The authors succeed admirably in achieving this aim and we look forward eagerly to reading the second volume on the calculus for functions of several variables. E. I.

110[X, Z].—J. A. ZONNEVELD, *Automatic Numerical Integration*, Mathematical Centre Tracts 8, Mathematisch Centrum Amsterdam, 1964, 110 pp., 24 cm.

This tract is concerned with the automatic integration of systems of ordinary differential equations with initial conditions. First order and second order equations are considered, including second order with first derivatives appearing, and without.

Equations which must be satisfied by the parameters in Runge-Kutta formulas are developed in a standard way, and formulas are obtained for all orders up to and including fifth order. Additional equations are developed for parameters which can be used to determine the accuracy of the method, and this leads to formulas for approximating the last term retained in the Taylor expansion of the true solution. (The increment in the Runge-Kutta formula approximates the *sum* of a certain number of terms in this expansion. The new formula approximates the last of these terms, and can be used to keep the error below a prescribed tolerance.)

The formula for the last term can be evaluated only at the cost of a slight increase in the number of function evaluations per step.

Formulas are given in each case for differential equations in which the independent variable appears explicitly, and also for equations in which it does not appear.

There is an interesting chapter on the choice of step-size, and on changing the variable of integration, including the use of the arc length for this variable.

Nine ALGOL 60 procedures are given, some for first order and some for second order equations. Two of them change the variable of integration automatically, and one uses the arc length.

Five numerical examples are presented to illustrate various possibilities. Two involve van der Pol's equation, one consists of 15 second order equations, and another contains a singularity. One is used to show how a "virtually foolproof" strategy can fail in special circumstances.

A bibliography of 24 items is included.

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111[Z].—S. H. HOLLINGDALE & G. C. TOOTILL, *Electronic Computers*, Penguin Books, Inc., Baltimore, Maryland, 1965, 335 pp., 19 cm. Price $1.65 (paperbound).

This delightful little book is within reach of everyone, both in price and in content, although some thought and patience will be required of the layman to realize the full rewards of a careful reading. It is an honest and apparently successful attempt at popularization of the "black arts" of computers.

Because the book was written in 1963 and 1964 the latest fashions in computing now sweeping the field, namely, time-sharing and its corollaries, are only mentioned in passing. We can hope for an early revision to bring the laity up to date

on "personal computing-1966" as this book already promises to do for computing and the basics of programming with respect to the older techniques.

One of the strong points of this volume is its pleasant pedagogical approach. When words alone do not suffice, a concrete example is used "to fix ideas." These examples illustrate the points being made quite adequately without exhausting the intelligent reader's patience or endurance. The authors manage quite nicely to increase the reader's cultural background through the use of anecdotes and historical sidelights that go well with the lesson. This is often characteristic of gifted authors, perhaps a little more frequently with British writers than with others. One wonders why this is so.

For style and lucidity of exposition and for its skill in pleasing, useful communication, as well as its content, this book is highly recommended.

The plea of G. H. Stearman [1] for the improvement of technical writing, with which this review strongly concurs, would be unnecessary if more of our colleagues wrote like the present authors.

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1. G. H. STEARMAN, "Is switching theory mathematics or engineering?," *IEEE Trans. on Electronic Computers*, v. EC-15, 1966, p. 124.

112[Z].—SEYMOUR V. POLLACK, *A Guide to Fortran* IV, Columbia University Press, New York, 1965, 260 pp., 24 cm. Price $5.00.

The text is written in a clear and lucid manner and contains a glossary of terms (the lack of which sometimes occurs in the best of texts of this type). The problem exercises are interesting but rather limited in scope (many having evolved from medical applications). The illustrations and flow charts are clear and well coordinated with the text, and a complete index is included. However, there is no discussion of the use of disc storage appropriate to some machine configurations and the material is scanty on the use and advantages of binary tape, an important medium for handling large amounts of data conveniently. The most serious criticism of the book concerns the complete lack of material concerned with the basic numerical problems associated with computing hardware. For example, when discussing the arithmetic IF statement, no material is presented on the use of a tolerance when comparing two floating point numbers. This presentation of the Fortran IV language appears to be geared toward researchers in the life sciences.

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113[Z].—CHARLES PHILIP LECHT, *The Programmer's Fortran* II *and* IV, McGraw-Hill Book Co., New York, 1966, xx + 162 pp., 28 cm. Price $7.95.

This concise, compact book is a catalogue of the main features of and contrasts between Fortran II and Fortran IV. Other forms of Fortran such as that for the CDC 3600, for instance, are not included. It is characterized by a simple and uniform