Mathematics

48-3923 QA162 MARC

Eie, Minking. **A course on abstract algebra,** by Minking Eie and Shou-Te Chang. World Scientific, 2010. 359p index ISBN 9814271888, $54.00; ISBN 9789814271882, $54.00

Eie and Chang (both, National Chung Cheng Univ., Taiwan) state in the preface that this undergraduate algebra course resource is aimed at students who are nonnative English speakers. Thus, since students who pursue careers in mathematics will likely have to write papers in English, the authors hope that language will not act as an overwhelming obstacle to learning the subject. Indeed, the English used appears to be structurally clear; in a random sample of sentences, this reviewer did not find any that strayed from subject-verb-object form. In terms of coverage, it is much like a standard year-long textbook, e.g., J. Gallian's *Contemporary Abstract Algebra* (7th ed., 2009), without the special topics at the end. There are many examples and exercises, which also look to be standard. The book could certainly be used in the normal undergraduate algebra course (and is much less expensive than Gallian's list price), but unless there is a call for such a work from the specially targeted audience, undergraduate libraries need not put this at the top of their acquisition lists. **Summing Up:** Optional. ★ Upper-division undergraduates.—*D. Robbins, Trinity College (CT)*

48-3924 QA188 MARC

Jeffrey, Alan. **Matrix operations for engineers and scientists: an essential guide in linear algebra.** Springer, 2010. 314p index afp ISBN 9048192730 pbk, $49.95; ISBN 9789048192731 pbk, $49.95

This work addresses all of the standard fare associated with an introductory course in linear algebra, albeit with an applied perspective appropriate for the audience suggested by its title. The reality is that the mathematical problems typically encountered in the real world do not lend themselves to closed-form solutions, and hence must be attacked by way of numerical approximation methods. Jeffrey (emer., Univ. of Newcastle upon Tyne, UK) makes a point of providing the reader with examples of how matrix methods can be used to facilitate the generation of such numerical solutions. Thus, there are discussions of using least squares to fit polynomials to experimental data, using matrices to find finite difference approximations for the Laplace equation, and numerical techniques for approximating eigenvalues. The author also devotes an entire chapter to applying matrix methods to the solution of systems of differential equations—a topic relegated to a single section in most linear algebra textbooks. Readers wishing to apply the methods of linear algebra to engineering problems would certainly find this book appropriate. Those looking for the classical mathematical treatment of the subject should probably look elsewhere. **Summing Up:** Recommended. ★★ Academic libraries serving upper-division undergraduates through researchers/faculty.—*D. S. Larson, Gonzaga University*

48-3925 QA387 MARC

Mansfield, Elizabeth Louise. **A practical guide to the invariant calculus.** Cambridge, 2010. 247p bibl index (Cambridge monographs on applied and computational mathematics, 26) ISBN 9780521857017, $75.00

Techniques (especially transversality) from different topology (but not differential geometry) underpin the methods presented in this work, whereby one obtains geometrically natural coordinates to solve variational problems. These problems concern objects living in spaces admitting continuous symmetries, so one seeks quantities attached to these objects, but invariant with respect to the action of a Lie group. The notion of moving frame, namely a certain kind of function from spaces back to their symmetry groups, plays a central role. This aiming of diverse tools and methods (from differential equations, abstract algebra, topology, and analysis) at questions of both great theoretical and practical importance makes ideal material for an advanced undergraduate capstone-type course. Even better, Mansfield (Univ. of Kent, UK) supplies ample background material, and casts calculations into ordinary undergraduate calculus. A quibble: though Mansfield patiently helps readers through the technical bits, she also makes highly enthusiastic narrative remarks that can puzzle readers. For example, when discussing Lie's third theorem, the author states, "At the time, this must have seemed incredible, and if you think about it, it still is." Readers may wonder what might make the truth just established still difficult to believe. A more copious index would have been helpful. **Summing Up:** Recommended. ★★ Upper-division undergraduate through professional collections.—*D. V. Feldman, University of New Hampshire*

48-3926 QA387 2010-13147 CIP

Markley, Nelson G. **Topological groups: an introduction.** Wiley, 2010. 367p bibl index ISBN 0470624515, $99.95; ISBN 9780470624517, $99.95

This work is an intriguing little introduction to topological groups by one of the last students of the late Yale topological dynamicist Gustav Arnold Hedlund. At a page a day, a diligent reader chomping away for not quite a year will acquire a decent understanding not only of matrix groups, their topologies, and how the notions of compactness, connectedness, local compactness, and total disconnectedness might apply to them, but also the extensions of these ideas at least to metric groups, if not quite to topological groups as a whole. Markley (formerly, Univ. of Maryland) states in the introduction that his "primary compromise" has been "to restrict attention to metric spaces." The author also treats the Pontryagin-van Kampen duality theory for locally compact abelian groups, again in its metric special case, at the end. The principal advantage of the metric restriction throughout is to expose in one slender volume everything that E. Hewitt and K. A. Ross, say, require two thick ones to deal with in full generality. This is probably a reasonable approach for a book considered an introductory work. The volume includes a copious set of exercises after each section and a special symbols index—both very useful to students. **Summing Up:** Recommended. ★★ Upper-division undergraduates through professionals.—*F. E. J. Linton, emeritus, Wesleyan University*

48-3927 Q143 2009-27575 CIP

The Scientific legacy of Poincaré, ed. by Éric Charpentier, Étienne Ghys, and Annick Lesne; tr. by Joshua Bowman. American Mathematical Society/London Mathematical Society, 2010. 391p bibl afp (History of mathematics, 36) ISBN 9780821847183, $89.00

Henri Poincaré (1854-1912)—as well as David Hilbert—has often been described as the world's last mathematical universalist, commanding essentially all his day's known mathematics and making revolutionary contributions to nearly every branch. Here, 19 surveys present Poincaré's achievement to a new generation of mathematicians and trace the flowering of Poincaré's ideas and work over the course of the last century. The mathematician recently received public attention when G. Perelman spectacularly settled Poincaré's conjecture characterizing the sphere among

three-dimensional manifolds; Bessières, Besson, and Boileau provide a brief but helpful introduction to the topic in chapter 12. In his day, the public knew Poincaré for his prize-winning work on the stability of the solar system, a story Béguin untangles in chapter 8. Expanding on questions of celestial mechanics, Poincaré founded abstract dynamical systems, now often known as chaos theory, treated in two further surveys. An equally vibrant modern industry, automorphic forms, derives from Poincaré's work on differential equations with algebraic coefficients; modern treatments seldom emphasize Poincaré's viewpoint, making Bergeron's survey in chapter 2 very useful. Other contributions examine Poincaré on probability, Lie theory, mathematical physics, and philosophy. **Summing Up:** Recommended. ★★ Academic, public, and professional libraries, all levels.—*D. V. Feldman, University of New Hampshire*

48-3928 QA248 2010-14077 CIP
Stillwell, John. **Roads to infinity: the mathematics of truth and proof.** A K Peters, 2010. 203p bibl index afp ISBN 1568814666, $39.00; ISBN 9781568814667, $39.00

Stillwell (Univ. of San Francisco) has produced an excellent book on infinity for the motivated lay reader. He begins with Cantor's diagonal argument of the uncountability of the real numbers and, in a historical context, develops the background required for introducing the continuum hypothesis. The author does a masterful job of painting a historical portrait of logic, set theory, incompleteness, computable functions, and many associated foundational questions. His lively style and clear exposition of the relationship between proof and truth will engage both the novice and the expert. Although there are numerous books on the topic of infinity (e.g., *Georg Cantor* by J. Dauben, CH, Sep'79; *Infinity and the Mind* by R. Rucker, 1982; *Mystery of the Aleph* by A. Aczel, CH, Apr'01, 38-4502), Stillwell tells a story which motivates the ideas he introduces. This is a book that anyone with an interest in mathematics should have in their library. **Summing Up:** Highly recommended. ★★★ Lower- and upper-division undergraduates, researchers/faculty, and general readers.—*R. L. Pour, Emory and Henry College*

48-3929 QA93 2009-53215 CIP
Szpiro, George G. **A mathematical medley: fifty easy pieces on mathematics,** tr. by Eva Burke. American Mathematical Society, 2010. 236p bibl afp ISBN 9780821849286 pbk, $35.00

A Mathematical Medley by mathematician/author Szpiro (*Numbers Rule*, CH, Sep'10, 48-0327; *Poincaré's Prize*, CH, Feb'08, 45-3175, etc.) is an interesting collection of stories that will be accessible to a wide audience. The book is divided into nine sections focusing on recently solved mathematical problems as well as old problems, games, the lives of mathematicians, mathematics in daily life, and more. The "Personalities" section contains the particularly fascinating story of Bella Abramova Subbotovskaya, who was accused of the "crime" of organizing the "Jewish People's University" (in her own apartment). In the four years that the school was open, she not only taught the students mathematics, but more importantly, gave them hope. The school brought forth about 100 "graduates," some of whom became faculty members at US universities. In another section, "Games, Gifts, and Other Diversions," the author discusses various seemingly simple games such ticktacktoe and how to mathematically determine if a player can guarantee a win if that player goes first. This book is useful for anyone who has an interest in mathematics. It can also serve as a supplemental resource for math majors in a history of mathematics course. **Summing Up:** Highly recommended. ★★★ Lower-division undergraduates through professionals; general audiences.—*J. A. Bakal, Felician College*

Physics

48-3930 QC787 2010-14835 CIP
Aczel, Amir D. **Present at the creation: the story of CERN and the Large Hadron Collider.** Crown, 2010. 271p bibl index ISBN 9780307591678, $25.99

Mathematician and prolific science writer Aczel (e.g., *Fermat's Last Theorem*, CH, Apr'97, 34-4520; *God's Equation*, CH, May'00, 37-5078) has produced an excellent review of past, current, and possible future theories of particle physics and how they relate to the field of cosmology. He uses the Large Hadron Collider (LHC), the most energetic particle accelerator ever built, as a focal point for a discussion of these theories. Scientists have recently begun to use the LHC to search for the last piece of the so-called standard model of particle physics and to probe for physics beyond this model. The author thoroughly researched the book's content by interviewing leading physicists who contributed to the development of the standard model as well as those who are proposing new, more comprehensive theories. Like all Aczel's books, this one is written in an accessible, engaging style and is a compelling read. Four of the volume's 14 chapters discuss details of the LHC and the first few months of its operation. These accounts give the reader a front seat at the opening of one of the most exciting endeavors in the history of physics. **Summing Up:** Highly recommended. ★★★ All levels/libraries.—*P. Oxley, The College of the Holy Cross*

48-3931 QC173 MARC
Baumgarte, Thomas W. **Numerical relativity: solving Einstein's equations on the computer,** by Thomas W. Baumgarte and Stuart L. Shapiro. Cambridge, 2010. 698p bibl index ISBN 9780521514071, $90.00

Numerical Relativity is a comprehensive introduction to the numerical solution of the equations of general relativity. This is a difficult, important area of contemporary research, with major experimental implications. The minimum prerequisite is a one-semester course in general relativity at the advanced graduate level. After some preliminary chapters on topics such as Einstein's equations, initial data, coordinate systems, and numerical methods, the book examines in detail the problems that have occupied most researchers in numerical relativity over the last few decades, including gravitational waves, colliding black holes, and neutron stars. Baumgarte (Bowdoin College) and Shapiro (Univ. of Illinois, Urbana-Champaign) strongly emphasize mathematical techniques and physical results, and readers beginning the subject will want to supplement this book with other works on numerical methods and good programming practices. *Numerical Relativity* will be widely used as a handbook for those entering the field, as a reference for active investigators, and as a resource for scholars in related fields. Libraries at any institution with an active research program in astrophysics or general relativity should have a copy. Scientists working in numerical relativity will want their own copies. **Summing Up:** Highly recommended. ★★★ Graduate students and above.—*M. C. Ogilvie, Washington University*

48-3932 QC173 2010-17820 MARC
Dongen, Jeroen van. **Einstein's unification.** Cambridge, 2010. 213p bibl index ISBN 9780521883467, $85.00

After publishing his theory of general relativity, Albert Einstein spent almost the entire latter half of his life searching for a "unified" field theory. Because it regards gravity as a manifestation of the geometry of space