Journal of Statistical Physics, Vol. 59, Nos. 1/2, 1990

Book Review: *Principles of Statistical Radiophysics, 3, Elements of Random Fields*

Principles of Statistical Radiophysics, 3, Elements of Random Fields. S. M. Rytov, Y. A. Kravtsov, and V. I. Tatarski.

This book is the third in a series on statistical radiophysics. The authors are leading experts in this field and the book reflects their command of the subject matter. This volume may be read almost independently of the other volumes, but the reader is required to have a good background in statistical concepts as applied to random fields. There are many useful exercises in the book and it may be used as a text for second- or third-year graduate students.

In addition to an introductory chapter on fundamental concepts for space-time random fields, there are three main chapters: Chapter 2, Radiation and diffraction of random wave fields; Chapter 3, Thermal electromagnetic fields; Chapter 4, Single scattering theory. With the exception of the material in Chapter 3, the material may be found in many texts and review articles. However, rarely have I read a book in which such careful attention is paid to the conditions under which approximate equations and solutions are applicable. For both the student and the experienced researcher, it will be worthwhile to consult this book when using a "well-known" statistical formulation with an atypical set of parameters.

The chapter on thermal electromagnetic fields contains a statistical formulation leading to a generalized Kirchhoff's law. This is based on the two-point correlation function of the electromagnetic field. Therefore, it is possible to calculate the spatial covariances of the fluctuation field in addition to the energy density and flux. This means that the angular spectrum of the radiation field may be found. The fluctuation-dissipation theorem is contained within the generalization by putting in the proper form of the spectral density of the field. (The spectral density is discussed in Vol. II on discrete systems and this is perhaps one of the few places where overlap between the volumes would have been desirable.)

As in all books, there are some things that a reviewer would like to

0022-4715/90/0400-0533$06.00/0

have included. Here, I would have liked to see a discussion of the partial differential equations governing the coherence function and a fuller treatment of the propagation of finite beams after passage through a phase screen. However, the authors have produced an excellent treatment of the propagation of continuous random fields and I strongly recommend it to anyone working in this field.

Mark J. Beran
Department of Electrical Engineering
Catholic University
Washington, D.C. 20064
Permanent address:
Department of Interdisciplinary Studies
Tel-Aviv University
Ramat-Aviv, Israel