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BOOK REVIEWS

BULTHEEL, A., GONZÁLEZ-VERA, P., HENDRIKSEN, E. AND NJÅSTAD, O. *Orthogonal rational functions* (Cambridge Monographs on Applied and Computational Mathematics, vol. 5, Cambridge, 1999), xiv + 407 pp., 0 521 65006 2 (hardback), £37.50 (US$59.95).

The connections between moment problems, corresponding continued fractions, rational approximations and orthogonal polynomials are classical, and there have been numerous excellent texts on these topics throughout most of the 20th century. These topics have now been studied very intensely and there are many different and detailed results available in a number of generalizations of the original theory, including those that generalize orthogonal polynomials to orthogonal rational functions. As the authors of this book state, it would be impossible to treat in one volume all of these generalizations from polynomials to rational functions. The four authors, and there are very few better qualified to write a monograph in this area, have thus wisely chosen to restrict the content to an introduction to the topic, followed by a treatment of the generalizations of classical interpolation problems of Schur and Carathéodory types, of quadrature formulae and of moment problems. In doing so, as have numerous authors before them, they accentuate the natural links between interpolation, quadrature and moment problems. As a result of their work they have now contributed one more extremely well-written text that I believe will be welcomed by all those whose interests are in this area, but also one that will be both very readable and very informative to a wider group of researchers. Since the subject has applications in system theory and electrical engineering, it is not only mathematicians who could appreciate the book.

There are 12 chapters. The first two deal with the necessary preliminaries and the relevant fundamental spaces. The material in the subsequent chapters includes coverage of such topics as kernel functions and recurrence functions, quadrature, interpolation, convergence and moment problems. There is also a chapter devoted to the boundary cases, distinguishing between the two possibilities of the boundary being the unit circle or the extended real line. This is followed by a final chapter on some very interesting applications. The 12 chapters are sandwiched between an excellent and comprehensive introduction and an equally useful conclusion. The bibliography at the end of the text contains a well-selected list of just over 200 articles.

The text is written with great clarity and the order in which the material is presented is well designed. A book with four authors is not common, but these four, each of whom is well known for his own published research, have combined very successfully in this joint venture and are to be applauded for their achievement.

J. H. McCABE

CRABB, M. C. AND JAMES, I. M. *Fibrewise homotopy theory* (Springer Monographs in Mathematics, Springer, 1998), viii + 341 pp., 1 85233 014 7 (hardcover), £49.50.

Fibrewise homotopy theory is a part of fibrewise topology, the study of spaces equipped with maps to a fixed base space B. A space X with a map $p\colon X \to B$ is called a fibrewise space over B, and the inverse images $p^{-1}(b)$ for $b \in B$ are called fibres. The basic idea is to carry out constructions on fibres individually; for example, if X and Y are fibrewise spaces with maps $p: X \to B$ and $q: Y \to B$, then their fibrewise product is a space $X \times_B Y$ with a map $r: X \times_B Y \to B$ such that

$$r^{-1}(b) = p^{-1}(b) \times q^{-1}(b)$$

for each b in B. Some things can be done quite mechanically, but not many; for example, in the case of the fibrewise product, one has to choose a suitable topology for $X \times_B Y$.

The subject originated with the study of fibre bundles; these are spaces X with maps $p: X \to B$ such that p is locally like the projection of a cartesian product onto a factor. This makes nearby fibres homeomorphic in a coherent way. For example, if X is a space on which a topological group G acts freely, then X is often a fibre bundle over the orbit space X/G. Fibrewise homotopy theory works much more generally, but for many significant results the spaces must still be something like fibre bundles. Unfortunately, this excludes some important spaces with singular fibres which come from algebraic geometry; for this reason, the authors hope that the theory can be developed further.

The book is written for readers who are familiar with ordinary homotopy theory. It is in two parts; the first part gives a general introduction, while the second part covers fibrewise stable homotopy theory. There is a lot of information, although the authors concentrate on applications rather than foundations. In particular, in the second part, they omit most of the elaborate machinery of spectra and infinite loop spaces, and they deal only with suspension spectra. The applications in the second part include fixed point indices, duality, transfer, manifolds, and homology. The highlights are a previously unpublished proof of the Adams conjecture and a fibrewise proof of Miller's stable splittings of the unitary groups.

One possible approach to fibrewise topology would be to start with ordinary topology, generalize it systematically, and see what happens. This was the approach taken by James in an earlier work [**1**]. The present book is more interesting but also more difficult. The details of arguments are often omitted; this makes it easy to see what is going on but requires a lot of work for a conscientious reader. The subject can be rather confusing, because there are many similar concepts with similar names. Sometimes the same name is used for different concepts: there are two different definitions for a fibrewise manifold. The authors are generally very helpful; they give lots of definitions and make careful distinctions. The book is interesting to read through, and it should also be useful for reference.

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References

1. JAMES, I. M., *Fibrewise topology* (Cambridge Tracts in Mathematics 91, Cambridge University Press, 1989).

FERES, R. *Dynamical systems and semisimple groups: an introduction* (Cambridge Tracts in Mathematics 126, Cambridge, 1998), xvi + 245 pp., 0 521 59162 7 (hardback), £35 (US$54.95).

The term *dynamical systems* has come to cover a wide range of topics and approaches. But in most of these approaches Lie groups play a prominent part, whether as symmetries in the case of integrable, Hamiltonian systems or, more generally, as the transformations parametrized by the (time) evolution parameter itself. In the present text we are dealing with the interplay between group representations and ergodic theory, the actions of semisimple Lie groups on manifolds with finite, group invariant measure. In accordance with the general philosophy of