stance, when quoting the work on electric field sensing for human–computer interfaces that I and others are doing at the MIT Media Lab, he claims that we are detecting the weak electric fields naturally emanating from the human body, even calling it an "aura." This is a terrible misunderstanding. In reality, we are merely exploiting the body as an electrical conductor in an application of capacitive sensing, which has long been a well-established technology devoid of any "auras." There are also some glaring oversights; for example, he credits the recent COBE (Cosmic Background Explorer) satellite with making the first observations of the 3° microwave background radiation left over from the Big Bang, ignoring the fact that this was detected decades before in the well-known, Nobel-prize-winning measurements of Arno Penzias and Robert Wilson.

Despite these drawbacks, Kaku's *Visions* is an entertaining and stimulating field trip through the technical future. Of course, nobody can get it all right: The depth of change that will occur even during a single human lifespan, will result in a world very different from anything that we can now conceive of, leaving plenty of exploration for the science fiction authors and social critics that Kaku disparages in his introduction.

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Group Theory in Physics: An Introduction

J. F. Cornwell
Academic, San Diego, Calif., 1997. 349 pp. $59.95 pb
ISBN 0-12-189800-8

Let me start by stating that I like J. F. Cornwell's new *Group Theory in Physics: An Introduction* and am recommending it as supplementary reading material for the undergraduate and graduate students whom I either mentor or teach in the classroom. Knowledge of group theory is necessary for the theoretical physicist who is specifically interested in symmetries, and it is a useful tool for physicists in general. Cornwell is able to communicate well the thoroughness needed for deeper appreciation of the subject. Further, once one begins to understand its mathematical notation and literary style, this book opens doors of mathematical reasoning that can only enhance the reader's ability to understand and communicate physics.

The book itself is principally a condensation of Cornwell's two-volume *Group Theory in Physics* (Academic, 1984) and covers material in print elsewhere and generally in use in research—for example, *Lie Algebras in Particle Physics* by Howard Georgi, (Addison-Wesley, 1982). And while the mathematical rigor the author insists on is instructive and valuable, it adds little to the traditional subject material.

To provide a view of the effect the book has on students, I asked four physics students, of different levels, backgrounds and interests—a freshman undergraduate, a senior undergraduate, a third-year graduate student and a theoretician/postdoc—to examine the book. My expectation was that the undergraduates would have difficulty understanding the work and the graduate student would possibly embrace it. I could not anticipate the reaction of the postdoc.

How did it turn out? The freshman—an aspiring experimentalist—did have difficulty with the language and could not connect chapters where appropriate. This reaction is not surprising. The senior—an aspiring theorist—liked the book and offered some suggestions as to how the material might better be presented. At the same time, he was able to extract some nontrivial meaning from its pages. (He used Cornwell's book, in addition to other sources, for summer reading and mathematical enhancement before going off to graduate school.)

The graduate student, a theorist with a master's degree in mathematics, was very interested in its contents and, while potentially enthusiastic, suggested that a more familiar notation for group symbols, for example, would have elucidated the points better, and he was critical of the author's use of what he considered an arcane notation throughout the book. He and I agreed that the reader does not need to know anything about groups prior to reading this book. The postdoc was generally unimpressed.

Group Theory in Physics: An Introduction is quite well put together, and close examination, on my part at least, revealed few typos and no logical flaws. The book is really a reference and not a classroom text. While applications of mathematics are made to condensed matter, atomic and particularly nuclear and high-energy physics, there are no problems to be solved at the ends of the chapters. There are examples—of varying transparency—within the chapters, but they sometimes seem isolated. I agree with the author's suggestion that the chapters on Lie groups and Lie algebras are important for today's theorists, particularly those

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interested in local and global symmetries. Yet, I was slightly disappointed not to find, for example, either much on supersymmetry or a chapter on chaotic mathematics. These subjects are not commonly covered in such monographs, and their inclusion could have spiced up the presentation.

I enjoyed reading *Group Theory in Physics: An Introduction* and will keep it in my personal library. The author has generally done a good job of approaching the subject at a level appropriate to graduate and undergraduate students, while writing a book that works as well for those professors, like me, who have not yet written such a book and who are delighted by and find benefit from solid, useful mathematical refreshment.

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Introduction to Scientific Programming: Computational Problem Solving Using *Mathematica* and C

Joseph L. Zachary
TELOS (Springer-Verlag), Santa Clara, Calif., 1998. 433 pp. $49.95 hc ISBN 0-387-98250-7 Includes diskette

Introduction to Partial Differential Equations with MATLAB

Jeffery Cooper
Birkhäuser, Boston, 1998. 540 pp. $59.95 hc ISBN 0-8176-3967-5

During the last few years, symbolic algebraic languages have become more attractive and popular. Their use in the classroom, however, is still controversial. Many instructors feel that their use should not be encouraged until the student is proficient in mathematical theory. This type of reasoning is reminiscent of the controversy that took place more than 30 years ago, when electronic calculators became available. At the time, some felt that students should be allowed to use the calculators in the classroom only after they were exposed to the rigors of certain types of numerical analysis. This same type of reasoning is now circulating in academic circles regarding the use of algebraic symbolic languages to solve differential equations, perform analytical integration, manipulate trigonometric equations, solve matrix equations and perform other algebraic manipulations.

The two books reviewed here are the latest in a series of computer algebra books to be published within the last two years. *Introduction to Scientific Programming* by Joseph L. Zachary and *Introduction to Partial Differential Equations with MATLAB* by Jeffery Cooper both deal with the application of symbolic algebraic languages to scientific and engineering applications. The two books are aimed at different audiences. *Introduction to Scientific Programming* is for the freshman or sophomore who needs an introduction to programming. *Introduction to Partial Differential Equations with MATLAB* is meant for senior undergraduates, beginning graduate students or practicing professionals who need a basic exposure to the theory of partial differential equations with some numerical techniques.

The Zachary book is very basic; it claims that no calculus background is required, although knowledge of differential equations makes the material easier for the student. Each chapter explores different aspects of programming by elaborating a physical or mathematical problem. The first half of the book covers the Mathematica symbolic language by solving and plotting the solutions to eight problems: population density of the world; circumference of earth; equilibrium and center of gravity of a system; line of sight from a hill; population growth of the USA; ballistic trajectory; power required by a ship moving in water; and division of the area of a circle into equal sections. The second half of the book uses the lessons learned in the first half to teach the C programming language, a very interesting approach. Each chapter in the second half is also devoted to a different problem: kinetics of robot motion; motion of a block on an inclined plane; location of cylinders stacked on top of each other; kinetics of a beam stacked against a box; length of a corrugated sheet; harmonic oscillator; temperature of an insulated rod; and temperature of a rod with heating. The book is very detailed (maybe too much so) in describing the purpose of each line of programming.

The book has two World Wide Web sites, which contain applets and copies of the codes developed in each chapter (http://www.telospub.com/catalog/MATHEMATICA/IntroSciProg/Mma.html and http://www.cs.utah.edu/~zachary/IntroSciProgMma.html). It is becoming more common for textbooks to have such Web sites, and I think it is an excellent idea.

The reader may want to consult some other recent books on the application of symbolic algebraic languages in advanced mathematics classes. *Advanced Engineering Mathematics with Mathematica and MATLAB*, by Reza Malek-Madami (Addison-Wesley, 1998) and *Advanced Engineering Mathematics*, seventh edition, by Erwin Kreyszig (Wiley, 1997) are both standard mathematics books that use symbolic algebraic languages to solve the problems. They present more types of problems, techniques and solutions than Zachary does; however, the exposition in these books is not detailed enough to be used in a programming class.

In *Introduction to Partial Differential Equations with MATLAB*, Cooper is rigorous in the discussion, and he details the existence and uniqueness of each partial differential equation and also whether each system studied is well posed. MATLAB is used to obtain numerical solutions to the classical linear equations and also to study the effect of the nonlinear terms when added to the equation.

Cooper's presentation is more from the point of view of a mathematician than that of an engineer. The basic tools of MATLAB are given in one of the book's appendices.

The differential equations presented in the book are the typical classical ones discussed in a first course on partial differential equations: wave equation, heat equation, harmonic equation, dispersive equation, Schrödinger equation. The classical techniques used to solve those equations are likewise given: separation of variables, Fourier series, Laplace transform, as well as the method of characteristics. The book's Web sites contain numerical methods using the MATLAB programming language for each of the sample problems solved in the book (http://www.Birkhauser.com/book/isbn/0-8176-3967-5 and http://www.math.umd.edu/~jec).

One of the drawbacks of the Cooper book is that the discussion and presentation of the MATLAB programs are not included in the book, but instead are found at the Web sites. This makes it very difficult to follow the presentation of the algebraic language within the context of each problem.

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