Radar and Electronic Warfare

1. Preliminaries, Radar Basics, Radar Detection

1.1 Preliminaries, brief review of some required math and electromagnetics
1.2 Basic pulsed radar, notions of PRF and unambiguous range
1.3 Range resolution and detectability
1.4 Maximum range , radar range equation
1.5 Receiver noise considerations, range ambiguities and solutions
1.6 Detection, Hypothesis testing, brief overview of Bayesian theory
1.7 Probability of detection and Probability of false alarm
1.8 Neyman Pearson criteria, Receiver operating curve (ROC)
1.9 Pre and Post Integration, Swerling models.

2. Doppler radar processing and pulse compression

2.1 Doppler effect, coherence, I and Q channels
2.2 CW radars, FM ranging
2.3 Pulse doppler radars and synchronous detectors
2.4 Doppler spectra, doppler processing with the FFT, digital filtering
2.5 Matched filter and correlation receivers, ambiguity diagram
2.6 Pulse compression, chirp, stretch processing, binary phase modulation
2.7 Barker, Costas and Frank coding schemes.
2.8 Appendix: complex time signals and the analytic signal.

3. Clutter and Tracking

3.1 Clutter RCS, airborne and ground clutter
3.2 Isodops, altitude return, mainlobe and sidelobe clutter
3.3 Doppler ambiguities
3.4 Low Medium and High PRF scenarios
3.5 MTI and clutter cancellers
3.6 Tracking, CORSO, sequential lobing scanning, monopulse techniques
3.7 Multiple target tracking: $\alpha\beta$ tracker and introduction to Kalman filtering

4. Electronic Warfare

4.1 Introduction and EW radar scenarios, EW hierarchy
4.2 Electronic Support (ELINT), receivers
4.3 Electronic Attack (Electronic counter measures -ECM),
4.4 Types of Radars: surveillance and tracking
4.5 Jamming, burn through, J/S ratios, passive EA, etc.
4.6 Electronic Protection (Electronic counter-counter measures -ECCM)

5. Wrap up: Conclusions and References