

and as a reference for the reader who is seriously interested in undulators and free-electron lasers.

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The Physics of Musical Instruments

Neville H. Fletcher and
Thomas D. Rossing
*Springer-Verlag, New York,
1991. 620 pp. \$69.00 hc
ISBN 0-387-96947-0*

This is a book for physicists. Its more than 600 pages are organized into five parts, entitled Vibrating Systems, Sound Waves, String Instruments, Wind Instruments and Percussion Instruments; these are in turn divided into a total of 21 chapters. Essentially everything you have ever wanted to know about the physics of musical instruments (whether or not you were afraid to ask) is there, presented on a level that a good college junior can begin to handle, but of which a graduate student or, for that matter, a professional need not be ashamed. The coverage ranges from excellent introductions to such standard topics as the transient response of an oscillator and bending waves in bars, to clear presentations of the dynamics of an air jet (in the context of flutes), the radiation from guitars and violins, the nonlinear interactions in lip-driven brass instruments and the effects of air loading on the normal frequencies of timpani. I also enjoyed the intelligent preface, which places musical acoustics in a larger context.

Inevitably there are small points on which one can remark critically, such as the figure that purports to show Lissajous figures but appears to be in error, or another that sketches progressive stages in the impact of a piano hammer on a string but does not show the slope discontinuity that accounts for the hammer's deceleration. I was also disturbed by the description of equal temperament as something that "modern ears have come to tolerate." In fact, completely apart from anything having to do with modulation, the "quasi-vibrato" introduced into 19th- and late-18th-century music by equal temperament is perceived by most listeners as an integral and necessary part of the musical style; indeed, such chords sound quite intolerable without it.

I would also suggest that when a revised edition is prepared, the authors consider including a fuller discussion of impedance, admittance and mobility. It is unfortunate that these

words tend to be used rather uncritically, so that mobility (or admittance) becomes simply the reciprocal of impedance. To me, the important difference is that "impedance" refers to a situation in which a velocity is imposed at one point of a dynamical system, with all other points kept fixed, whereas in an "admittance" experiment a force is applied at one point, and all other points are left free. The two are equivalent only for a system with one degree of freedom, which is seldom a case of great interest.

These minor criticisms do not change the fact that if someone asked me what musical acoustics book I would most like to see written and published, it would be precisely this one, and precisely by these authors, whose encyclopedic knowledge and seemingly boundless energy have impressed me (and made me envious) on more than one occasion. The text fills a great need for all who are interested in the field, and I recommend it highly.

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The Physics of Phonons

G. P. Srivastava
*Adam Hilger, Bristol, UK
(US dist. AIP), 1990. 421 pp.
\$80.00 hc ISBN 0-85274-153-7*

The physics of phonons is one of the most important and fast developing areas of solid state physics. This fact makes the reviewed book attractive; the author and publisher deserve high credit for their effort.

The book is a scientific monograph that covers a wide range of topics. It starts out with a description of crystal symmetry, Brillouin zones and related topics (the reciprocal space could be introduced in a less formal way), followed by a discussion of lattice dynamics. In chapter 4 the author pays special attention to the important question of the effects of anharmonicity. I think that the double-well-potential problem also should have been covered in the book.

Among the various phenomena connected with lattice dynamics, lattice thermal conductivity is described in detail. Because it represents one of the most important transport phenomena, this subject fully deserves the attention devoted to it. Furthermore, the author himself has made significant contributions to this field. The detailed discussion of various relaxation mechanisms is full and elegant. It would have been useful to include a description of phonon ther-

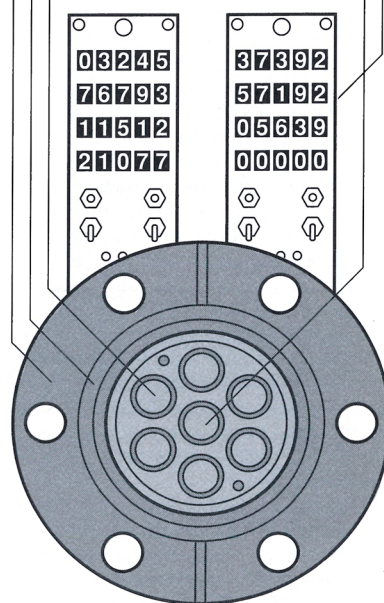
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mal conductivity in metals, specifically the term resulting from scattering of phonons by electronic excitations. This scattering channel is important in alloys, particularly in the superconducting state.

In addition to the above topics, a number of others that are not addressed in the book can be pointed out. Of course, one could respond that no one is capable of writing about everything. I agree that judgment should be made based on the contents, rather than on the omissions; as noted earlier, the broad spectrum of the book deserves high credit. Nevertheless, the criticism is valid because the monograph has been designed to serve as a general exposition. For example, one cannot help being surprised by the absence of a discussion of neutron scattering, a unique and powerful tool for studying lattice dynamics. The sections describing infrared and Raman spectroscopies are written in a very clear way, but the topics deserve a more detailed analysis.

Chapter 8 contains an interesting discussion of phonons in low-dimensional solids, including surface modes and phonons in superlattices. A description of peculiar phonon modes in layered crystals could perhaps have been included.

Other interesting subjects covered in this book include lattice dynamics in impure and mixed crystals (chapter 9), amorphous solids (chapter 10) and phonon states in liquid helium (chapter 12).

Overall, the presentation of material is clear and logical. However, the discussion sometimes becomes overloaded by technical details. For example, I would recommend that in the next edition a major part of the evaluation of lattice thermal conductivity by variational methods (chapter 5) be transferred to the appendixes.

The book will be useful for students and scientists working in the field of solid state physics.

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