

EC4610 Course Outline

I. INTRODUCTION (Vol. I)

- Basic concepts
- Radar functions and classifications
- Derivation of the radar range equation
- Noise in radar systems
- Noise temperature; noise figure; signal-to-noise ratio
- Fundamental design tradeoffs and system block diagrams

II. ANALYSIS OF RADAR SYSTEMS (Vol. I)

- Review
 - Fourier transforms; spectrum of a pulse train
 - Basic probability and statistics; distributions
 - Linear systems; impulse response and transfer functions
 - Frequency response of cascaded linear systems
 - Mixing (heterodyning)
- Radar system design
 - Probability of false alarm; probability of detection
 - Integration of pulses; processing gain
- Radar cross section (RCS)
 - Definition of RCS
 - Scattering mechanisms
 - RCS of typical targets (aircraft, ships, ground vehicles, etc.)
 - RCS reduction methods; stealth philosophy
 - Fluctuating targets: Swerling types
 - Probability of detection for fluctuating targets

III. DOPPLER EFFECT AND CW RADARS (Vol. II)

- Doppler shift
- Continuous wave (CW) radar
- Doppler filtering
- Transmit/receive isolation
- Frequency modulated CW (FMCW) radar

IV. AIRBORNE RADARS (Vol. II)

- Moving target indication (MTI)

- Pulse doppler radar; ambiguities
- Clutter illumination conditions
- Clutter spectrum
- Delay line cancelers; range gates; FFT
- Noncoherent MTI and improvement factors

V. MICROWAVE DEVICES (Vol. III)

- Transmission line refresher
- Passive devices
 - Filters; multiplexers
 - Circulators; isolators
- Active devices
 - Power amplifiers: tubes and solid state devices
 - Low noise amplifiers
- Radar antennas

- Antenna parameters
- Reflectors; sidelobe control
- Arrays; grating lobes; scanning
- Multibeam antennas; active antennas; photonics

VI. SEARCH VS TRACKING RADARS (Vol. III)

- Search vs track functions; search radar equation
- Monopulse; conical scan
- Low angle tracking; multipath; frequency diversity

VII. RADAR RECEIVERS (Vol. III)

- Matched filters
- Analog and digital pulse compression (chirp)
- Ambiguity diagrams; measurement accuracy; resolution

VIII. SPECIAL RADAR SYSTEMS (Vol. IV)

- Synthetic aperture radar
- Ultra-wideband radar
- Stepped frequency radar
- Laser radar
- High frequency over-the-horizon radar

Bistatic radar
Weather radar