has been of crucial importance in some recent developments and can be seen at its best in such a book as *The large scale structure of space-time* by Hawking and Ellis, to the study of which the book under review would be an excellent propaedeutic. The beginning relativist should, of course, make himself familiar with both the old and the new approaches; often, one simply has to revert to using components, and, it is not unknown for a result to have been obtained first by the old fashioned methods and then established by a more modern method.

Frankel's book is mathematically elegant throughout and has a number of distinctive features. Einstein's field equations are obtained heuristically in a novel way and are then written in several geometric forms one of which is particularly neat. The Schwarzschild exterior and interior solutions are obtained in a non-standard way. Free use of differential forms (including de Rham's forms of odd kind) is made throughout and particularly in the chapters on electromagnetism, where their usefulness is shown to good effect in the short proof of the conformal invariance of Maxwell's equations.

The book covers most of the topics included in a first course on general relativity and stops short of matters such as the Kruskal metric, the Kerr black hole, singularities in space-time and the Weyl tensor. My only criticism of the book is that it contains no unworked examples by which the student can test his understanding of the theory.

D. MARTIN

DODSON, C. T. J. and POSTON, T. *Tensor geometry: the geometric viewpoint and its uses* (Pitman, 1979), xiii + 598 pp. £24.00; paperback, £9.95.

This book provides a first course on differential geometry which is eminently suitable for beginning theoretical physicists, especially those wishing to study the general theory of relativity. The treatment is very modern, the style is discursive and clear, and only a minimum of mathematical knowledge is assumed. Even an introductory chapter on sets, functions and the like is included. I doubt if this chapter and the next, which gives an introduction to linear algebra, are really necessary for the readers for whom the book is intended; there must be few honours graduates in physics nowadays who have not been exposed to some linear algebra (treated in a modern way) in their ancillary mathematics courses.

As the title of the book suggests the motivation is geometric wherever possible—there are plenty of diagrams—and coordinate-free methods are used throughout. At the same time, classical tensor calculus is by no means neglected, since results expressed in terms of components are so often required by the working physicist. The contents of the book include such matters as tensor algebra, manifolds, vector fields, covariant differentiation, the curvature and Weyl tensors, and geodesics; brief accounts of both special and general relativity are also included. A notable omission is a treatment of exterior differential forms, but this will appear in a subsequent volume. A plentiful supply of exercises is provided, some of the exercises consisting of theory broken down into self-contained parts, which gently lead the student to the desired result.

Anyone conscientious enough to work carefully through this book will lay a solid foundation of knowledge on which to build a proper understanding of the more sophisticated geometrical techniques commonly used in some parts of theoretical physics today.

D. MARTIN

ROSE, J. A. *A course on group theory* (Cambridge University Press, 1978), 310 pp., cloth £19.75, paper £8.25.

The number of textbooks on group theory at present available in the better bookshops is quite large. So the first question that comes to mind when a new book on group theory arrives on one's desk is whether it fills a gap and is deserving of publication. In the case of this book the answer is an unqualified yes.

The material covered is that of a second course in group theory. A knowledge of elementary vector space theory and the basic facts about groups, rings and fields is assumed. A list of presuppositions is given in the introductory chapter which also serves to establish notation. Then follows Chapter 1, a short (6 pages) introduction to the aims and some of the interesting results of finite group theory. This is very useful in giving an overall view and a feel for the subject and the idea could with profit be used by other authors. The next ten chapters provide the meat of the book.

A chapter on examples of groups and homomorphisms, whose contents prove useful throughout the book, is followed by a chapter on normal subgroups, homomorphisms and quotients. Next we meet group actions on sets, finite p-groups and Sylow's theorem. A more unusual subject for books at this level is the subject of the next chapter: groups of even orders. One of the results proved here is the theorem of Brauer and Fowler which bounds the order of a group in terms of the order of a centralizer of an involution. Then series, direct products and finitely generated abelian groups, and group actions on groups come next. There is a chapter on transfer and splitting theorems, a very elegant treatment owing much to Professor Wielandt. The final chapter deals with nilpotent and soluble groups.

As can be seen from this list of contents, a lot of material is covered, some of which would not normally be expected in a book at this level. At times it is probably true that the pace would be a little hot for an undergraduate. But the work is always clearly presented with many examples and exercises to help the serious student. The author's interest in finite groups comes through strongly. Several sections are devoted to results on finite groups only, though where it does not cause undue problems, infinite groups are included. The chapters tend to emphasise either the "normal" structure of a group, in which case finiteness is not generally assumed, or the "arithmetical" structure, in which case finiteness is often in the hypotheses. The two kinds of structure are linked mainly in the last two chapters.

There are two aspects of the book which deserve special mention. The first is the large number, 679, of exercises scattered at regular intervals through the book. They "illustrate and extend the material of the formal course" and do it very well. They are often referred to and some are used in later parts of the book. Some are quite easy and some are really hard, though these have hints for solution. All in all they are a very useful facet of the book. The other point is the theme which occurs throughout, that of group actions. This is used as a natural unifying thread and a powerful tool in proofs and applications. Beginners in the subject find the idea of two levels of structure, a set and a group acting on the set, very difficult to grasp. But in a second course, this should cause no problem, and it is a very helpful device.

For those undergraduates specialising in group theory, for postgraduate students and lecturers this book will be a very useful and profitable addition to their library. It is perhaps a bit high powered for the average undergraduate. But anyone doing a second or further course in group theory, particularly if it has an emphasis on finite groups, would do well to consider this book very seriously. It has a lot to commend it. For such a book, the price is not excessive and the standard of production is high.

J. D. P. MELDRUM