In view of my reservations I cannot recommend this book for use with specialist mathematics students. Indeed it is not clear that the amount of material presented is suitable for them. But I do recommend it for other disciplines, especially for students of economics and business studies, since the applications are so suitable.

D. W. ARTHUR

CAMERON, P. J., *Combinatorial Surveys* (Proceedings of the Sixth British Combinatorial Conference, Academic Press, 1977.)

This book contains seven of the nine principal lectures given at the 6th British Combinatorial Conference, held at Royal Holloway College, London, during July 1977. The book was in fact on sale at the conference—an excellent idea in my opinion. A wide range of combinatorial topics is covered, with block designs, graphs and projective spaces as the main themes.

The first chapter, by F. Buekenhout ("What is a subspace?") is concerned with making a definition of a subspace of an incidence structure, which obviously must be consistent with existing notions of subspace for certain known incidence structures. The ideas are very general and the author himself admits that little progress is possible without considerable restrictions on the incidence structure.

Chapter 2 (P. J. Cameron, "Extensions of designs; variations on a theme") and Chapter 4 (D. K. Ray-Chaudhuri, "Combinatorial characterization theorems for geometric incidence structures") are good survey articles of the areas mentioned in the titles, presenting many of the known results, giving most of the necessary definitions and indicating some of the proofs. Both articles are relatively easy to read and give the reader a certain amount of feeling for the subject. On the other hand, Chapter 3, (L. Lovász, "Flats in matroids and geometric graphs") is extremely difficult to understand, mainly because none of the basic definitions are given. The author is concerned with covering problems in graphs, which he looks at from the point of view of flats in matroids.

The longest chapter (which incidentally gave rise to the shortest lecture) is by N. J. A. Sloane ("Binary codes, lattices and sphere packings"), in which he investigates connections between error-correcting codes and sphere packings, especially lattice packings. The article becomes very technical in places, but fortunately there are plenty of examples. Several open (and presumably difficult) problems are posed and there is an extensive bibliography.

Perhaps the best article is Chapter 6 (A. T. White, "Graphs of groups on surfaces") in which the author extends some of the ideas in his book of (roughly) the same title, using the recently developed theory of voltage graphs. At the end of the chapter there is a very interesting section on an application of imbeddings of graphs to problems in campanology.

The final chapter by D. R. Woodall ("Zeros of chromatic polynomials") is essentially self-contained and would be an excellent starting point for somebody wishing to study chromatic polynomials.

Overall, I feel that the book has achieved a nice balance; on the one hand, containing a collection of good expository articles on a wide variety of combinatorial topics, whilst on the other, showing clearly some of the overlap between the various subjects. Finally, the book is well presented, with few typographical errors—a reflection, I think, on the editor, Peter Cameron.

MICHAEL J. GANLEY

PITTIE, H. V., *Characteristic classes of foliations* (Research Notes in Mathematics No. 10, Pitman), 107 pp.

In this book, the author attempts a rapid treatment of the theory of primary and secondary characteristic classes of foliations and their relationship to recent work of Gelfand and Fuks on the cohomology of formal vector fields. Much emphasis is put on examples which demonstrate that the characteristic classes described may be non-zero.

I found it hard to judge at what audience the book is aimed. In view of the condensed nature of the arguments, it could hardly serve as a satisfactory introduction to the subject. Nor is it likely to be of great use to the expert in the field (although the reviewer does not count himself among this number) since all the material covered is available elsewhere, as the author acknowledges, and nowhere has he expanded on the original to any extent.

Chapter I, on the construction of the Godbillon-Vey class for a codimension 1 foliation, is mostly a shortened account of sections 6 and 10 of Bott's Mexico Lecture Notes. The proof of Bott's vanishing theorem would surely benefit from an explicit statement of what a basic connection is and that one always exists for the bundle TM/E, where E is an integrable subbundle of the tangent bundle TM.

The second chapter begins by generalising the Godbillon-Vey class to codimension q, in order to motivate the definition of secondary classes in general. Once again, the description closely follows §10 of Bott. There follows a lengthy account of foliations for which these secondary classes are non-zero. The examples discussed become extremely complicated and I found it impossible to get any geometric feel for the situation from the account given. The author's practice of using inverted commas instead of specifying exactly what is meant does not help.

In Chapter 3, an alternative approach to constructing characteristic classes is described. The presentation, which relies on constructing a homomorphism from the cohomology of the Lie algebra of formal vector fields to the cohomology of the manifold, follows closely some unpublished notes of M. F. Atiyah and serves a useful purpose in making this mathematics more generally available. The Godbillon-Vey class and some of the examples of the previous section are rediscussed in this new setting. A condensed version of the exposé by C. Godbillon which computes the cohomology of the Lie algebra of formal vector fields is given and the connection with distributions, via the Lie algebra of C^∞-vector fields, is discussed, although many details are again left to the reader.

In the fourth and final chapter, an account is given of the work of Gelfand, Feigin and Fuks on the variation of the secondary classes as the foliation varies in a specified way. A meaning can be given to the derivative of a characteristic class with respect to the variation parameter and it is proved that certain classes are rigid, i.e. have zero derivative.

There are two appendices. The first gives an account of the Chern-Weil theory which is basic to the construction of characteristic classes. The prerequisite facts on connections and curvature are also included. The second appendix contains some results from Lie theory, including the Chevalley–Eilenberg Theorem. The proof, the only thing in the book which the author claims is new, is incorrectly presented, although the general method is sound.

Overall I found this a hard book to read. The terminology is highly technical and there is much unnecessary underlining which, as with inverted commas, is often used as a substitute for a definition or explanation. The number of misprints, many quite misleading, is unacceptable. This is perhaps a consequence of the fact that, as with all books in this series, the author's own typescript is reproduced but it does suggest that more efficient checking procedures are needed.

RICHARD WOOLFSON

DICKEY, R. W., *Bifurcation problems in nonlinear elasticity* (Pitman, 1976), 119 pp.

This book provides a lucid exposition of several important papers concerned with the existence, multiplicity and qualitative nature of solutions of non-linear differential equations arising in elasticity theory. An introductory chapter on linear operators on Hilbert space and second order linear differential equations should make the material easily accessible to any postgraduate student. Subsequent chapters discuss differential equations arising from the static problem for the non-linear string and non-linear membrane, from the rotating chain, from the inextensible elastica and from the buckling of the circular plate. There is also a chapter on the positone problems, i.e. equations possessing only positive solutions. The proofs are expressed clearly throughout but there are a fair number of misprints.

Although the book provides good, clear solutions to the particular problems discussed in it, I think it would have been improved by the inclusion of a more general discussion of bifurcation theory. Such a discussion may be found in I. Stakgold, "Branching of solutions of nonlinear equations", *SIAM Review*, **13** (1971). Moreover the papers described in the book were almost all published not later than 1971 and there have been a number of major advances and generalisations in the subject since then. For example: