

University Press stable providing such an alternative approach springs immediately to mind. This is *Presentations of Groups* by D. L. Johnson, where an understanding of the abstract theory of generators and relations for groups is obtained by "observing and performing easy and concrete calculations". D. L. Johnson's book is, of course, at a more advanced level than R. P. Burn's book. Other books aim to encourage the learning of elementary group theory by giving many group theory problems together with comprehensive solutions. The subject of this review provides yet another approach to group theory. In aiming to be "faithful to the historical origins of the theory" the groups discussed in the book are groups of transformations. Most of the groups described in the book are examples in two- and three-dimensional space. As with the other authors, R. P. Burn feels very strongly that mathematics is best learnt doing examples.

The twenty-three chapters of the book are divided into three main sections. The first five chapters including chapters on the Möbius group and the regular solids are followed by a more abstract introduction to group theory describing topics such as group axioms, cosets, direct products, homomorphisms and conjugacy. The final chapters are concerned with linear fractional groups, affine groups, orthogonal groups and wallpaper groups. The layout of each chapter consists of a particular topic taught through a series of examples with cross-references to other more standard approaches. At the end of each chapter there is a summary of the theory described. Before answers are given to the questions in the chapter there is a historical note and this I found especially interesting. Even in the contents at the beginning of the book there is, with each chapter, a brief description of the main result described in that chapter.

The book is very much at the level of advanced school-pupils (perhaps very advanced as far as the complete book is concerned) and undergraduates in their early years of study. The book is neatly presented and well-produced and the author manages to convey a lively enthusiasm for his subject. I recommend it to all those who have an interest in the examples that form the basis of a beginning course in group theory. Many mathematicians will enjoy its geometrical approach.

C. M. CAMPBELL

McBRIDE, A. C., *Semigroups of linear operators: an introduction* (Pitman Research Notes in Mathematics Series 156, Longman Scientific and Technical, 1987), pp. 134, 0 582 99484 5, £14.

The author has written this introduction to semigroups of linear operators for anyone with an Honours student's knowledge of complex and functional analysis preferably, though not essentially, including the Lebesgue integral. His first chapter explains the notion of a one-parameter semigroup, and discusses four examples which are referred to throughout the text, namely the semigroup of translations, the Gauss-Weierstrass and Poisson semigroups, and the fractional power semigroup. This is followed by chapters on infinitesimal generators and on resolvents and the Hille-Yosida-Phillips theorem. Next come two shorter chapters, on exponential formulae which enable one to recover a semigroup from its generator, and on the generation of one semigroup from another by a relation such as  $U(t) = \int_0^\infty p_i(u)T(u)du$  where  $p_i$  is a probability density function. The final chapter shows how the preceding theory can be applied to the solution of initial-value problems associated with the partial differential equations  $u_t = u_x$ ,  $u_t = u_{xx}$  and  $u_{tt} = u_{xx}$  while referring the reader to more advanced texts for the study of other abstract Cauchy problems.

Many proofs are given with complete rigour, but the author does not hesitate on appropriate occasions to give just an outline proof or to omit details completely. His informal style and excellent judgment make this a very readable introduction to the subject, for example for someone who might encounter semigroups in p.d.e. theory but would find the specialist literature formidable. The text has been reproduced photographically from a very pleasing typescript, and I found only a small number of misprints.

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