Acoustics in Moving Inhomogeneous Media, Second Edition
Vladimir E. Ostashev and D. Keith Wilson
CRC Press, Boca Raton, FL, (2016),
xix+521 pp., Hardbound, 195 USD,
ISBN 978-0-415-564, eBook, 136 USD

Ostashev and Wilson's second edition of "Acoustics in Moving Inhomogeneous Media" is an obviously well-prepared reference for those working to understand, model and predict real world acoustics. The book is divided into three logical parts – Part I: Theory, Part II: Propagation and Scattering, and Part III: Numerical Propagation Methods – and ends with a generous reference list.

1 PART I: THEORY

Chapter 1 traces the historical development of spatial and temporal coherence mathematics through published treatises, but is thin on relating the practical motivations behind each step. The few applications that are included fail to mention the vast contributions from underwater acoustics studies. Chapter 2 develops the wave equations and includes an excellent flowchart, mapping the relationships between equations and noting their limitations. Chapter 3 develops geometric acoustics and concludes with examples of atmospheric acoustic tomography. Chapter 4 develops wave theory and concludes with an example of an atmospheric waveguide. Part I ends with Chapter 5 covering the development of equations for moving sources and receivers.

2 PART II: PROPAGATION AND SCATTERING

Chapter 6 introduces turbulence spectra, fluctuation of sound speed, media density and scattering. Chapter 7 develops models for line of sight propagation and Chapter 8 carries the analysis to multipath transmission. Obvious underwater absences here include volume reverberation and scattering due to biologics, bubbles and rough sea surfaces. Statistical models concentrate on Von Karman, Kolmogorov and Gaussian turbulence regimes, which are commonly used to model temperature, concentration and velocity profiles in boundary layer meteorology but which are not particularly useful in describing those same profiles in the ocean. Parameter values given for the sea are given as ranges with no dependence on a boundary layer height.

3 PART III: NUMERICAL PROPAGATION METHODS

Chapter 9 introduces computational fluid dynamics, spectral kinematic modeling, and eddy-based kinematic modeling and then develops spectral and eddy models to describe variations due to atmospheric turbulence. The chapter's development of the quasi-wavelet method is an interesting way of using fuzzy fractals to describe randomly dispersed eddies. Chapter 10 reviews ray tracing and ground interaction. Chapter 11 reviews wavenumber integration, the parabolic equation and boundary element methods. Chapter 12 introduces finite difference, time domain methods. The book ends with Chapter 13's excellent study on the uncertainties encountered when attempting to model acoustics in the real world.

4 ARMY VS. NAVY

Although the book attempts to present generalized moving inhomogeneous media acoustics, atmospheric acoustics seems to be its main subject, with ocean acoustics being relegated to a few short paragraphs at the end of some of the chapters to highlight differences. Some important ocean acoustic phenomena are left out altogether. This observation should not be a surprise as Ostashev and Wilson point out that their choices of references and examples have been shaped by their work with the Army and experience in atmospheric acoustics. Only 6% of the book's 445 references are underwater studies. The one reference listed for Vern Knudsen (who served as the founding director of the Naval Undersea Research and Development Center) is not even an underwater paper. A more balanced list would include the U.S. Navy 1946 Division 6 Technical Report (Physics of Sound in the Sea), Eckart and Carhart's 1950 "Fluctuations of Sound in the Sea," papers by G. Gaunaurd, P.G. Bergmann, D. Mintzer, E. Skudryzk, R.J. Urick and R.F. Shvachko and scores of others who have contributed from the sub sea surface side of the problem.

Maybe it is just an Army–Navy rivalry thing, but for the book to be an appropriate text for use in both atmospheric and oceanic graduate-level programs, I suggest the third edition be split into two volumes with simple titles such as "Acoustics of Turbulent Atmospheres" and "Acoustics of Fluctuating Oceans." This would allow equal attention to underwater acoustics and provide each volume with enough room to include practical applications.

Jon W. Mooney
KJWW Engineering
Rock Island, Illinois, USA
mooneyjw@kjww.com