

For example, the Navier–Stokes equations could be presented, and the force balances, scaling and analytical results that apply in different limits could be derived.

Undergraduates at any level should be able to follow the book if they have a background in high school physics and elementary calculus. Dimensionless numbers, such as the Reynolds number, Froude number and Rossby number, are defined for the reader, and quantities such as the Coriolis force and potential temperature are carefully explained.

I have used this book successfully as a reference for an undergraduate class in geological and environmental fluid mechanics. Because of the interesting applications and the absence of advanced math and physics, this book might even be useful as a guide for a freshman seminar.

In summary, this book is well written and thoughtfully motivated and has clear explanations. Its great strength is in the physical insight it provides into many commonly occurring flows and phenomena. As a testimony to the contagion of Simpson's fascination with gravity currents, I now seem to notice these phenomena everywhere and appreciate the physical processes they represent, such as the spreading of syrup on my pancakes, a low Reynolds number current spreading on a porous surface.

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Signals, Sound, and Sensation

▶ William M. Hartmann
AIP, Woodbury, N.Y., 1997.
647 pp. \$80.00 hc
ISBN 1-56396-283-7

Psychophysics is the study of the relationship between the magnitude of a stimulus measured in conventional units and the magnitude of the sensation as perceived by the brain. In *Signals, Sound, and Sensation*, William Hartmann provides a comprehensive treatment of the theory and methods used by psychophysicists to study the perception of sound, and he introduces the reader to the quantitative methods of psychoacoustics.

The story begins with an explanation of the importance of a pure tone and the use of decibels to quantify measurements of power and intensity. The reader is assumed to know basic calculus and is provided with other mathematical tools as needed. The connection to psychoacoustics is firmly

established in chapter 4 with a discussion of the relationship between intensity and loudness. The chapters on signal theory present topics such as Fourier analysis and filters in the same systematic manner that you would expect to find in an engineering text, although the style is somewhat friendlier. Key concepts and results from psychophysics are interspersed throughout, at appropriate places.

The cochlea's fundamental role as a frequency analyzer is discussed primarily in terms of auditory filters. There is very little discussion of auditory physiology here. Auditory filters in psychoacoustics are idealized as having rectangular, "roex" and "gamma-tone" shapes. The critical band, described as the "single most dominant concept in auditory theory," is a channel for processing auditory information, and its bandwidth is measured by psychoacoustic methods. Tones separated in frequency by less than a critical band interact with each other much more than do tones that are further separated.

The chapter on music theory covers mainly the mathematics of musical intervals. This is followed by a discussion of the psychoacoustics of pitch perception. More advanced topics in the book include correlation, probability density functions, modulation, nonlinear distortion, noise and signal-detection theory. Signal-detection theory has become the hallmark of modern psychophysics. For the most part, variables describing perceived quantities are best thought of as random variables.

Hartmann's many years of teaching acoustics and physics are evident in the confident manner in which he presents this material. He covers a wide range of topics in a clear, authoritative and easy-to-read style. The material is most appropriate for the student who has an interest in the science of hearing and who wishes to acquire familiarity with acoustics and signal theory.

Signals, Sound, and Sensation is intended to be used as a text for a second course in psychoacoustics. For this purpose, the coverage of relevant topics is very thorough. The exercises at the end of each chapter are generally easy to do and are used to introduce additional material. The book would also be a useful reference for anyone interested in the study of auditory perception. Readers who already have an acquaintance with signal theory may appreciate the sensible style of the discussions of such psychoacoustic topics as loudness and pitch perception. Numerous references to the journal literature are included for those seeking further details.

As a hearing-research scientist with a background in physics and electrical engineering, I appreciated the direct, accessible style of Hartmann's book and found it a pleasure to read. It should be considered by anyone wanting to teach signal theory to students with an interest in psychoacoustics.

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The Dancing Universe: From Creation Myths to the Big Bang

▶ Marcelo Gleiser
Dutton (Penguin), New York,
1997. 352 pp. \$25.95 hc
ISBN 0-525-94112-6

The publication of books about the relationships among myth, religion and science is a booming cottage industry. Physicists and cosmologists are particularly eager to explain their esoteric attempts to understand creation and to tie them to other belief systems. Some cosmologists even believe that they have pushed science right up to the edge of faith.

Much of modern cosmology, when simplified for presentation to the lay public, reads much like a creation myth. Even the big-bang and steady-state universes, and closed vs. open universes, have parallels in ancient belief systems.

Consider the Maori myth of the Creation:

*From Nothing, the begetting
From nothing, the increase
From nothing, the abundance
The power of increasing the
living breath.*

*It dwelt with the empty space,
And produced the atmosphere
which is above us,
The atmosphere which floats
above the Earth;
The great firmament above us
dwelt with the early dawn,
And the Moon sprang forth.
The atmosphere above us dwelt
with the heat.*

There is no Being behind this creation; things appear from nothing, simply due to an inexorable urge to be. Does this sound familiar? The Roman poet Ovid wrote in 8 AD, in *Metamorphoses*:

*Before the Ocean was, or Earth,
or Heaven,
Nature was all alike, a
shapelessness,
Chaos, so-called, all ruse and*