Introduction to Sound

Sound: An Interactive eBook

Sound: An Interactive eBook consists of 33 interactive simulations which require the reader to click buttons, move sliders, etc. in order to answer questions about the behavior of waves and sound in particular. There are also dozens of links to YouTube videos and other online resources that pertain to the topics being covered as well as suggestions for laboratory exercises and sound clips for understanding the fascinating subject of sound and music. The goal was to create an engaging text that integrates the strengths of printed, static textbooks and the interactive dynamics possible with simulations to engage the student in actively learning the physics of sound.

This book began in the way most textbooks do, as notes put together for a new course. The physics of sound, however, lends itself particularly well to examples, demonstrations and student participation in experiments. There are thousands of YouTube videos of interesting sound phenomena and dozens of simulations related to the physics of sound and music. This book was created from trying to provide access to these resources in a single source, first from a web page, then as interactive simulations on web pages and finally as this interactive textbook.

Interactivity

Gutenberg's invention of movable type around 1450 did not revolutionize the content or the format of the information being provided. It did have the important consequence of speeding up and broadening access to information. In a similar way, much of our modern technology has accelerated and expanded access to the world's knowledge base. Instructors today routinely provide a course syllabus, course information, instructor notes, assignments, sample tests, supplementary reading, and web links to other material, all online using a course management system or simple web pages. Many university students now receive access to a PDF version of the course textbook when they register for a course.

These uses, however, are *not* interactive. Much like an enhanced printing press, this technology serves to accelerate the one way transfer of material from the instructor to the student. In this regard it is not much different from what was already being done 560 years ago by Gutenberg; the information flow is unidirectional, albeit much faster. While, in hindsight, Gutenberg's creation was seminal to mass education, the communications revolution of the past century has yet to produce comparable improvements in human learning. However, today's technology has the capacity to function much more interactively of which this book is an example.

> **Note**
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> Not all platforms allow JavaScript access to the sound hardware. Reset the simulation and try the Sound button again if the sound fails to play.

The above simulation (found in Chapter 10) is an example of the interactive nature of the simulations in this book. Play the simulation (you may have to click the reset button for the sound to turn on). What do you hear? What is the mathematical relationship between the beats you hear and the two frequencies? Use the slider to gradually change the difference in frequencies. At what point do you no longer hear beats? This unpleasant sound is called *dissonance*. At what difference in frequencies does this occur? If you continue to separate the two frequencies you will eventually hear two separate tones. When does this occur?

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