obtained using Fourier analysis and sufficient conditions using energy methods. The use of both methods is illustrated by a number of examples.

Finally, the discretisation of elliptic equations is considered along with a discussion on the treatment of curved boundaries. Here a discrete maximum principle technique is introduced to establish numerical stability and then convergence. It is with elliptic equations that the finite element method holds sway and here we find a brief account of this important method. No discussion of elliptic and implicit methods would be complete without mention of the structure and solution techniques of the linear algebraic systems which arise in the solution process. The final chapter deals with iterative techniques for the solution of these equations including the Jacobi, Gauss–Seidel and SOR methods. Fourier analysis again is the main analytical tool, used this time to establish convergence rates and optimal relaxation parameters.

Overall the book is very readable through the use of numerical examples and numerous illustrations. Exercises of various degrees of difficulty are given at the end of each chapter along with directions to further references.

The book would be of use to engineers and scientists requiring an introduction to numerical methods. Realistic applications to complex domains would however require a discussion of the use of generalised coordinates or finite volume methods. The strength of the book however is the rigorous analysis of many of the methods which would be taught to final honours year and MSc level mathematicians.

J. A. MACKENZIE

ROMAN, S. *Field theory* (Graduate Texts in Mathematics, Vol. 158, Springer-Verlag Berlin–Heidelberg–New York–London–Paris–Tokyo–Hong Kong 1995), 272 pp., softcover 0 387 94408 7, £21.00

This is a carefully judged and beautifully written account of what is of course a beautiful subject, pitched at first year graduate level. The exposition is succinct and expects the appropriate level of mathematical maturity, yet always gives all that could be desired in the way of motivational commentary, illustrative examples and the drawing of fine distinctions where necessary. There is a very full range of useful exercises for each chapter. Altogether, the author is to be congratulated on an excellent piece of work: this book will act as a model for beginning research students as to what they should aim for in the way of elegance of argument and exposition; it is also an effective teaching tool and a useful reference.

As to tone and contents the book goes considerably further than the usual undergraduate course in Galois theory and, where standard undergraduate topics are covered, the exposition is more sophisticated and demanding; thus the book acts as a useful revision of any topics that are already known and indicates the new level of maturity needed for graduate study. On the other hand it does not go as far as graduate texts such as D. Winter's *Structure of fields* (Graduate Texts in Mathematics, Vol 16, Springer-Verlag, 1974) or G. Karpilovsky's *Field theory: classical foundations and multiplicative groups* (Marcel Dekker, 1988) in that it contains no cohomology or valuation theory, nor does it treat algebraic function fields; it does however have two very useful chapters on finite fields, going beyond what these older books contain, perhaps reflecting the new importance of this topic in the light of links with coding and signal theory. Certainly it provides an excellent background from which to proceed to more advanced topics such as those already mentioned.

After opening chapters on preliminaries and basic theory the first part of the book discusses field extensions, algebraic independence and separability. Part Two, on Galois theory, uses so-called 'indexed Galois Correspondences' as an organisation tool, treats Linear Disjointness and the Krull Topology and calculates in detail the Galois groups of some small degree polynomials; norms and traces are also considered as well as normal bases. Next, finite fields are considered in some detail; in particular normal bases are exhibited, Steinitz numbers are used to describe algebraic closures and the number of irreducible polynomials is calculated using Möbius inversion. The final part of the book focuses on the theory of binomials and takes in cyclotomic extensions, Wedderburn's theorem on finite division rings, the realisation of groups as Galois groups and the independence of irrational numbers, finishing with an account of Kummer theory.

The book is beautifully produced and remarkably free of typographical errors—I noticed only one obvious slip, which (somewhat unfortunately) was in the statement of a theorem (9.4.1, to be specific).

I recommend this text very strongly indeed.

L. O'CARROLL