mean to a student who hasn't read the detector section first. And a reasonably large fraction of the text consists of detailed descriptions of experiments.

It would probably be impossible to correct many of these faults, as one of the book's biggest shortcomings is also in some ways its biggest strength: It tries to be all things to all people. It is for graduates and undergraduates, and it describes in detail experiment, theory, particle physics, and cosmology. That's a lot of material in one book.

Other popular textbooks do exist that can partially fill this book's niche. *The Experimental Foundations of Particle Physics*, by Robert N. Cahn and Gerson Goldhaber (Cambridge U. Press, 1989), gives a historical review of pivotal experiments, including reprints of their publications. *Introduction to Elementary Particles*, by David Griffiths (Wiley, 1987), *Modern Elementary Particle Physics*, by Gordon L. Kane (Addison-Wesley, 1993), and *Collider Physics*, by Vernon Barger and Roger Phillips (Addison-Wesley, 1997), all discuss most of the essential phenomenology that a young particle physicist needs to learn, and they all include elementary quantum field theory.

They don't, however, describe experiments in detail. Perkins will thus continue to be a "must-have" for practicing experimentalists. It will also continue as a good choice for advanced undergraduates who have completed a course on quantum mechanics that includes scattering theory (it would be nice if this text reviewed scattering theory), or as part of a graduate course.

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Mathematical Methods: For Students of Physics and Related Fields

Sadri Hassani
Springer-Verlag, New York, 2000. $69.95 (659 pp.).
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Sadri Hassani's *Mathematical Methods* is the latest addition to the already long list of textbooks for an undergraduate course on mathematical methods for students of physics, engineering, and related fields. Four of these books (not including this one) were recently discussed in an excellent comparative review by Donald Spector (*American Journal of Physics*, volume 67, page 165, 1999). In terms of target audience, pace, and field coverage, Hassani's text is most nearly comparable to *Mathematical Methods in the Physical Sciences*, second edition, by Mary L. Boas (Wiley, 1983).

The topic coverage is fairly standard—infinite series, vector analysis, eigenvalues and eigenvectors, complex analysis, and ordinary and partial differential equations. There is an entire chapter on the Dirac delta function, including two- and three-dimensional versions, that I particularly like, and a chapter on nonlinear dynamics and chaos that is also well done. Topics covered in other books at this level but not covered here include the calculus of variations, probabilities, tensors, integral transforms, and the use of computers either for symbolic computing or numerical analysis. The first I don't particularly miss; students can learn the calculus of variations, when the need arises, in a classical mechanics course. The rest, however, I do miss to varying degrees.

The book has many strengths. For example: Each chapter starts with a preamble that puts the chapter in context. Often, the author uses physical examples to motivate definitions, illustrate relationships, or culminate the development of particular mathematical strands. The use of Maxwell's equations to cap the presentation of vector calculus, a discussion that includes some tidbits about what led Maxwell to the displacement current, is a particularly enjoyable example. Historical touches like this are not isolated cases; the book includes a large number of notes on people and ideas, subtly reminding the student that science and mathematics are continuing and fascinating human activities.

Sometimes, the author deviates from the traditional subdivisions to stress connections among different topics and techniques. For instance, he unifies the discussion of finite-dimensional vector spaces and orthogonal polynomials so that, when Fourier series or special functions are later used to solve ordinary differential equations, the notion of a function space with an orthogonal basis set is no longer entirely new. There are numerous detailed examples that students should find helpful, and many and varied end-of-chapter problems.

On the other hand, the first two-and-a-half chapters review material that students taking a mathematical methods course should already know. The chapters are not just straightforward review, however. It seems as if the author has identified certain problems and misconceptions that he is determined to exorcise, but the exorcisms can sometimes lead to more confusion. One of his candidate misconceptions is the notion that a derivative is "just a rate of change." His solution is to assert (in a statement enclosed in a box for emphasis) that a derivative is just "the ratio of two physical quantities which are defined locally." This may work if the quantities are functionally related, but it does not quite exclude the possibility of trying to define a derivative in the absence of a function.

The book contains numerous unwarranted generalizations ("in all cases of physical interest the separation of variables works"). It also has too many footnotes (18 in chapter 3, 31 in chapter 8—I find them distracting), too many acronyms (PDE, ODE, FODE, SODE, HSOLDE). Additionally, considering the large number of historical notes, some people are bound to take exception to one or another of them. My list includes such things as stopping at Julian Schwinger and Richard Feynman in a list that should have included Sin-Itiro Tomonaga, or describing a positron as a particle with negative energy—which, as P. A. M. Dirac himself cautioned, "would make the dynamical relations all wrong."

I would find the book more attractive if the first couple of chapters were shorter, or had avoided "exorcisms," or were omitted altogether. Then Hassani might have made room for some discussion of probabilities, tensors, and integral transforms. Furthermore, at a time when the physics community is becoming more aware that linear, or separable, or exactly soluble problems do not exhaust the complexity of the physical universe, and the use of computers is more ubiquitous, some discussion of the use of computers for numerical analysis would have been welcome. All in all, however, this book could provide Boas with some serious competition, especially if her forthcoming third edition, scheduled for January 2002, does not come forth soon.

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Quantum Chemistry: Classic Scientific Papers

Hinne Hettema
World Scientific, River Edge, N.J., 2000. $90.00 (478 pp.). ISBN 981-02-2771-X

Hinne Hettema's *Quantum Chemistry* is a finely produced, useful, and highly thought-provoking book. Hettema is a chemist turned philosopher, and he has credentials in both disciplines.

The body of the book consists of 26 German-language papers by 18 authors, written between 1926 and 1934, all expertly translated into English. Of the papers, 21 are from the journal *Zeitshrift für Physik*. Given the importance of these papers, teachers of quantum chemistry or molecular physics well might require their students to read this book at the time they are treating the theory of molecules and molecular spectra. What more valuable experience could there be than to study the magnificent paper by Max Born and J. Robert Oppenheimer, or several of the astounding papers of Fritz London, or those of Friedrich Hund, Egil Hylleraas, John Charles Polanyi, or Eugene Wigner? By 1934, there were many classic papers in English as well as in German, and so "Classic German Scientific Papers" would have been a better subtitle for the book.

At the start of the book is a provoking 23-page essay by Hettema entitled "Philosophical and Historical Introduction." This includes an analysis of the shift of the center of research in quantum chemistry away from Germany and to the English-speaking countries. The author concludes that "the smooth transition of quantum chemistry to the USA, as it took place in the 1930s, had to do with the embedding of the quantum chemistry community in the wider environment in Weimar Germany, and the manner in which the applications of quantum mechanics were ill-suited to the Weimar intellectual environment."

To the contrary, I would rather claim that this transition was due quite simply to the Gilbert N. Lewis–Linus Pauling tradition in the US, plus the distinguished leadership, through the transition period in the English-speaking countries, of Robert Mulliken, John Slater, John Van Vleck, Henry Eyring, John Lennard-Jones (England), and Gerhard Herzberg (Canada). Of these, only Herzberg was an immigrant, although other immigrants played central roles. In particular, one should mention Maria Goeppert-Mayer, whose 1938 paper (with Alfred Sklar) in the *Journal of Chemical Physics* was her only contribution to quantum chemistry but perhaps was the most farsighted electronic-structure paper before World War II. Karl Herzfeld also made important contributions (of which few people know).

When I began research in the 1940s,