approach and relates it to a program listed in full in the text. Mathematical details are kept to a minimum in these discussions, though the authors do not neglect the basic requirements of successful numerical computation of special functions, such as choosing crossover points wisely and running recurrence processes in the stable direction. A feature that may tilt the orientation of the book toward educators is the development of alternative methods and programs in each of cases (1) through (4). Section 6 assesses accuracy and validity using consistency and comparison checks. The software of Section 7 computes zeros of the functions by Newton's method. The use of asymptotic expansions, illustrated in [1, p. 387], would avoid unnecessary loss of precision through cancellation but is not considered. Section 8 shows how to apply the previous software to compute lambda functions, and the final section gives 15 pages of numerical values in tables computed by the authors' software.

References

[1] M. Abramowitz and I. A. Stegun (eds.), *Handbook of mathematical functions with formulas, graphs and mathematical tables*, National Bureau of Standards Applied Mathematics Series, vol. 55, U.S. Government Printing Office, Washington, DC, 1964. MR **29:**4914

[2] L. Baker, *C mathematical function handbook*, McGraw-Hill, 1992.

[3] S. L. Moshier, *Methods and programs for mathematical functions*, Ellis Horwood, 1989. MR **92a:**65019

[4] United Laboratories, Inc., *Mathematical function library for Microsoft-Fortran*, John Wiley & Sons, 1989.

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6[86-08, 86A05]—*Computational ocean acoustics*, by Finn B. Jensen, William A. Kuperman, Michael B. Porter and Henrik Schmidt, AIP Series in Modern Acoustics and Signal Processing, American Institute of Physics, New York, NY, 1994, xvi+612 pp., 24 cm, $85.00

I have enjoyed reading this book. Indeed once I picked it up, I found it hard to put down until I had gone through it. This book has a truly panoramic view of the subject, beginning with elementary ideas, and then proceeding to the most advanced aspects of the material. It is thorough in its treatment of the various topics. The first chapter *Fundamentals of Ocean Acoustics* is a very nice introduction of the material from a historical perspective, and also presents a large number of facts in a very economical manner. Chapter 2 *Wave Propagation Theory* gives a derivation of the acoustic differential equation and has an introduction to acoustic propagation in a waveguide, including the ideal fluid wave guide and the Perkeris waveguide. Chapter 3, on *Ray Methods*, obtains the Eikonal equations from the Helmholtz equation and solves the transport equations. A discussion of caustics, ray tracing, and WKB theory are included in this chapter. Chapter 4, on *Wavenumber Integration Techniques*, contains what one would expect, namely a reduction of the Helmholtz equation, with source term, through Hankel transformation to an ordinary differential equation. The Hankel transformed equation is then solved under various situations, i.e. homogeneous fluid layers, n^2-linear layers, etc. Homogeneous elastic layers are also treated by means of displacement potentials. As is usual, attenuation of the acoustic pressure is managed by means of complex Lamé coefficients. Numerical integration techniques, such as the propagator matrix and invariant imbedding approaches, are also discussed.

The *Normal Modes* method is treated in chapter 5. Here the homogeneous Helmholtz equation is investigated using separation of variables. The usual modal expansion of the Green's function is derived. A generalized derivation including the possibility of a continuous spectrum is given. It is shown that in the case of the Perkeris waveguide, which has a finite depth iso-velocity region over a semi-infinite iso-velocity region, one obtains a singular eigenvalue problem. A spectral representation is then used to represent the acoustic pressure. One obtains a representation including a sum of residues plus a branch-line integral. One method for solving the modal equations is by finite difference techniques, which are then used. Various other numerical approaches such as shooting methods, layer methods, etc. are considered. An extension of these methods to range-dependent environments is also included in this chapter.

Chapter 6 is devoted to parabolic approximation methods. The authors begin with a derivation in the case of the Helmholtz equation and proceed to give several parabolic wave equations based on various expansions of the square-root operator. For the elastic seabed they present Collin's parabolic approximation of the Navier equations. This work was completed just prior to publication of the book. Hence, the book is very much up-to-date. This work, however, has been recently extended to the case of poro-elastic seabeds; see for example, Collins [2], Buchanan-Gilbert-Lin [1], [3] and the references therein. In order to obtain the correct far-field by the parabolic approach it is necessary to have a proper starting field; hence, there are sections on analytic starters, and generalized Gaussian sources etc. Chapter 7 begins with a general introduction to finite difference methods for second order equations in two independent variables. Then a general introduction to finite-element methods is given for two- and three-dimensional partial differential equations. Chapter 8 *Broadband Modeling* contains material on fast Fourier transforms, sampling, complex frequency integration, spectral techniques, etc.

Chapter 9 on *Ambient Noise* treats surface noise. A derivation of the cross-spectral density is given. In the appendix to this chapter the cross-spectral density is calculated from noise sources on a circular area. The last chapter, 10, on *Signals in Noise* deals with beamforming, linear beamforming, adaptive beamforming, matched-field processing, etc.

All-in-all this is a very nice book. If I were to recommend a book to someone starting in ocean acoustics, who wished to get a modern overview of ocean acoustics quickly, it would be this book. It is complete, up-to-date, has a historical perspective, and explains rather complicated issues in a straightforward and clear manner. There is a detailed bibliography after each chapter for pointers to further reading. This book certainly belongs on the shelf of every person working in ocean acoustics.

References

[1] J. L. Buchanan and R. P. Gilbert, *Transmission loss in the far field over a one-layer seabed assuming the Biot sediment model*, Z. Angew. Math. Mech. **77** (1997), 121–135. CMP 97:10

[2] M. D. Collins, W.A. Kuperman, and W. L. Siegman, *A parabolic equation for poro-elastic media*, J. Acoust. Soc. Amer. **98** (1995), 1645–1656.

[3] R. P. Gilbert and Z. Lin, *Acoustic field in a shallow, stratified ocean with a poro-elastic seabed*, Z. Angew. Math. Mech. **77** (1997), 1–12.

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7[65-06, 65Y05, 65C20, 68U20]—*Applications on advanced architecture computers*, Greg Astfalk (Editor), SIAM, Philadelphia, PA, 1996, xvii+359 pp., $25\frac{1}{2}$ cm, softcover, $35.00

In 1990, SIAM (the Society for Industrial and Applied Mathematics) began a regular column in its newsletter to explore current applications and methods in parallel computing and other advanced-architecture computing. The column, which still exists, provides a place for people to describe how they are using high-performance computers to solve very large and difficult real-world problems, or to review research in relevant algorithms. The first 30 columns are reprinted in this book. Together, they provide a useful picture of this fast-moving field. A few of the applications are: electronic structure, molecular dynamics, combustion chemistry, financial modeling, and electromagnetic scattering. The algorithmic articles cover ordinary and partial differential equations, optimization, computational geometry, load balancing, and other areas. The editor's own article, Advanced Architectures: Current and Future, does a good job of setting the stage for the other articles. It was rewritten completely to account for architectural developments since its original appearance in 1990.

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