that can follow a multivariate normal, a lognormal, or an additive logistic normal distribution. Nonmathematicians will likely find the content of these five chapters very dry and be overwhelmed by the multiplicity of properties and definitions. It might have been worthwhile presenting a few examples in the first part of the book to make it accessible to a wider audience.

The last two chapters of the book address the practical aspects of compositional data analysis and present an application to real data taken from an oil field. Practical issues include several options to deal with zeros in compositional data, the modeling of direct and cross semivariograms between component variables, the back-transform of means and variances estimated after additive logratio transform of original data, the computation of confidence intervals and confidence regions, and criteria to assess prediction performances of different algorithms. A key step in the analysis of compositional data is the modeling of the set of direct and cross semivariograms for which the authors adopted a spectral approach that has been seldom used in the geostatistical literature so far. The reader will, however, find numerous implementation tips that should facilitate the application of this innovative approach. I also liked the presentation of the derivation of confidence intervals and regions for different scenarios. The last section of Chapter 6, devoted to performance criteria, includes an interesting proposal to use the STRESS (STandardized REsidual Sum of Squares) as a distance measure that compares the dispersion of the original data set with the dispersion of the estimated data set. This measure would, however, fail to detect any systematic bias in the estimation, a weakness not mentioned in this monograph.

Practitioners will appreciate Chapter 7, where a dataset including 76 observations of three variables (proportions of oil, water, and rock) is analyzed using the public-domain software Gslib and ad hoc programs written by the authors. Detailed information on how to fit the direct and cross correlograms is provided, while cross-validation allows one to compare the prediction performances of alternative interpolation and transform approaches. The small size of the dataset demonstrates that application of geostatistical techniques does not require hundreds of observations, a common misunderstanding among practitioners. Although the values of a few parameters are listed in the book, it would have been more useful to print the entire Gslib parameter files in an appendix as well as give a copy of the dataset. The reader interested in reproducing the analysis needs to contact the authors to obtain a copy of the dataset and some of the programs. Cross-validation demonstrates the importance of transforming compositional data before their analysis and the small benefit of cokriging over kriging when all the variables are measured at the sampled locations.

In summary, this book provides a clear and very complete overview of the analysis of compositional data. As mentioned in the introductory chapter, this monograph is intended as a "state-of-the-art" book rather than as a textbook. It is mathematically challenging but practitioners will find useful implementation tips in the last couple of chapters. With the public-domain software and programs developed by the authors, interested readers should be able to conduct a similar analysis of their data.

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Essential Mathematical Methods for Physicists. *By Hans J. Weber and George B. Arfken.* Elsevier Academic Press, 2004. $89.95. 932 pp., hardcover. ISBN 0-12-059877-9.

Hans J. Weber and George B. Arfken have transformed their *Mathematical Methods for Physicists* (*MMP*) [1]—now in its 5th edition—into *Essential Mathematical Methods for Physicists* (*EMMP*), narrowing the audience to undergraduates. Although the authors have made improvements to the text, they have also introduced new deficiencies, such that the overall quality has not increased.

The new book addresses largely the same subjects as its predecessor. Indeed, the authors recommend the same subset of each book as the curriculum for a one-semester course, namely, vector calculus, determinants and matrices, infinite series, complex variables, and ordinary differential equations. *EMMP* leaves out the chapter on integral equations, though, replacing it with a new chapter on probability and statistics. It also juggles the outline a bit, as later editions commonly do.

Although some material has simply moved from one part of the book to another, the typical chapter has lost a couple of sections, often the last and most advanced topics. Excluding Lorentz covariance of Maxwell's equations and discrete groups from a group-theory chapter might free up valuable space in the new text for undergraduates. Of course, one could just as easily skip these in *MMP*. Also, some instructors will object to which parts of *MMP* got the ax: For instance, as long as a book contains four chapters on special functions, why not retain the modified Bessel functions?

The authors have used good judgment in simplifying the introductions to some subjects. As a case in point, they have removed a discussion of rotation of coordinate axes from amid a unit on vector arithmetic. Also, they no longer transform the trigonometric Fourier series into exponential form and compare it to a Laurent series as a prelude to defining the coefficients of the sines and cosines.

Sometimes, though, cutting back the material has introduced problems with the logical flow of ideas. For example, because of the excision of the section on rotation of coordinate axes, students lose the introduction to summation notation and see it for the first time in a tricky form of the distributive law within a problem involving summation of elastic forces.

In other cases, additional explanation balances the trimming of the content. Undergraduates will appreciate, for example, that the new book does not jump directly to the Fourier-series expansion of a sawtooth wave as in *MMP*. Instead it shows the integral formulas for the coefficients applied to the example, and the authors both name and show the integration by parts.

The text also introduces some incomplete explanations, though. For example, rather than merely citing the right-hand rule as in the old book, *EMMP* defines it with the idea of curling the fingers from one vector to the other. However, the point gets lost because of the failure to mention that the hand must wrap through an angle that does not exceed 180 degrees (an issue that has confused this reviewer's students even when explicitly stated). The book contains many similarly imprecise statements.

In addition to more explanation, the authors have introduced new examples. They round out the discussions in *MMP*, for instance complementing an example of differentiation of a Fourier series with integration. Where *MMP* has only arithmetic examples of vector addition and dot product (one apiece) and no example of cross product, *EMMP* does well to apply the operations to physical and geometric examples like center of mass, forces, free particle motion, distances between rockets and observers, and properties of triangles. (It also unnecessarily omits one of the two original examples.)

Unfortunately, poor prose makes many straightforward problems appear unnecessarily hard. Many examples lack both motivation and focus and fail to state the question before finding an answer. At the same time, solutions skip steps that even a reader already familiar with the mathematics must supply in order to follow the thread. Often the statement of justification for a step comes only after several more steps. Some examples show several solution methods with the hardest one first and the connections among them nonobvious. Also, more and better figures would have improved the explanations.

Some examples and many problems present significantly more challenging mathematical and physical tasks than the corresponding section addresses. These will prove surmountable and rewarding to the strong student, but a sophisticated student would benefit equally from *MMP*.

Benchmarking against *MMP*, which instructors commonly use, some students may find the new text more accessible. However, this reviewer considers that the authors do not streamline the material effectively for undergraduates in *EMMP* in general. Overall, they do not enhance explanations effectively, nor do they reinforce the ideas with uniformly clear, succinct, and accessible new examples. Except for some new problems in the very beginning, by and large the problem sets in *EMMP* come directly from the old book with several problems per section omitted, so the homework problems do not present a significant improvement as learning tools for undergraduates.

Weber and Arfken's earlier publications on the subject aside, *EMMP* has a good mix of topics for physics students, provided one does not want to cover much in the way of numerical methods. In particular, the book includes group theory, which books on engineering mathematics omit. The collection of examples does not illustrate ideas for the sake of mathematics alone but addresses problems from throughout the physics curriculum, including applications absent from texts that target engineers. Many sections have convenient and well-written summaries.

The sections would do well to open with the summaries. Instead, the book develops concepts in a choppy fashion, making some explanations even of elementary concepts hard to follow. Terms and notation appear without or prior to their definitions; e.g., arguments throughout the chapter on vector analysis rely on projections, which the authors never define by either formula or figure. (They use the term to mean scalar projection.)

Yet taken as a reference, if not as exposition, the book does not highlight the key points. In fact, some lie hidden in problems. The problems in turn often depart markedly from the section content, so that the book does not lend itself to independent study. As such, the text does not have a clear role in teaching or reviewing mathematical methods.

REFERENCE

[1] G. Arfken and H. Weber, *Mathematical Methods for Physicists*, 5th ed., Harcourt Academic Press, San Diego, 2001.

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Lie Theory. Lie Algebras and Representations. *Edited by Jean-Philippe Anker and Bent Ørsted.* Birkhäuser Boston, Boston,2003. $69.95. xii+328 pp., hardcover. ISBN 0-8176-3373-1.

This book, edited by Jean-Philippe Anker and Bent Ørsted, is the first of three volumes presenting long articles on topics in the areas of Lie groups, Lie algebras, and representations. This volume contains articles by Jens Jantzen and Karl-Hermann Neeb.

1. Jens Jantzen, "Nilpotent Orbits and Representation Theory." Jens Jantzen's portion of the book aims to introduce the reader to methods in representation theory involving the adjoint orbits of nilpotent elements in a Lie algebra. The main point of the book is to study the algebraic and geometric properties of nilpotent orbits in the classical Lie algebras: $\mathrm{gl}(n,\mathbb{C})$, $\mathrm{sl}(n,\mathbb{C})$, $\mathrm{sp}(n,\mathbb{C})$, $\mathrm{so}(n,\mathbb{C})$, and at the end to show how these properties are tied to the representation theory of reductive algebraic groups and Weyl groups.

In the first seven sections of Jantzen's portion, representation theory is not discussed. The topics include: classification of nilpotent orbits, in the classical groups and in general, following Bala and Carter; centralizers of nilpotent elements over fields of arbitrary characteristic, first for the classical groups and then the general case; geometry of algebraic group orbits; and geometry of the nilpotent cone as a whole. Starting with a lengthy section 8, the module structure of $\mathbb{K}[\mathfrak{g}]$ (the algebra of regular functions on $\mathfrak{g}$) is discussed following Kostant and also using various resolutions of singularities. In section 9, the noncommutative analogue is studied: modules over a universal enveloping algebra, associated varieties, and associated cycles. The rest of Jantzen's article is devoted to understanding the Springer resolution and Springer representations, including a small crash course in l-adic cohomology and perverse sheaves.

Jantzen presents the material in sections 1–8 in thorough detail for the classical Lie algebras, in both characteristic zero and positive characteristic. The picture for Lie algebras of general type is often discussed at the end of a section or subsection. At many points, Jantzen presents proofs in the characteristic zero case and only outlines