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Book Review

Publishers are invited to send two copies of new books for review to Dr. I. Michael Ross, Code: AA/Ro, Department of Aeronautics and Astronautics, U.S. Naval Postgraduate School, 699 Dyer Road, Monterey, CA 93943.

Radar Systems Analysis and Design Using MATLAB®

Bassem Mahafza, Chapman and Hall/CRC Press, 2000, 529 pp., $94.95, hardback, ISBN 1-58488-182-8

Usually books reviewed in this journal are somehow connected with guidance, navigation, and control. Guidance and control engineers and researchers frequently work with radar engineers when involved with projects containing radar systems. In these cases, it is often important for the guidance and control engineer to understand the important radar principles in order to better understand key system drivers and fundamental system limitations. Unfortunately many of the radar books available are either written strictly for radar people or at a level that is too high for easy comprehension by radar novices. In addition, the units, jargon and nomenclature of the radar books can be intimidating (Refs. 1 and 2 are exceptions).

It is therefore my pleasure to alert readers that there is a relatively new book that may be of value to them. "Radar Systems Analysis and Design Using MATLAB®" by Bassem Mahafza takes a hands-on practical approach to the subject matter and attempts to communicate the material to the reader using numerous mathematical examples including MATLAB listings. In fact, most of the figures presented in the book can be generated using the MATLAB code. The various listings are brief and heavily commented so that the reader will not get confused. The numerical examples will help clarify many important concepts to the guidance and control engineer. The author writes well and communicates with the reader using flow diagrams and understandable equations. The book is very readable.

Chapter 1 describes most of the terms used in radar systems and shows the many different ways that the radar range equation can be used. Radar cross section and its dependence on aspect angle, frequency, and polarization are discussed in Chapter 2. Both continuous-wave and pulsed radar along with information on resolving range and Doppler ambiguities are covered in Chapter 3. Chapter 4 covers radar probability-of-detection calculations along with a discussion of coherent and noncoherent integration. Various radar waveforms are analyzed in Chapter 5. Chapter 6 covers matched filters and the radar ambiguity function. Analog and digital pulse compression are discussed in Chapter 7. Multipath, refraction, diffraction, divergence, and atmospheric attenuation are examined in Chapter 8. Chapter 9 presents information on clutter and Moving Target Indicator. Radar antennas are covered in Chapter 10 while Chapter 11 discusses radar tracking systems. In fact, to make the guidance and control engineer feel at home, both fixed-gain and Kalman filtering concepts and examples are presented here. MATLAB code for both types of filtering are presented and appear to work fine. Chapter 12 discusses synthetic aperture radar including signal processing and design considerations. Chapter 13 presents an overview of signal processing.

As was previously mentioned, the MATLAB programs in each chapter enhance the understanding of the radar theory. This is especially important for guidance and control engineers who may have attempted to read various radar survey books only to find that they do not contain examples that can be easily duplicated by the novice. All of the concepts discussed in the book are illustrated via examples and often have an accompanying MATLAB program. The only weak point of the book is that a disk or CD-ROM of the code is not included. The book claims the code can be downloaded from a particular web site, but I was not able to find the code there. This small deficiency is not important because most of the programs are small. In summary, this book is a valuable learning tool and may be of considerable interest to readers of this journal.

References

[1]Stimson, G., *Introduction to Airborne Radar*, 2nd ed., Scitech Publishing, Inc., Park Ridge, NJ, 1998.

[2]Toomay, J. C., *Radar Principles for the Non-Specialist*, 2nd ed., Scitech Publishing, Inc., Park Ridge, NJ, 1998.

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