special interest is the author's use of the zeta-transform to study Markovian processes.

In attempting to treat so much material in the advanced portion of the book, the author is not able to maintain the same clarity found in the first part of the book. Some topics are explained thoroughly in the advanced part, but others are poorly developed and confusing. I count the first half a great success as a lucid introduction to these topics. However, the second half is more useful when augmented by readings from other sources. A minor irritation is an abundance of typographical errors. Its use as a text is possible for many types of courses; it has a useful bibliography and index but no exercises. It is a wide-ranging book with sections comprehensible at many levels of mathematical sophistication.

Ira Pohl

Stanford Linear Accelerator Center
Stanford University
Stanford, California 94305

1. Claude Berge, *The Theory of Graphs and Its Applications*, Methuen, London, 1962.
2. J. C. C. McKinsey, *An Introduction to the Theory of Games*, McGraw-Hill, New York, 1952.
3. A. Kaufmann & R. Cruon, *Dynamic Programming*, Academic Press, New York, 1967.

63[4].—Werner Glasmacher & Dietmar Sommer, *Implizite Runge-Kutta-Formeln*, Westdeutscher Verlag, Köln, 1966, 178 pp., 24 cm. Price DM 44.00.

Implicit Runge-Kutta methods based on Gauss-Legendre quadrature formulae were introduced by Ceschino and Kuntzmann [1] and by the reviewer [2]. Methods based on Lobatto and on Radau quadrature formulae were introduced by the reviewer [3]. These methods have the property that if m is the number of stages, then the order is $2m$ for the Gauss case, $2m - 2$ for the Lobatto case, and $2m - 1$ for the two types of the Radau case. A disadvantage of the methods for integrating differential equations in practice is their implicit nature.

The only previous tables of the coefficients of the methods are those of the reviewer [4], which give coefficients to 20D for methods of the four types with orders not exceeding 20. The present tables give coefficients to 24S for the four methods up to $m = 20$. In addition to the tables, full descriptions of the evaluation methods are given, including an Algol programme and flow charts.

J. C. Butcher

The University of Auckland
New Zealand

1. F. Ceschino & J. Kuntzmann, *Problèmes Différentiels de Conditions Initiales*, Dunod, Paris, 1963.
2. J. C. Butcher, "Implicit Runge-Kutta processes," *Math. Comp.*, v. 18, 1964, pp. 50–64.
3. J. C. Butcher, "Integration processes based on Radau quadrature formulas," *Math. Comp.*, v. 18, 1964, pp. 233–244.
4. J. C. Butcher, *Tables of Coefficients for Implicit Runge-Kutta Processes*, ms. of 9 sheets deposited in the UMT file [see *Math. Comp.*, v. 19, 1965, p. 348, RMT 56].

64[4].—Minoru Urabe, *Nonlinear Autonomous Oscillations, Analytical Theory*, Academic Press, New York, 1967, xi + 330 pp., 24 cm. Price $16.00.

This monograph contains results in the theory of nonlinear autonomous oscillations, most of them based on the author's research. The main topic is the analytical and numerical construction of periodic solutions. In attempting "to present a self-contained and readable account for mathematicians, physicists, and engineers" the author includes the statement of many basic theorems of ordinary differential equation theory and, with the aid of a mysterious selection principle, some proofs. As a consequence, a careful nonspecialist must have access to a modern textbook on ordinary differential equations; hence, he does not need at least half the monograph. Since the specialist will proceed directly to the more advanced topics, the supplementary material is presumably intended for those who want to refer to the theorems and need to see enough proofs so that they can believe that a complete theory exists.

The material most likely to be of interest to numerical analysts is included in a chapter on the numerical computation of periodic solutions and in an appendix on Newton's method and numerical methods for solving ordinary differential equations. In the chapter the author reduces the search for the initial values of a periodic solution of an nth order system of ordinary differential equations to the solution by Newton's method of a system of $n - 1$ algebraic equations. The functions occurring in the algebraic equations are evaluated by integrating the differential equations written relative to a moving orthogonal coordinate system. The problem is nontrivial and is carefully treated. Several numerical examples and graphs are included. In addition, the Galerkin procedure is briefly discussed.

In general, the book is carefully written and can be used as a supplementary text for a course in ordinary differential equations or numerical analysis. The students should be warned, however, that the author sometimes uses inappropriate mathematical formalisms in heuristic discussions. For example, on p. 298 in a discussion of when to terminate an iterative scheme in a practical computation, we are told to take $\epsilon = o(\alpha)$, where ϵ is the given bound on the error and α is the cutoff criterion. On the other hand, in mathematical discussions, the terms "small," "accurate" and "approximate" are used most casually. For example, on p. 283 in a discussion of an iterative solution to $x = f(x)$, he writes "if [the starting approximate solution] x_0 is accurate, then the quantity $|f(x_0) - x_0| = |x_1 - x_0|$ is small." One is reminded of the ancient joke, Q. "How's your wife?", A. "Compared to what?"

Tom Kyner

University of Southern California
Mathematics Department
Los Angeles, California

65[7].—Chih-Bing Ling, *On the Values of Two Coefficients related to the Weierstrass Elliptic Functions*, Virginia Polytechnic Institute, Blacksburg, Virginia, January 1968, ms. of 4 typewritten sheets deposited in UMT file.

Using Jacobi theta functions, the author has herein extended to 101S the results of his previous calculation [1] of the following two coefficients, which are related to the Weierstrass functions of double periods $(1, i)$ and $(1, e^{\pi i/3})$, respectively:

$$\sigma_4 = 3.15121\ 20021\ 53897\ 53821\ 76899\ 42248\ 68855\ 66455\ 19354\ 51485\ 24384\ 70540\ 35738\ 42598\ 37682\ 74612\ 16108\ 69439\ 55074\ 50822\,,$$

$$\sigma_6 = 5.86303\ 16934\ 25401\ 59797\ 02134\ 43837\ 82343\ 75153\ 76204\ 12955\ 75122\ 82731\ 11230\ 49523\ 95831\ 56859\ 89351\ 55366\ 27614\ 95871\,.$$