particular a proper link to the differential calculus. I do however have a worry here; it is not clear in the abstract setting precisely how to link these nonabsolute integrals to topological and metric properties of the underlying space.

This worry can be stated clearly in the context of the Wiener integral. The metric and topology of continuous path-space are closely and explicitly linked to the usual measure-theoretic development. The Henstock integral as expounded in the monograph applies directly, avoiding metric and topological niceties, to produce a non-absolute integral generalizing the conventional Wiener integral. But unambiguous *interpretation* of this extension in metric and topological terms appears still to be lacking. And much of the richness of the orthodox theory lies in its interpretations.

Incidentally, readers should note the extensive and important generalization of the Wiener integral to the stochastic or Itô integral (see Rogers and Williams, 1987, for a recent exposition).

The Feynman integral is to the Wiener integral as $\int_0^\infty \exp(ix^2)\,dx$ is to $\int_0^\infty \exp(-x^2)\,dx$, but with even more difficulty imposed by the infinite-dimensional character of path-space. In this setting conditional or non-absolute integration has an essential role to play. The monograph shows how Henstock's procedure can be applied, and relates the ensuing definition to definitions and results due to Nelson, Cameron, and Truman. (It is not however clear to me whether the Henstock version is as general as that proposed in Elworthy and Truman, 1984.)

In conclusion, this monograph provides a useful exposition in book form of Henstock integration theory as applied to path integrals, and we owe the author thanks for this. However I believe there is still wanting an exposition which interprets Henstock's constructions in terms which can be directly related to constructions in measure theory, topology, and geometry.

REFERENCES

K. D. Elworthy and A. Truman, Feynman maps, Cameron-Martin formulae and anharmonic oscillators, *Ann. Inst. H. Poincaré Phys. Théor.* **41** (1984), 115–142.

L. C. G. Rogers and D. Williams, *Diffusions, Markov processes and martingales*, Vol. 2 (Wiley, Chichester 1987).

R. Solovay, A model of set-theory in which every set of reals is Lebesgue measurable, *Ann. of Math.* **92** (1970), 1–56.

W. S. KENDALL

Blackadar, B. *K-theory for operator algebras* (Mathematical Sciences Research Institute Publications Vol. 5, Springer-Verlag, New York–Berlin, 1986), pp. 337, 3 540 96391 X, DM 78.

The introduction of K-theory in operator algebras in the seventies has revolutionized C*-algebra theory, and led to several major advances since then. Though there have been several conferences on K-theory in C*-algebras, there was no unified account of the subject until this book appeared. Blackadar has set himself the task of giving a comprehensive account of K-theory in operator algebras with the exception of the applications of the theory. He has succeeded in taking the subject from its beginnings to its most recent advances in Kasparov's KK-theory. The tremendous range of mathematics covered in this book means that some of the proofs are given in the detail of a monograph rather than a textbook or lecture notes.

The book assumes the basic theory of Banach algebras and C*-algebras. A familiarity with ideas from topology is helpful for motivation and for several of the analogies implicitly drawn. The book starts with brief "overviews" of topological and operator K-theory to motivate the subsequent mathematics and detailed definitions. The main discussion begins with the definition of $K_0(A)$ of a C*-algebra A as a group with order. The definition is in terms of algebraic equivalence classes of idempotents in $M_\infty(A)$, where $M_\infty(A)$ is the inductive limit of the $n\times n$ matrix algebras $M_n(A)$ over A. There is of course a little twist that is required in the definition if A is not initial. However, here there is probably too little detail for the novice reader, a point which will reduce the usefulness of the book to some potential readers. For example, the crucial Whitehead matrix calculations that are so clear in J. L. Taylor's account of K-theory ("Banach algebras and topology" in *Algebras in analysis*, ed. J. H. Williamson, Academic Press 1975), are not clearly visible here, though there is a discussion of the 2×2 matrix methods used.

From K_0 and its basic structure he leads on to K_1 and Bott periodicity. These topics are developed clearly, and in a standard way. The K-theory of crossed products based on the work of Pimsner, Voiculescu and Connes is given. There is a discussion of the theory of extensions of C*-algebras leading to the Brown–Douglas–Fillmore theory. One of the definitions of Kasparov's KK-theory is given in detail. Sometimes the back references in the book are not as clear as could be desired. It has some of the lack of polish of lecture notes, but this makes the mathematics feel alive.

This book is a good contribution to the literature on topology and operator algebras. It is exceedingly helpful for those who wish to read the current research in K-theory and KK-theory, for example the recent work of G. Kasparov and J. Cuntz. Blackadar's book is essential reading for those who wish to study C*-algebras seriously.

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LEDERMANN, W. *Introduction to group characters* (Cambridge University Press, Cambridge, 2nd edition, 1987), pp. 225, hard covers, 0 521 33246 X, £27.50; paper, 0 521 33781 X, £8.95.

The central theme of this well-received text, which is not greatly changed from its first edition, is the character theory associated with the matrix representations over the complex number field of a finite group. The level of presentation, which is aimed avowedly at final honours or beginning postgraduate students, requires only a comparatively modest acquaintance with linear algebra and finite group theory. Partly because problems of the non-semisimplicity of representations do not arise, the text focuses not so much on modules as on actual matrix representations. This has the considerable didactic advantage that the text becomes immediately alive and meaningful so that the novice can quickly get his hands dirty by performing actual calculations to determine characters. The text abounds with worked illustrations and the many exercises are provided with solutions. This book leads the student to an appreciation of the insights of the great classical masters of the subject; thus he will meet the various theorems associated with the names of Burnside, Frobenius and Schur, for example, the Frobenius reciprocity theorem for the character relations between a subgroup and a group, the innocent-looking Schur's lemma and Burnside's (p,q) theorem. Some of these insights, such as the use of the so-called Schur functions to elucidate the characters of the symmetric group, were gleaned through ingenuity in the use of determinants, a topic which is less familiar nowadays, and, in consequence, additional material on this has been provided in an appendix. On encountering Burnside's theorem the student is led to reflect that its proof, which could be said to depend on a condition for the equality of the modulus of a sum of several complex numbers with the sum of their moduli, was a foundation stone for an edifice of much finite group theory but that some fifty odd years were to elapse before a purely group-theoretic proof was to appear. Throughout the text the exciting interplay between number theory and representation theory is stressed.

The general mathematical reader, the theoretical physicist in need of representation theory and the student beginner have much to learn from this fascinating account which is a clear and careful propaedeutic to other deeper, but often less perspicuous, treatises. The author acknowledges that his interest in the subject was first aroused by attendance at lectures by Schur, himself a pupil of Frobenius; the present reviewer in turn is glad to express his debt to Professor Ledermann who inspired his own first researches in group representations. It is therefore a pleasure both to welcome and to recommend this pedagogic distillation of Professor Ledermann's group-representational experience.

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