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Bookreview

Doicu A, Eremin Y, Wriedt T: **Acoustic and electromagnetic scattering analysis using discrete sources.** Academic Press, San Diego 2000. XIII/317 pp., numerous figs., hardbound. US$ 79.25. ISBN 0-12-219740-2.

A myriad of applications exist for the scattering of nonionizing radiation by particles of finite size - e.g., microwave dosimetry for biological objects, lidar and radar meteorology remote sensing, and particulate contamination of semiconductor wafers. Many theoretical techniques have been devised to predict the scattering characteristics of different types of particles in different frequency regimes. The most versatile of these techniques are numerical, but with analytical foundations; examples include the null field method (also called the T-matrix method), the method of moments, the coupled dipole method, and the finite-difference time-domain method. In deriving integral equations for scattering. the scattering problem is often converted into a radiation problem by the artifice of some equivalence principles that replace scatterers by discrete sources of radiation. Whereas the method of moments and the coupled dipole method involve the replacement of a scatterer by volume current densities, the null field method replaces a scatterer by surface current densities. This latter approach is the subject of the hook being reviewed.

The null field method is generally traced to a 1965 paper [Waterman PC: Proc. IEEE 53 (1965) 905-812]. A 1988 survey [Varadan VV, Lakhtakia A, Varadan VK: J. Acoust. Soc. Amer. 84 (1988) 2280-2284] amply demonstrates the wide applicability of this semi-analytical method. This book does not capture that versatility, as the authors have ignored elastodynamic scattering as well as scattering by infinitely long particles and infinitely extended surfaces. They have also not presented the many variations of the null field method that evolved during the 1980s and the 1990s, for which a survey chapter in another new book [Mishchenko MI, Hovenier JW, Travis LD: Light Scattering by Nonspherical Particles. Academic Press, San Diego, CA 2001] is recommended. Instead, the book is focused on the analytic foundations of the null field method.

The authors appear to have the modeled their book after a 1983 book [Colton D, Kress. R: Integral Equation Methods in Scattering Theory, Wiley. New York, 1983], which did not have a single illustration. Nevertheless in welcome contrast, the authors have taken care to ensure that their books is much more accessible to physicists and engineers. Assuming minimal background on functional analysis of the reader, they have emphasized the regularity properties of square-integrable potentials and the construction of adequate systems of multipolar sources. Using these sources, they lay the foundations of the null field method. Most of the 10 chapters of this book are intensely analytical, often with the theorem-proof structure that is characteristic of mathematical literature. Implementations of the null field method are not detailed, but certain key results are graphically illustrated to good effect.

The authors have written very well on their chosen focus. Anyone who is interested in scattering theory should order a copy of this book for their personal use.

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