Title
A Guided Tour of Mathematical Methods for the Physical Sciences

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program can be run at any speed, and paused at any point, so it is ideal for explaining wave propagation in the classroom.

In all the programs, additional information is available on each diagram, including an explanation of each featured earthquake. The photo gallery includes pictures from several famous earthquakes and eruptions, with detailed captions provided for each. The earthquake and eruption records through time can be updated from the Smithsonian Web site, and the authors say they will have additional earthquakes for the seismic waves program available at the Web site in the future. An advanced user can also add his or her own events using information from the IRIS Web site.

Overall, this is a tremendous CD-ROM, well worth the price just for its utility in the classroom; but I suspect it might end up on one's home computer, too. It is user-friendly, full of hidden tidbits, and just plain interesting.

Reviewer

Michael H. Ort
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The Secret Life of Dust

PAGES 316–317

HANNAH HOLMES
John Wiley & Sons, Inc., New York, ISBN 0-471-37743-0, 240 pp., 2001, $22.95.

The Secret Life of Dust by Hannah Holmes is not a quick read. I frequently paused to reach for a pen to mark interesting pages, to write down surprising facts, or to tell my spouse about some wonderful story I had just read. This is not a book to rush through; it is a book to sink into, and it is densely packed with information. Holmes does not glorify dust, but she certainly finds it fascinating, little appreciated, and much misunderstood. *The Secret Life of Dust* is her attempt to open our eyes to something that is too small to see easily, but too large to catch the attention of most physicists or chemists. Dust is everywhere, and it is far more important than most of us realize.

I have a professional interest in dust. I've published a theory that changes in dust accretion—not insolation—are responsible for the glacial cycles, a theory that gets only passing mention in Holmes' book. I also have a scientist's general interest in remote topics that relate to my field even slightly. Even so, I was astonished at the wide range of fascinating phenomena that Holmes was able to bring to this book. She moves effortlessly from cosmic dust to desert dust—yes, Afghanistan is one of the dustiest places on Earth—to vacuum cleaner dust. Many vacuum cleaners do harm: they pick dust off the ground, filter out the larger particles, and then spray the fine particles into the air. They can easily enter the inner recesses of our lungs.

I began reading the book thinking that dust was an arcane subject of narrow interest to me and a few colleagues. By the time I finished the book, I came away thinking that dust research is one of the most fascinating areas of science, right up with the accelerating universe and 10-dimensional space-time. There are no dust experts; the field is too broad and touches too many different areas of physics, astrophysics, geophysics, biology, health, archeology, cooking, and even politics. Noxious dust in China is responsible for the death of one out of every 14 people in that country, and the "Asian Express"—dust blown completely across the Pacific to the United States—threatens the health of people in the United States.

Holmes has a vivid style, and her delightful descriptions of scientists are better than photographs. Rick Hoblitt "has the classic look of a geologist, with an impressive mustache and leather hiking boots a team of surgeons will have to remove when he dies." She describes David Leisawitz as "a textbook example of his breed: he travels a tight orbit around a coffeepot, his sentences stagger under a burden of terminology, and his walls are papered with pinups of satellites." In a pleasant reversal, her descriptions of men tend to be more picturesque than those of women. Her portrayal of personalities and appearances helps to humanize the book and brings out the fun of doing dust science. I'm curious to see how she would describe me, if she ever does.

Holmes is a science writer, not a scientist, so she can be forgiven for the occasional minor mistake; for example, "IR is infrared radiation—the heat that you see rippling off hot pavement." Her writing is, for the most part, clear and accurate. She makes a point of describing all the things that are NOT known, from the origin of the current asthma plague—which is widely attributed either to dust or to its absence in overly-clean homes—to the role of dust in climate. That makes this book particularly good for the non-professional, since it shows the confusing paradoxes and mysteries as exactly that, and—after all—that is what attracts many of us professionals to science. She manages to draw out the scientists and get them to speculate, and to say some things they would never say to their colleagues. Yet, she is careful to distinguish their scientific results from their speculations. Crazy ideas are not the product of science, but they often serve as the motivation and starting point. They lead us into difficult measurements, sometimes impossible measurements, but measurements that we would never bother trying to make if there weren't some speculation driving us. In this way, Holmes illustrates the true "scientific method" far better than do most textbooks. Her book includes a long and useful bibliography.

If you are looking for a dazzling story, this is not your book. *The Secret Life of Dust* is for any scientist or layman who wants to learn a lot, is interested in a wide range of subjects, and is willing to read slowly and wallow in dust.

Reviewer

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A Guided Tour of Mathematical Methods for the Physical Sciences

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ROEL SNEIDER
Colorado School of Mines, ISBN 0-521-78751-3, xi + 429 pp., 2001.

After reading *A Guided Tour of Mathematical Methods for the Physical Sciences*, not only will you be able to impress your friends with a back-of-the-envelope scaling analysis to debunk the myth that a bathtub drains in different directions in both hemispheres. You will also know whether life is possible in a five-dimensional world. In fact, you will understand a lot of mathematical methods and know how to apply them to real physical problems. This unique textbook presents all of its material in the form of problems that invite the reader to participate in the development of the theory. Guided by Roel Sneider's textbook, learning mathematical methods can be fun.

The book's intended readership consists of upper-level undergraduate and beginning graduate students of the physical sciences. A good knowledge of calculus and linear algebra as covered in typical undergraduate courses is all the preparation needed to study the book. A step-by-step approach is used to break down difficult mathematics into manageable problems that are usually simple enough. This approach, coupled with the ample discussion interlaced with the problems, makes the book effective for self-study. Teachers of physics courses will also find the book useful as a source of problems to help the students master required mathematical skills. I have used it effectively in a course on physical oceanography to cover scale analysis, advective derivatives, and pressure gradients to an interdisciplinary group of students.

Many of the problems are drawn from geophysics, but almost all branches of physics are represented. A surprising amount of mathematical methods is covered through these problems. Some that are especially well presented include scale analysis, Green's functions, and perturbation theory. Much of the standard material provided in texts on mathematical physics is also well covered, for example, vector calculus, special functions, and Fourier analysis, to name a few from a long list. Treatment of the mathematical methods is never exhaustive, but it is almost always straightforward with a lucid explanation of the mathematics and its application.

A Guided Tour of Mathematical Methods for the Physical Sciences particularly excels when the physical problems are well-chosen, so that the reader can draw on his or her physical intuition to help understand the mathematics. Unfortunately, not all the methods presented in the book are accompanied by a physical problem. For example, the presentation of the singular value decomposition and the Householder transformations are presented without any physical application or references to any such applications.

The book has an extensive bibliography with many references to good mathematical physics textbooks that can provide a useful source of exercises to build up the skill necessary to apply mathematical methods to new physical problems. Also included are many references to books and journal articles related to the physics encountered in the problems. I found myself making several trips to the library to learn more about quantum mechanics and seismology after my interest was captured by some of the problems in the book. I highly recommend *A Guided Tour of Mathematical Methods for the Physical Sciences*.

Reviewer

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ABOUT AGU

Thomas Vincent McEvilly (1934-2002)

PAGE 311

On 22 February 2002, the seismological community lost one of its most engaging and distinguished members, Thomas McEvilly (or Tom as he was known to all), professor emeritus of geophysics at the University of California, Berkeley. He was undergoing treatment at St. Anthony's Medical Center in St. Louis, the city of his birth. McEvilly was an AGU Fellow, and a member of the Seismology Section (1957).

His contributions to geophysics ranged widely, particularly in seismology. His many publications investigated, among other topics, seismic crustal profiling, earthquake source properties, test-ban treaty verification methods, earthquake prediction, and seismographic instrumentation. He was also a Fellow of the American Association for the Advancement of Science, and an honorary member of the Seismological Society of America. McEvilly served on many scientific advisory committees for government, university, and professional organizations, including UNESCO, the National Science Foundation, the U.S. Geological Survey, and the Department of Energy. he also held the notable position of chairman of the Committee of Seismology of the National Academy of Science/National Research Council from 1981 to 1983.

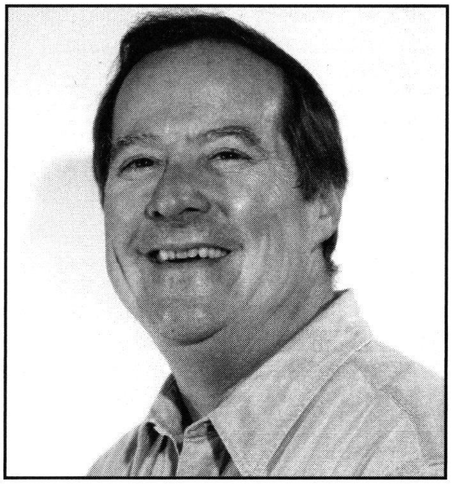
McEvilly graduated with a B.S. summa cum laude in geophysics from St. Louis University in 1956. He worked briefly in oil exploration with the California Company and was associated with the Sprengnether Instrument Company (1961–1968), eventually becoming engineering vice-president. In 1960, he returned to St. Louis University, where he graduated with a Ph.D. in geophysics in 1964.

In the early 1960s, considerable federal money became available for upgrades in seismology to support surveillance of a nuclear test-ban treaty. At the Seismographic Stations at the University of California, Berkeley, Professor Perry Byerly had secured substantial funds for the first regional telemetry seismographic network in the world. The late Don Tocher had been appointed senior research seismologist and was in charge of installing and operating the network. When Byerly became ill, it was necessary, in short order, to secure the services of another professor. As a consequence, I was appointed professor and director in 1963, and in turn sought the help of an assistant professor of seismology. In those days, candidates were not found by advertising in journals, but through personal contacts. The Department of Geology and Geophysics—now Earth and Planetary Science—at Berkeley had a close relationship with St. Louis University, where a strong seismology program had been developed by J. B. Macelwane, a Ph.D. from Berkeley, who had taught seismology there for a while. When approached, the St. Louis faculty unanimously recommended McEvilly in the most laudatory way. They said he was clever, innovative, with experience in field geophysical exploration and, of special value to the Berkeley situation, deeply knowledgeable about state-of-the-art seismological instrumentation.

Selection was rapid, and McEvilly arrived at the Seismographic Stations in August 1964. Everyone was struck by how young he looked. Indeed, he never seemed to age. During field work with Berkeley graduate students John Filson and William Bakun, McEvilly was the only one to be asked for age identification at a neighborhood bar. Don Tocher had resigned before Tom arrived at Berkeley to head the seismology program of the U.S. Coast and Geodetic Survey. McEvilly, Tocher, and their wives became close friends, not only through earthquake studies, but through mutual delight in fine California wines and wineries, which they often found in the near-field of active faults!

At once, McEvilly began detailed studies of California earthquakes, research which became a major and persistent part of his career. The initial pivot, to which he returned many times in his life, was the Parkfield earthquake of 1966. In due course, he became assistant director of the Seismographic Stations (1968–1989) and was appointed chairman of the Department of Geology and Geophysics (1976–1980) and director of the Earth Sciences Division of the National Lawrence Berkeley Laboratory (1982–1983).

The first major project he was involved with at Berkeley was the planning and construction of the San Andreas Multi-purpose Observatory on the San Andreas Fault near Hollister. It was



thought that instruments at this site would capture the dynamics of a large fault rupture. McEvilly, his staff, and students derived much pleasure and stimulus from this enterprise, which was ahead of its time in many ways. In 1968, he wrote a joint paper with Cinna Lomnitz and myself that summarized the main University of California, Berkeley seismological contributions to the establishment of plate tectonics. This analysis of plate margin seismicity in central and northern California was made feasible by the high resolution of focal depth and fault mechanism—a McEvilly specialty—provided by the Berkeley Telemetry Network.

Research grants from the Advanced Research Project Agency (ARPA) remained generous and ongoing through the 1970s. In 1968, Lane Johnson joined the faculty, and McEvilly and Johnson took over the major research effort supported by ARPA. Many lasting publications by them and their students followed.

Over the years, McEvilly's research became more and more diverse within the context of seismicity, crustal structure, seismic source, and fault properties. An extensive list of over 100 publications resulted, featuring an unusual variety of dozens of student and professional co-authors. I would select two seminal scientific contributions that relate to seismological observations and practice. The first was a joint research paper with Filson. They convincingly measured, for the first time, the rupture velocity along a rebounding fault using radiated Love wave spectra of Parkfield earthquakes recorded remotely at Berkeley by a novel ultra-long period seismograph. The result became a key quote in advanced texts.

The second was of a very different kind: the critical role of McEvilly to the success, from its