

chapters are devoted to acoustical measurement, physical environment planning theory, and design of electro-acoustic systems.

I can highly recommend the book to anybody who is interested in the principles of concert hall acoustics. Readers who wish to explore the subject further will enjoy reading the extensive referenced publications, which substantiate the material summarized in the book.

JIRI TICHY

*Pennsylvania State University
University Park, Pennsylvania*

RF Superconductivity for Accelerators

▶ Hasan Padamsee, Jens Knobloch, and Tom Hays
*Wiley, New York, 1998. 523 pp.
\$79.95 hc ISBN 0-471-15432-6*

The books in the Wiley series Beam Physics and Accelerator Technology, edited by Mel Month, are in large part an outgrowth of courses given at US Particle Accelerator Schools held at major universities around the country. These schools, brought into being in 1987 and nourished since then almost entirely through the efforts of the series editor, are now the main vehicle for the transmission of knowledge in particle beam physics and related technologies, compensating (certainly in the early years) for a lack of formal university courses in accelerator physics. *RF Superconductivity for Accelerators* by Hasan Padamsee, Jens Knobloch, and Tom Hays is a welcome addition to the textbooks catalyzed by the Particle Accelerator Schools.

The text is divided into four parts. Part I gives a descriptive overview of the subject, including a short section on the historical foundations of radio frequency superconductivity, followed by some well-written sections on superconductivity essentials and the electrodynamics of superconducting surfaces. The section on historical background is all too brief, giving little hint of the complex story behind the rather sudden flowering of the field in the mid-1960s. (For the complete story, readers should turn to the 1997 report by Catherine Westfall; *The Prehistory of Jefferson Lab's SRF Accelerating Cavities, 1962 to 1985*, published by the Thomas Jefferson National Accelerator Facility. Westfall's account offers some valuable lessons: First, research is often characterized by long periods of frustration with little noticeable progress; second, bursts of progress often follow the development of new instrumentation and measurement techniques; and third, the entire research

process is strongly modulated by a not-entirely-rational human element.)

Part 2 of the text discusses the performance of superconducting cavities. Because the authors have been intimately involved in rf superconductivity technology for many years, this section is much more than a collection of references and recipes. Extensive material on cavity fabrication technology, much of it not available in the published literature, is pulled together here. The interplay between theory and practical technology is nicely illustrated. The highlight of part 2, and perhaps of the whole book, is the excellent treatment of multipactor and field emission. Because these effects are also prominently observed in room-temperature copper accelerating structures and other rf components operating at high field levels, anyone interested in the high-gradient frontier is well advised to become familiar with this material.

Part 3 discusses couplers, tuners, windows, and beam loading, material that will be of great interest to those concerned with the detailed technology of superconducting accelerating cavities. The final part of the book, on frontier accelerators, discusses the application of superconducting cavities to high-current storage rings (so-called B factories), to intense proton accelerators for pulsed neutron sources and nuclear waste transmutation, and to high-energy linear colliders. As might be expected, the attractive features of the superconducting TESLA (TeV Energy Superconducting Linear Accelerator) collider proposal receive top billing. As might also be expected, the authors do not emphasize the main disadvantage of superconducting rf technology: that at present it can achieve (optimistically) an accelerating gradient of perhaps 40 MV/m. Higher gradients will require some sort of major breakthrough, and, although such a breakthrough can never be ruled out, the best bet for realizing a linear collider with an energy above 1 TeV remains with conventional rf technology based on copper accelerating structures. Advocates of muon colliders (briefly mentioned in the book) would claim that they have a better way to reach this energy regime, but that is another story.

The book is richly illustrated (with over 300 figures) and has 378 references. This last feature underscores the book's somewhat ambiguous purpose: Does it aim to be a detailed summary of the current status of superconducting rf research and technology, or is it meant to be a text to introduce a graduate student to the field? Toward the latter goal, as in the other texts in the series, the book includes 57 well-designed problems, which

require the student to fill in details of the theory or to work out numerical examples illustrating practical situations. The tutorial aspect of the book is occasionally weak, however, in particular when the text veers from its main topic into beam physics or rf theory. At these points, the student needs to be directed to good tutorial references (rather than research papers), and this is not always clearly done in the text. This is a minor quibble however; *RF Superconductivity for Accelerators* is a useful, important, and even essential reference for anyone interested in this field.

PERRY B. WILSON

*Stanford Linear Accelerator Center
Stanford, California*

Fundamentals of Acoustical Oceanography

▶ Herman Medwin
and Clarence S. Clay
*Academic Press, San Diego,
Calif., 1998. 712 pp. \$75.00 hc
ISBN 0-12-487570-X*

Both of the authors of *Fundamentals of Acoustical Oceanography*, Herman Medwin and Clarence Clay, were trained as applied physicists and then developed their research careers in ocean acoustics. Between them, they have spent many decades on experimental and theoretical investigations of the use of sound to explore the ocean. Medwin is world-renowned for his work on acoustic scattering from bubbles and from ocean surface roughness; he has treated these problems from both the theoretical and laboratory experimental points of view. Clay has contributed to many aspects of ocean acoustics, particularly to understanding the effects of ocean-bottom structure. The authors' research expertise has very much influenced the content of *Fundamentals of Acoustical Oceanography*, both its earlier edition (*Acoustical Oceanography*) and this revised volume, coming just over 20 years later.

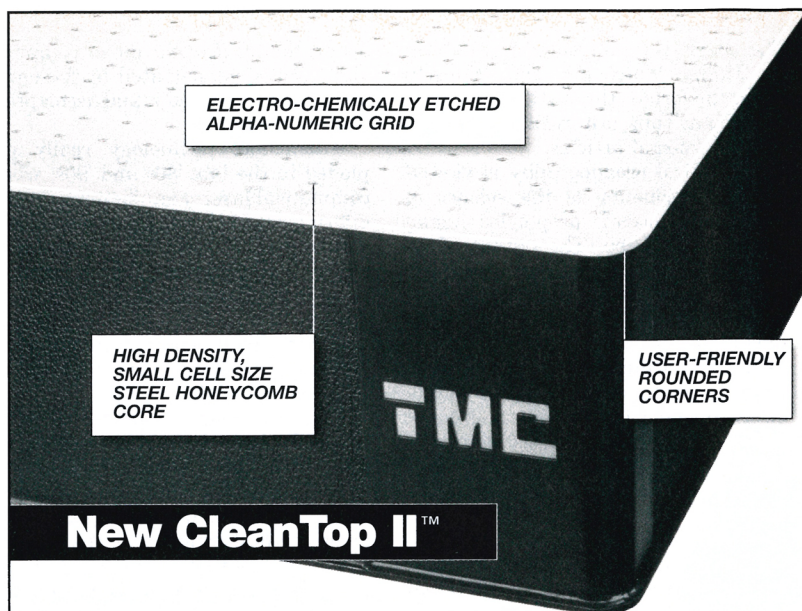
The change in title reflects the unavoidable fact that this book, despite its 700-odd pages, only scratches the surface of many of the subjects presented, although a selected subset is covered in detail. Typical introductory presentations of topics—for example, the wave equation, geometrical acoustics, and Snell's law—require familiarity with mathematical physics at the level of an upper-division physics major. Each chapter has a set of problems that make it possible to use the book as a course textbook as well as a research reference.

The first third of the book provides brief descriptions of wave propagation and scattering topics that will be needed in the subsequent two-thirds of the book. Covered are such elementary topics as spherical waves, reflection from planar boundaries, geometrical acoustics, Doppler shifts, and beam-forming. More sophisticated topics are also presented, such as head waves, caustics, high-intensity sources, definitions of power spectra, and characteristics of ocean-noise power spectra.

The middle third of the book covers scattering from cylinders, spheres, and bubbles in great detail. Also discussed are physical bubbles and biological creatures whose scattering strength derives mainly from swim bladders or other physical structures that can be approximated with cylinders and spheres. Considerable information about biomass scattering is provided and interpreted.

The last third of the book covers scattering from the boundaries of the ocean's volume: the surface with its waves and the bottom with its rough topography and sediment-layer sound-speed structure. Diffractive scattering from ocean swell, treated as a diffraction grating, is analyzed in detail, although neither the Doppler effect nor Bragg scattering are mentioned. Scattering from the random waves created by wind is carefully covered. The Biot-Tolstoy theory of scattering from wedges is used in a variety of ways, and treatment of a wedge-shaped bottom layer is extensively discussed.

For those interested in the ocean's surface, bottom, and bubbles, this book provides a detailed introduction, with up-to-date references. The information provided applies to the forward problem. (The forward, or direct, problem is about ways to predict the scattered signal if you know the ocean structure; the inverse deals with deducing the structure by observing the signal.) The inverse problem is treated only in the sense of noting that the intensity of a sound wave may be proportional to the number of scatterers or the surface-roughness variance. In both cases, a measurement can be simply inverted for a single parameter, assuming all others are known. Readers interested in more sophisticated inverse techniques would be advised to obtain a book like Walter Munk, Peter Worcester, and Carl Wunsch's *Ocean Acoustic Tomography* (Cambridge U. P., 1995). Furthermore, in Medwin and Clay's book there is not a mathematical word about the effects of volume inhomogeneities, such as turbulent microstructure, internal waves (either deterministic or statistical), fronts, mesoscale eddies, or large-scale circulation.



ITS MOST IMPRESSIVE FEATURES ARE ONLY VISIBLE IN YOUR RESULTS

You can't see the patented breakthrough features that make TMC's CleanTop II the best optical table for demanding applications.



PATENTED CLEANTOP SPILLPROOF CORE

But you can depend on them. That's why CleanTop II is now standard on all TMC tables. CleanTop II starts clean and stays that way. The ultra-flat stainless steel top plate is cleaned of all manufacturing residue. And, TMC's patented spillproof feature has been enhanced with new *corrosion free* Nylon-6 cups. For the ultimate in corrosion protection, we offer 316 alloy stainless steel cups for a total stainless steel work surface to handle the harshest chemicals. Cups are epoxy-bonded (not welded) to the top plate.



Spills can be quickly and completely removed. There is no potential for contamination or out-gassing. Precision tapped and countersunk holes accelerate set-up; no wrench is ever required.

And radius corners add to user comfort and safety.

To request a catalog, contact our Technical Sales Group.

TMC

Technical Manufacturing Corporation

15 Centennial Drive, Peabody, MA 01960 USA
Tel: 978-532-6330, **800-542-9725**, Fax: 978-531-8682
e-mail: sales@techmfg.com www.techmfg.com

VIBRATION SOLUTIONS WORLDWIDE

The latter two are treated in the book by Munk, Worcester, and Wunsch, while the former three still await book treatment; they are available only in isolated journal articles.

Acoustical oceanography is viewed by its proponents as the science of measuring ocean properties using sound as a probe. The output of an acoustical oceanographic measurement will be something oceanic, like the average temperature of an ocean basin, the variance of ocean wave height, or the number of phytoplankton per cubic meter as a function of depth. Medwin and Clay provide a glimpse into a few of the techniques needed to measure some of those properties. They hope to inspire young scientists and engineers from various disciplines to become fascinated with the ocean and to use a manifestly physics-oriented tool to help explore one of our great frontiers. The success of the first edition of their book suggests that they have built an audience and that this new edition will be welcomed by those who hope for growth in this young field.

STANLEY M. FLATTÉ

University of California, Santa Cruz

Femtosecond Laser Pulses: Principles and Experiments

Edited by Claude Rullière
Springer-Verlag, New York, 1998.
309 pp. \$59.95 hc
ISBN 3-540-63663-3

The field of ultrafast laser technology started in the late 1960s with a handful of scientists, most of whom were at industrial research laboratories, with a few at universities in the US, England, and Germany. The members of this small, elite clan of scientists could produce their own working picosecond lasers.

Ultrafast technology emerged as an active research area with the generation of pulses in the 5 to 10 ps range. A major advance occurred when Stanley Shapiro and I demonstrated the white-light supercontinuum based on self-phase modulation and four-photon mixing. The supercontinuum is currently being used to produce femtosecond pulses and for ultra high speed optical communications.

The next significant advance toward the femtosecond era was the development by Erich Ippen, Richard Fork, and Charles Shank of the colliding-pulse mode-locked dye laser, termed the CPM laser, reliably to generate subpicosecond, and later femtosecond, pulses. Then the production of table-top high-power fs and ps lasers was revolutionized by Gerard Mourou's

group, using grating pulse compression (first demonstrated in the early 1970s by Brian Treacy) and decompression methods.

Ultrashort technology really exploded in the late '80s and '90s, when commercial laser manufacturers began offering several kinds of picosecond and femtosecond lasers. The femtosecond era truly started when Wilson Sibbett's team demonstrated ~100 fs pulse generation from a solid-state Ti:sapphire laser without an apparent mode locker, where the mechanism was later traced to Kerr-lens mode-locking.

Over the years, a number of useful textbooks have focused on various aspects of ultrafast laser technology. Of these, *Ultrafast Light Pulses*, edited by Stanley L. Shapiro (Springer, 1977), gives the best overview of the subject; it was followed by *Lasers for Ultrafast Light Pulses* by Joachim Hermann and Bernd Wilhelms (North Holland, 1987), *Ultrashort Laser Pulse Phenomena* by Jean Claude Diels and Wolfgang Rudolph (Academic Press, 1996), and *Ultrashort Laser Pulses and Applications* edited by Wolfgang Kaiser (Springer, 1988). A series of books that I edited focused on applications: *Biological Events Probed by Ultrafast Laser Spectroscopy* (Academic Press, 1982), *Semiconductors Probed by Ultrafast Laser Spectroscopy* (Academic Press, 1984), and *The Supercontinuum Laser Source* (Springer, 1989). Graham Fleming's *Chemical Applications of Ultrafast Spectroscopy* (Oxford U. P., 1986) surveyed the chemistry application area.

Femtosecond Laser Sources, edited by Claude Rullière, covers much of the history of these devices and complements the earlier books. It offers useful information for the beginner and graduate student entering the field, as well as the old-timer who is interested in a recent update of the field. An outgrowth of a series of lectures given at France's Bordeaux University in the early 1990s, the book is a compendium of articles written principally by French scientists, who present a cursory overview of the topics required to undertake a program in picosecond measurements.

Although it is described as a textbook, this collection of articles lacks in many places enough detail and depth on femtosecond optics and problems to sustain that claim. Only half of the chapters give problems for students to work on.

The first chapter gives an overview of the basic laser principles needed to understand how ultrashort pulses are generated. The second chapter gives too brief an introduction to the basic principles of ultrafast optics; the topics

covered are adequate for pulsewidths greater than $\frac{1}{3}$ psec but fall short on the experimental problems encountered in the femtosecond regime. Chapters 3 and 4 give a good review of how ultrashort light pulses are generated from various laser media. There are some important omissions, however. For example, chromium (Cr^{4+})-ion doped lasers are of particular interest for the wavelength ranges they cover, but Chapter 3 misses important references to prior work. Chapter 5 adequately describes semiconductor lasers used to generate ultrashort laser pulses and their properties. Chapter 6 briefly presents methods used to amplify and compress short pulses but gives no examples of calculations for selecting femtosecond optical components. Chapter 7 describes how to measure the characteristics of pulses (duration and spectral content). Here again, the authors give no details on the problems associated with the measurement of pulses shorter than 50 fs caused by optics, output mirrors, spectrometers, and nonlinear optical crystals.

Chapter 8 describes in detail the principles behind the various time-resolved spectroscopic techniques based on fluorescence, absorption, and Raman phenomena. Chapter 9 addresses coherence properties of the underlying processes in materials and laser pulses arising when the pulse duration is as short as the coherence time of the excitation. The last chapter provides an in-depth view of terahertz pulse generation and its applications for characterizing electronic devices and spectroscopy of materials.

Overall, although the book has some shortcomings, I believe the reader will obtain beneficial information on various aspects of ultrafast laser technology.

ROBERT R. ALFANO

City College of the City University
of New York
New York, New York

NEW BOOKS

Condensed Matter Physics

Atomic Simulation of Electro-optic and Magneto-optic Oxide Materials. Springer Tracts in Modern Physics 151. H. Donnerberg. Springer-Verlag, New York, 1999. 205 pp. \$129.00 hc ISBN 3-540-65111-X

Condensed Matter Theories, Vol. 13. Proc. Wksp., Luso, Portugal, Sep. 1997. J. da Providência, F. B. Malik, eds. Nova Science, Commack, N.Y., 1998. 525 pp. \$97.00 hc ISBN 1-56072-602-4, Diskette

Dynamics and Defects in Liquid Crystals: A Festschrift in Honor of Alfred Saupe. P. E. Cladis, P. Palffy-Muhoray, eds. Gordon and Breach, Amsterdam, the Neth-