



The Fundamentals of Sound Science

Elena Borovitskaya

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"*The Fundamentals of Sound Science* teaches the principles of the physics of sound, as well as basic principles of physics, by linking them to music and musical instruments.

The book begins by asking students to question the meaning of sound itself. What is sound? How far and how fast does it travel? By asking students to think about sound in this way, the material is able to connect our daily experience of sound to principles of physics such as distance, velocity, scalars, and vectors. Through the next six chapters students learn about harmonic motion, waves, the sources and physical properties of sound, and measurements of loudness.

The second half of the book uses music as the vehicle for a deeper exploration of sound. Students study some basic musicianship, including articulation, intervals, and harmonic series. These concepts become the springboard for an examination of the Fourier Analysis of Simplest Sound Spectra, which encompasses steady tones, periodic waves of arbitrary form, square, triangular, and sawtooth waves, and modulated tones.

Different families of instruments are discussed in depth: percussion, strings, flutes and recorders, woodwinds, and finally the human voice. The book concludes with a chapter on room acoustics, which covers the precedence effect and reverberations.

Each chapter is filled with detailed explanations, and numerous examples are used to enhance student understanding. Study questions are included to encourage critical thinking, and prepare students for tests. Chapter summaries aid retention by reviewing terms and relations.

By finding the common ground between physics and music, *The Fundamentals of Sound Science* strengthens understanding of both, revealing that many principles of the physical world are a part of our common, taken for granted, daily experience. All we have to do is listen.

The Fundamentals of Sound Science can be used for introductory courses in physics, including those at the high school level. The accessibility of the material makes the book appropriate for non-majors at the university level, and students can achieve mastery of the content without a background in mathematics, making the book ideal for general education courses.

Elena Borovitskaya earned her Ph.D. in physics and mathematics at the Institute of Applied Physics, Russian Academy of Science in Nizhni Novgorod, Russia. Her area of expertise is the physics of low-dimensional systems such as quantum wells, quantum wires, and quantum dots. Dr. Borovitskaya also studied at a music school in Nizhni Novgorod. Her joint areas of interest and expertise have enabled her to connect the language of physics and the language of music. Currently she is a faculty member at Temple University in Philadelphia, where she enjoys teaching a variety of courses, musical acoustics being her favorite. "

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