NOBLE, B. *Numerical Methods, I: Iteration, Programming and Algebraic Equations* (Oliver and Boyd, Edinburgh, 1964), 156 pp., 10s. 6d.

The resurgence of interest in numerical mathematics initiated by developments in automatic computation has brought with it a proliferation of books on the subject which fall roughly into two classes; the erudite and often elegant exposition by a researcher in the field intent on propagating new ideas and the rather pedestrian textbook which often fails to reflect the changes induced by the new techniques. In this most recent addition to the well-established University Mathematical Text series, Dr Noble has succeeded in combining an awareness of how the subject is evolving with an appreciation of the limitations of the undergraduate student for whom the book is intended. A great deal of hard thinking has gone into the preparation of this text and both student and teacher will reap the benefits.

The dilemma as to whether an introductory course should be oriented to hand machine or automatic machine techniques has been resolved by recognising that they are complementary and the essential features of both methods are covered. The author avoids the multiplicity of formulae usually found in textbooks on numerical analysis but presents selected methods, emphasising concepts which are fundamental to numerical work without obscuring their practical use with unnecessary mathematical rigor. Consideration is given to the requirements of numerical accuracy and estimation of tolerances of numerical results.

This is the first of two volumes, the second is as yet unpublished, and deals with iterative methods for the solution of equations with particular emphasis on Newton-Raphson iteration and its adaptation to the solution of polynomial equations, elementary programming for automatic computers based on a FORTRAN type language with flow diagrams and applications to algorithms derived in the text using suitable starting procedures, and computational procedures associated with linear algebra including the solution of linear equations, inversion of matrices, and the determination of their eigenvalues. The importance of the " condition " of the equations is discussed and this volume is concluded by an account of iterative methods of solving sets of linear equations with an interesting simplified treatment of the convergence rate in the method of successive over-relaxation.

The enlightened and competent manner in which these topics are dealt with will leave readers waiting expectantly for the issue of the second volume the topics of which will be differences, integration and differential equations.

JAMES FULTON

FEJES TOTH, L., *Regular Figures* (Pergamon Press, 1964), xi+339 pp., 84s.

This interesting book falls into two distinct parts, of approximately equal length, which form a complete contrast to each other.

The first part, which the author calls " Systematology of the Regular Figures," is a formal development of the theory of regular and Archimedean polyhedra and of regular polytopes. The treatment, in which elementary group theory is well to the fore, is concise and complete. The chapter headings give a clear enough notion of the contents: I. Plane Ornaments (which contains a complete discussion of the two-dimensional crystallographic groups); II. Spherical arrangements (including an enumeration of the 32 crystal classes); III. Hyperbolic tessellations (essentially a discussion of the discrete groups generated by two operations whose product is involutary); IV. Polyhedra (including the enumeration of the regular solids, concave as well as convex, and of the convex Archimedean solids); V. Regular polytopes (which completes the enumeration of the regular figures in Euclidean space of higher dimension than three).

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The author's exposition matches the elegance of his subject. This part of the book invites obvious comparison with the well-known work by Professor H. S. M. Coxeter, which has clearly, in part, been its inspiration; however there are enough differences in approach and emphasis to make this account welcome in its own right. There are interesting historical notes at the end of each chapter; but surely, in the last line but two on p. 97, the reference should be to Legendre and not to Lagrange.

The second part of the book, which the author calls " Genetics of the Regular Figures," is of quite a different nature. Here, as it seems to the reviewer, we have no well-rounded theory, but rather a number of special problems, the solution of some of which is by no means complete. The subject matter consists of various extremal problems in which regular figures play a part. This is a subject to which the author has made notable contributions, and this seems to be the first time that current knowledge on the subject has been put together as a whole. Chapter VI deals with some relatively simple problems of packings and coverings of circles in a plane, and Chapter VII with tessellations on a sphere. We quote one theorem, out of many, as an example of the sort of thing the reader will find. Suppose that we have a tessellation of the unit sphere by convex faces of equal area, with e edges, and suppose that p and q denote, respectively, the average number of edges in a face, and the average number of edges meeting in a vertex. Then the total length of the edges in the tessellation is not less than

$$2e \text{ arc cos} \left[\cos \frac{\pi}{p} \text{ cosec } \frac{\pi}{q}\right],$$

and this lower bound is attained if, and only if, the tessellation is regular. The remaining chapters deal with problems in the hyperbolic plane, and in Euclidean space of three or more dimensions. It is clear that this is a subject in which there is still much scope for research, and one which calls for considerable ingenuity in approaching its problems.

The book is copiously illustrated, with some anaglyphs in a folder at the end, and contains an extensive bibliography.

The excellence of the text is unfortunately not matched by a corresponding elegance of production, which falls a long way short of the standard one is now accustomed to expect in mathematical printing. There are numerous cases in which mathematical expressions or sentences are broken by the end of a line instead of being displayed and the number of obvious misprints in passages of plain text, not to mention weak letters, suggests that the press reader has not been sufficiently careful. The current standard of " higher mathematical printing " in this country is high, and it is a pity that it is not attained in this book which, both by its contents and its price, claims to be judged by the highest standards. J. A. TODD

MIKHLIN, S. G., *Integral Equations and their Applications to Certain Problems in Mechanics, Mathematical Physics and Technology*. Translated from the Russian By A. H. Armstrong (Pergamon Press, 1964), xiv+341 pp., 80s.

Ever since the appearance of the first English translation in 1957, Mikhlin's book on integral equations enjoyed a well-deserved popularity, especially among applied mathematicians. According to the author's preface, no substantial changes have been made in the present second edition of the translation. Some slips have been corrected, and some improvements (and minor additions) have been made. Nevertheless, it seems appropriate to describe briefly the contents of the book since it has not been previously reviewed in these Proceedings.

Part I, which occupies about two-fifths of the book, is devoted to the mathematical theory of integral equations under three headings: the Fredholm theory, the Hilbert-Schmidt theory, and singular integral equations (i.e., equations involving principal

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