Sensors **2013**, *13*, 1146-1150; doi:10.3390/s130101146

OPEN ACCESS

sensors

ISSN 1424-8220

www.mdpi.com/journal/sensors

New Book Received *

Introduction to Modern EW Systems. Edited by Andrea De Martino, Artech House, 2012; 417 pages. Price: £119.00, ISBN 978-1-60807-207-1

Shu-Kun Lin

MDPI AG, Kandererstrasse 25, CH-4057 Basel, Switzerland; E-Mail: lin@mdpi.com

Received: 10 January 2013 / Accepted: 14 January 2013 / Published: 17 January 2013

The following paragraphs are reproduced from the website of the publisher [1].

Master the latest electronic warfare (EW) techniques and technologies related to on-board military platforms with this authoritative resource. You gain expert design guidance on technologies and equipment used to detect and identify emitter threats, giving you an advantage in the never-ending chess game between sensor guided weapons and EW systems. This unique book offers you deeper insight into EW systems principles of operation and their mathematical descriptions, arming you with better knowledge for your specific design applications.

Moreover, you get practical information on how to counter modern communications data links which provide connectivity and command flow among the armed forces in the battlefield. Taking a sufficiently broad perspective, this comprehensive volume offers you a panoramic view of the various physical domains—RF, Infrared, and electronics—that are present in modern electronic warfare systems. This in-depth book is supported with over 280 illustrations and more than 560 equations.

Table of Contents

Foreword **xi**
Introduction **xiii**
Acknowledgments **xiv**

Chapter 1 Introduction to Electronic Warfare Scenarios **1**
1.1 Definitions and EW Role in the Military Field 1
1.2 Main Weapons Systems of Interest to EW 3
1.2.1 Artillery Systems 6
1.2.2 Missile Systems 7

1.2.3 Active Homing Missiles 10
1.2.4 Track via Missile Systems 12
1.2.5 Passive IR-Guided Missiles 13
1.2.6 Sea-Skimming Missiles 13
1.2.7 Antiradiation Missiles 14
1.3 EW in Symmetric Conflicts 15
1.4 EW in Asymmetric Conflicts 20
References 21

Chapter 2 Evolution of Signal Emitters and Sensors 23
2.1 Introduction 23
2.2 Sensor Electromagnetic Spectrum and Atmospheric Propagation 24
2.3 Radar Principles and Types 26
2.3.1 Radar Equation 29
2.3.2 Radar Structure 32
2.3.3 Radar Signal Processing Fundamentals 37
2.3.4 Automatic Detection 50
2.3.5 Pulse Compression 55
2.3.6 Surveillance Radars 65
2.3.7 LPI Radars 66
2.3.8 Pulse Doppler Radars 75
2.3.9 Tracking Radars 83
2.3.10 Synthetic Aperture Radars 101
2.3.11 Bistatic Radars 104
2.4 Communications 113
2.4.1 Access Methods 115
2.4.2 Digital Signaling 116
2.4.3 Secure Communications 119
2.4.4 Coding of Communication Signals 120
2.4.5 Typical Military Communication Systems 123
2.5 Satellite Navigation Systems 125
2.6 Electro-Optical Thermal Imagers 129
2.6.1 Minimum Resolvable Temperature 136
2.6.2 IR Missile Seekers 139
2.6.3 Missile Approach Warner 147
2.7 Laser Radar Systems 147
2.7.1 Laser Target Designation and Ranging 148
2.7.2 Laser Radar Receivers 149
2.7.3 Laser Radar Range Equation 149
2.7.4 Target Detection 153
References 154

Chapter 3 Electronic Warfare RF Band Sensor Systems **157**
3.1 Introduction 157
3.2 EW Radar Band Sensors 158
3.2.1 RWR Architecture 159
3.2.2 ESM Architecture 160
3.2.3 ELINT Architecture 161
3.3 EW Sensor Sensitivity 161
3.3.1 Conclusions 168
3.4 Probability of Interception 168
3.5 EW Radar Band Sensor Architectures 175
3.5.1 Architecture of Past Generation Intercept Receivers 175
3.5.2 Architecture of New EW Radar Band Sensors 184
3.5.3 DSP Technologies 192
3.6 Detection and Classification of LPI Radars 197
3.7 Emitter Deinterleaving and Sorting 204
3.8 Emitter Identification 206
3.9 Communications ESM 208
3.9.1 CESM 208
3.9.2 COMINT 215
3.10 SIGINT 216
3.11 Conclusion 217
References 220

Chapter 4 RF Direction-Finding and Emitter Location Techniques **221**
4.1 Introduction 221
4.2 Amplitude Comparison DF Methods 222
4.3 Phase Comparison Monopulse DF Measurement Methods 229
4.3.1 Correlative Phase DF 232
4.4 Time-Difference DF 238
4.5 Emitter Location 244
4.5.1 Triangulation 245
4.5.2 Trilateration 247
4.5.3 Frequency Difference on Arrival Passive Location Technique 251
4.5.4 Inverse Passive Location 255
4.6 Conclusion 259
References 259

Chapter 5 Electronic Countermeasure Systems **261**
5.1 Introduction 261
5.1.1 Typical RECM Requirements and Missions 263
5.1.2 EW Radar Jamming Equation 264
5.2 Radar ECM Architecture 267

5.3 Digital Radio-Frequency Memory 272
5.3.1 Phase-Sampled DRFMs 274
5.4 Radar ECM Transmitters 276
5.5 Chaff 289
5.6 Communication ECM Systems 291
5.7 Infrared ECM Systems 295
5.7.1 Flares 300
5.8 Conclusion 302
References 302

Chapter 6 ECM Techniques and Sensor ECCMs 303
6.1 Introduction 303
6.2 ECM Principles and Techniques Used Against Surveillance Radars and Related ECCMs 304
6.2.1 Frequency Agility in Transmission 304
6.2.2 PRI Agility 304
6.2.3 Ultralow Sidelobes 305
6.2.4 Multiple-Sidelobe Cancellers 305
6.2.5 Sidelobe Blanker 308
6.2.6 Adaptive Arrays 310
6.2.7 Noise Jamming 311
6.2.8 False Targets 312
6.3 ECM Principles and Techniques Used Against Tracking Radars and Related ECCMs 313
6.3.1 Range Tracking Loop Deception 314
6.3.2 RECM Techniques Used Against Radar Doppler Tracking 318
6.3.3 RECM Techniques Used Against Radar Angle Measurement 320
6.4 Conclusions About RECM Techniques 337
6.5 ECM Principles and Techniques Used Against Communication Systems 338
6.5.1 Noise Jamming 341
6.5.2 Follower Jammer 343
6.6 Conclusions About ECM Techniques 345
References 346

Appendix A Signal Detection in Sensor Receivers 349
A.1 Integration of Successive Radar Pulses 354
A.2 Coherent Detection 355
References 356

Appendix B Introductory Concepts of Estimation Theory 357
B.1 Maximum Likelihood Function Estimator 359
B.2 Least-Squares Method of Estimation 360
Reference 361

Appendix C Antennas and Phased Array Antennas **363**
C.1 Antenna Types 366
C.2 Array Antennas 368
References 379

Appendix D Analog Modulation Methods **381**
D.1 Amplitude Modulation 381
D.2 Angle Modulation 381
D.3 Quadrature Modulation 384
Reference 385

Appendix E Evaluation of BER Increase for Noise and CW Tone Jamming in Communication Systems Employing BFSK Modulation 387
References 392

List of Acronyms **393**

About the Author **401**

* *Editor's Note*: The brief summary and the contents of the books are reported as provided by the authors or the publishers. Authors and publishers are encouraged to send review copies of their recent books of potential interest to readers of *Sensors* to the Publisher (Dr. Shu-Kun Lin, Multidisciplinary Digital Publishing Institute (MDPI), Kandererstrasse 25, CH-4057 Basel, Switzerland. Tel. +41-61-683-77-34; Fax: +41-61-302-89-18; E-Mail: lin@mdpi.com). Some books will be offered to the scholarly community for the purpose of preparing full-length reviews.

Note

1. The website for this book is: http://www.artechhouse.com/International/Books/Introduction-to-Modern-EW-Systems-1958.aspx.

© 2013 by the authors; licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/3.0/).