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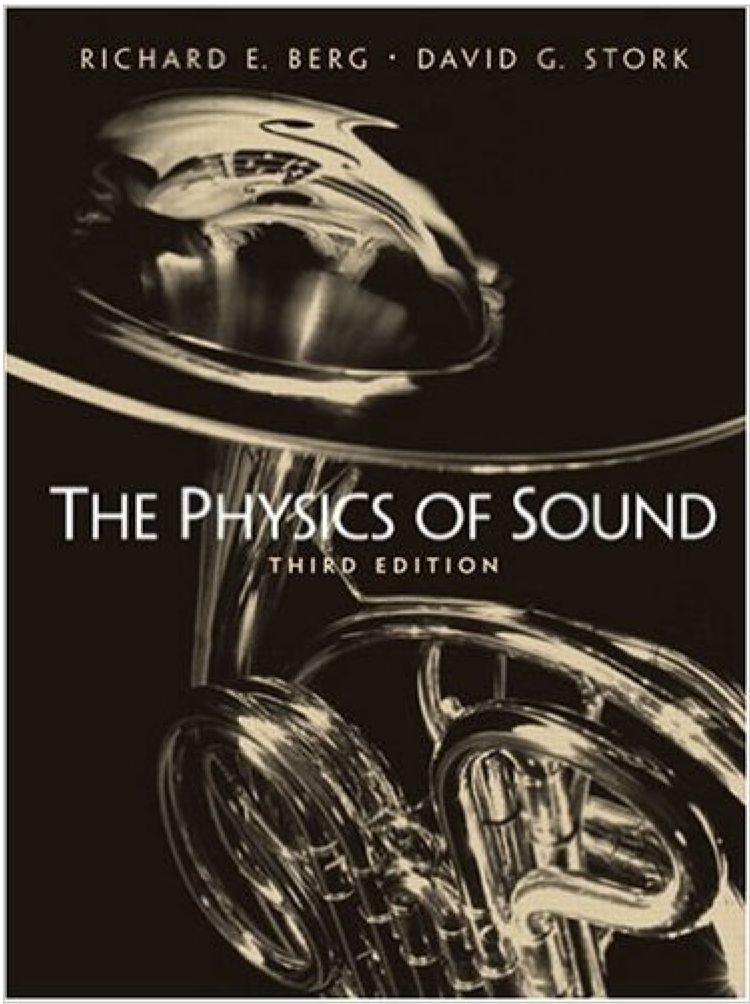
The Physics Of Sound, 3rd Edition



Synopsis

This book incorporates the developments in digital audio technology, including consumer products, into a firm foundation of the physics of sound. No knowledge of physics, mathematics, or music is required.   Includes updated information on musical synthesizers. Provides recent information on the ear, including new advances in cochlear implant technology. Updates material for modern technology, particularly MP3. Features abundant examples, including discussion of demonstration experiments. Includes historical discussion of musical temperaments and instruments. Offers videotapes of musical demonstrations on topics discussed in the book, available from author.   A useful reference for musicians or anyone interested in learning more about the physics of music.

Book Information

Series: The Physics of Sound Third Edition

Paperback: 398 pages

Publisher: Pearson; 3 edition (August 27, 2004)

Language: English

ISBN-10: 0131457896

ISBN-13: 978-0131457898

Product Dimensions: 7 x 1 x 9.1 inches

Shipping Weight: 1.7 pounds (View shipping rates and policies)

Average Customer Review: 3.6 out of 5 starsÂ Â See all reviewsÂ (11 customer reviews)

Best Sellers Rank: #163,326 in Books (See Top 100 in Books)   #84 inÂ Books > Science & Math > Physics > Acoustics & Sound   #429 inÂ Books > Textbooks > Humanities > Performing Arts > Music   #483 inÂ Books > Textbooks > Science & Mathematics > Physics

Customer Reviews

Acoustics is an interesting subject, at all levels, and very important of course due to the human love for music and the need for high fidelity sound reproduction. This book is written for a readership that does not have expertise in physics or mathematics beyond the high school level. The authors do an excellent job, and the book could be used in classes on music theory or a class in physics for the humanities. The audiophile reader will gain a greater appreciation of the physics behind quality sound reproduction. Heavy use is made of demonstrations to illustrate the properties of sound, and most of these are easily set up in the classroom. I have used most of these demonstrations in the classroom, and can highly recommend their use to reinforce the understanding of the physics of sound. The book opens, appropriately, with a discussion of simple harmonic motion, with the properties of this type of motion related to sound waves. The nature of simple harmonic motion as periodic, in contrast with noise, which is nonperiodic, is pointed out very early on. To introduce the concept of resonance, in particular the concept of coupling resonance, the author use the coupled pendulum system. This demonstration is easily constructed for classroom use and very effective in illustrating coupled resonance. Lissajous figures, which arise in the study of the relationship between two waves, is discussed in some detail. The difference between longitudinal waves, which sound waves are, and transverse waves (such as light), is illustrated in chapter 2. To reinforce the difference between sound and light, the authors use the "bell in vacuum" demonstration. A demonstration for measuring the speed of sound is also described. Ripple tanks are used to demonstrate Huygen's principle, interference, and parabolic reflectors. The origin of beats, so important in music theory, is discussed, along with a very detailed overview of the Doppler effect. Ultrasound, very important medically, is treated also. A very brief discussion of infrasonic waves is given. Infrasonic waves, which are outside the range of hearing since they are below 20 Hz, are only experienced as vibrations. They have recently been discussed in the popular press as being explanations behind "haunted" houses. The anxiety felt in some old houses is thought of as being due to infrasonic waves. The origin of the overtone series, so very important in music theory, is discussed in chapter 3. The three laws of Mersenne, which govern the fundamental frequency of stretched wires, are also treated. The Kundt's tube demonstration is used to describe the properties of longitudinal standing waves, and the famous Chladni plates are used to demonstrate standing waves in two dimensions. All throughout the chapter the properties of standing waves are related to music and musical instruments. Fourier analysis and synthesis, which is typically very formidable mathematically, is presented in chapter 4 in a manner that is very understandable to the targeted readership. The Fourier synthesis of triangular, square, and sawtooth waves, along with a pulse train, is discussed. After a treatment of Fourier spectrum of these waves, the authors discuss the factors contributing to tone quality. In chapter 5, the authors turn to more practical considerations, wherein they discuss how to create electronic music. Analog synthesizers, although very antiquated by modern standards, are used to illustrate how to combine waves to obtain special sounds or effects. The authors then immediately turn to digital synthesizers and keyboards. They discuss the Musical Instrument Digital Interface (MIDI), but the equipment they illustrate in the chapter is considerably out of date. The anatomy and physics of the human ear and voice tract are discussed in chapter 6. The diagrams they include are useful, and they discuss the "place theory of hearing" , which is based on the correlation of sound frequency with position of response along the basilar membrane. The critical band, just noticeable difference, and the limit of frequency discrimination are all discussed in the context of this theory, with several different experiments proposed to illustrate these concepts. Most interesting is the discussion on periodicity pitch, which musicians seem to have a knack for. Also interesting is the treatment of vocal formants, which are frequency regions in which harmonics have large amplitudes. Due to the element of subjectivity in hearing and listening, the connection of the material in this chapter to "psychophysics" and "psychoacoustics" is readily apparent. Most of the next chapter is out-dated since the authors discuss sound reproduction using LPs and tape recorders. However, the authors do discuss how this is done using compact disks, which though are themselves on their way out, due to the rise of the Internet, MP3 formats, and digital music files. Chapter 8 is timeless though, as the authors discuss the acoustics of auditoriums and rooms, detailing the most important acoustical characteristics that contribute to a pleasant musical experience, and some of the problems that arise in acoustical design. The last section of the chapter gives a fairly good overview of what is involved in setting up a home listening room. In chapter 9, the authors take the plunge into music theory, discussing temperament and musical pitch. The history behind these concepts is detailed, emphasizing in particular that an ideal temperament is not available, its choice being dictated by the musical requirements at hand. Arithmetic descriptions of the Pythagorean, just, mean-tone, Werckmeister, and equal temperaments are given. The last five chapters are specialized to the principles behind woodwind, brass, string, and percussion instruments, and the piano. The discussion is purely descriptive, but some of the physical principles studied in the first chapters of the book are applied here to give an understanding of the acoustical and musical properties of these instruments.

One of the most frustrating things for non-scientistswho want to understand how the universe works is a lack ofinsightful and fundamental popular books writen in clear, beautiful English, with illustrations clear enough to explain what is going on when the word concepts are hard to visualize. All hail THE PHYSICS OF SOUND! This is the best book to date I know of which tackles hard, fundamental problems in accounstic and sound. It would be perfect for a "Physics for Poets" course, or as a textbook for use in explaining to musicians (and just about anyone else) why sound is, and how you can learn to control its quality. A visually beautiful book-well balanced white space, *excellent* illustrations, lyical text by people who care profoundly about the beauty of their subject. Beautifully bound, to boot. Can’t say enough about this one.

Positives:The book tries to introduce MANY topics in a manner that is somewhat accessible to nonphysics people.The questions at the end of each section are ordered from easiest to most difficult.Chapter summaries are provided.Logical structuring of later chapters (musical instruments)Negatives:Authors sometimes "give up" on topics or mention them only as an aside.Chapters rarely provide mathematics needed to answer chapter exercises."Big picture" is often lost in order to focus on minute details.Some music theory knowledge is requiredThe book has moments of "bad writing"; that is, ambiguity in terms of paragraph structure (English stuff)Poor applications/ has trouble connecting to a musician's experiencesI think this book would benefit from two additions:1) Appendix A (Intro. to Music Theory) should be given its own chapter at the beginning of the book. I had trouble digesting overtones at first.2) Perhaps a mathematics-heavy chapter at the beginning of the book.Now, I could handle the math, music theory, etc. fairly well; however, as a book geared towards people with limited knowledge of mathematics, I still suggest that this book is only "okay."If I were a music major, I would find myself lost in the finer details by the end of this book. I would perhaps desire a stronger foundation of the PHYSICS of sound.

The Physics of Sound is a great book for both musicians and nonmuscians alike. Its not a book for anyone who is afraid of a little mind work. I recommend Physics of Sound because immediately upon after reading it I gained a whole new perspective and deep appreciation for the fundamental elements,and principles that govern this wonderful phenomena we call "SOUND".Ever wondered how fast sound travel? What about how various sound frequencies react to each other,and in rooms? What exactly is sound? All these questions and more,are answered here. Physics of sound even gives you basic formulas that allow you to manipulate sound in the real world.Gain Knowledge,Gain Insight,Gain information.

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