that the method of least squares satisfies these criteria. Here constraints are handled by the method of penalty functions. Various special techniques for handling eigenvalue problems are given. A comparison of the least-squares method with others is made. The least-squares method is applied to the problem of fuel depletion in a nuclear reactor and the results are compared with those obtained by standard methods. Excellent results are obtained.

The book contains numerous examples which illustrate the effectiveness of the various methods employed. The basic theory upon which the method is based is summarized in appendices. No attempt is made to give a priori error estimates.

The book should prove to be useful to one who is interested in solving problems and to be instructive to one who is interested in theory. Many useful ideas are set forth. The examples are well chosen and illustrate difficulties as well as advantages of a particular method.

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40[X].—FRANCIS B. HILDEBRAND, *Methods of Applied Mathematics*, Second Edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1965, ix + 362 pp., 24 cm. Price $10.00.

This volume is the second edition of a book published originally in 1952. It consists of three long chapters entitled "Matrices and Linear Equations," "Calculus of Variations and Applications," and "Integral Equations." The first edition contained an additional chapter entitled "Difference Equations." This chapter has been removed and is to be expanded and published as a separate volume.

The material in each chapter is essentially independent of the other chapters. Each chapter is a brief but reasonably comprehensive treatment of the topic from an applied point of view. There are a large number of problems and a list of answers is given at the back of the book.

In order to fairly appraise the book it is necessary to consider it in conjunction with the author's text *Advanced Calculus for Applications*, together with his forthcoming book on difference equations and finite-difference methods. The present volume is an obvious extension of *Advanced Calculus for Applications*, containing additional topics which could not be included there. The two volumes can be nicely used in a three- or four-semester course on methods of applied mathematics at an intermediate level. The book can also be used for reference or self study. It is well written, and considerable care has been taken in introducing the topics in each chapter. It can be highly recommended if used as noted above.

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41[X].—L. B. RALL, Editor, *Error in Digital Computation*, Volume I, John Wiley & Sons, Inc., New York, 1965, ix + 324 pp., 24 cm. Price $6.75.

This book is the proceedings of an advanced seminar conducted by the Mathematics Research Center, United States Army at the University of Wisconsin, October 5–7, 1964. As such it contains five papers based on the addresses of the invited speakers. The latter part of the book consists of a bibliography of books and papers on error analysis taken from the Mathematical Reviews.

The speakers and their topics were:

The Problem of Error in Digital Computation, by John Todd

Techniques for Automatic Error Monitoring and Control, by Robert L. Ashenhurst

The Automatic Analysis and Control of Error in Digital Computing Based on the Use of Interval Numbers, by Ramon E. Moore

Error in Digital Solution of Linear Problems, by Ernest L. Albasiny

The Propagation of Error in the Digital Integration of Ordinary Differential Equations, by Peter Henrici.

John Todd's paper describes some of the recent efforts in analyzing the error in digital computation, illustrated with several examples which have arisen recently at Caltech. He has many suggestions for the future directed at various segments of the computer field from mathematician to design engineer.

Robert L. Ashenhurst discusses the effect on error propagation of various types of computer arithmetic. Starting with a precise definition of terms, the exposition leads to significance adjustment rules and the question of normalized versus unnormalized arithmetic.

In his paper Ramon E. Moore defines an arithmetic system of closed intervals which contains the real numbers as a subsystem. A topology is introduced which leads to the concept of continuity of set functions defined for these intervals. An integral calculus is then developed together with an interval form of Gaussian quadrature. The principal application is to the approximate solution of the initial-value problem for ordinary differential equations. By use of interval arithmetic and appropriate rounding procedures, numerical methods are described which give a numerical solution together with rigorous bounds on the error. The bounds themselves behave like the mesh size to an appropriate power. This method has been programmed for an IBM 7094, and the results of certain sample cases are given.

Ernest L. Albasiny discusses recent studies (mainly those of J. H. Wilkinson) of the effect of round-off errors in the numerical solution of various problems in linear algebra. Topics included are the solution of linear equations, matrix inversion, determinant evaluation, and the determination of eigenvalues.

Peter Henrici surveys recent developments in the numerical solution of the initial-value problem for ordinary differential equations by finite-difference methods. The problem of defining the term "stability" is discussed, and some consideration is given to the value of error estimates and error bounds.

As can be seen from the above discussion, this book brings together many of the recent developments of significance in the fields covered.

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42[X].—*The Universal Encyclopedia of Mathematics* (with a foreword by JAMES R. NEWMAN), Mentor Book, New York, 1965, 715 pp., 18 cm. Price $1.50 (paperbound).

This is an inexpensive paperback edition of the $8.95 hard-cover volume previously reviewed here in *Mathematics of Computation*, v. 19, 1965, p. 164, RMT **22**. See that review for further details. We might repeat the previously made point that the coverage is not as broad as that suggested by the title, since a publisher's press