an interest in joining these research disciplines, and researchers involved in current generation OTHR.

PRESENTER

Gordon J. Frazer (IEEE Member 1982, Senior Member 2009) is presently the Research Leader for High Frequency Radar in Intelligence, Surveillance and Reconnaissance Division, part of the Australian Defence Science and Technology Organisation, DSTO. He has contributed to several HF radar programs including: Jindalee, JORN, Dundee, Iluka I and II, and is the principal investigator for the SkyLOS, HILOW, HFLOSR and the MSE and MSR next generation OTHR programs. Dr Frazer is responsible for all facets of DSTO’s high-frequency radar program, including research and development aspects for JFAS/JORN evolution, next generation OTHR, ISR applications of HF radar, ballistic missile defence applications of HF radar, and HF surface-wave radar. His research focus is the development and transition to service of third generation over-the-horizon radar.