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MATHEMATICS OF COMPUTATION

5.0 GENERAL

5.1 NUMERICAL ANALYSIS

5.10 General

See: 19,455; 19,456

5.11 Error Analysis; Computer Arithmetic

JONES, WILLIAM B.; AND SNELL, R. I. 19,437
Truncation error bounds for continued fractions.
SIAM J. Numer. Anal. 6, 2 (June 1969), 210–221.

This paper gives a priori error bounds for continued fractions of the form

$$K(a_n/b_n) = \frac{a_1}{b_1} + \frac{a_2}{b_2} + \frac{a_3}{b_3} + \cdots$$

where a_n and b_n are elements of some field F, $a_n \neq 0$, $n = 1, 2, \cdots$. Applications are given to C-fractions, S-fractions, Z-fractions and T-fractions.

I. Gargantini, London, Ont., Canada

5.12 Function Evaluation

See also: 19,356

FETTIS, H. E. 19,438
Note on the computation of Jacobi's Nome and its inverse.
Computing 4, 3 (1969), 202–206.

This note is essentially a summary of a method to compute one of k, k', or q, given another one of these parameters. Ordinarily, the author's equation (2) suffices to compute $k(q)$ given q, for $0 \leqslant q \leqslant 0.7$ (say) with little computational effort. It is for values q, $0.7 < q < 1$ in which his algorithm becomes desirable, although it seems to this reviewer that one should employ the algorithm to the point where equation (2) is feasible, thus reducing the need for finding successive square roots, which is costly.

The inverse problem of computing q, given $k(q)$ can be treated in a similar fashion. The series for computing q is quite slow when $k \sim 1$. Using the author's algorithm, one may determine by several Landen transformations a value k_n sufficiently small, $k_n \leqslant 1/3$ (say) for which the series for q_n converges rapidly. A one-step transformation is illustrated in Magnus-Oberhettiger, *Formulas and Theorems for the Special Functions of Mathematical Physics*, Chap. X, pp. 378 [Springer-Verlag, New York, 1966]. The author's algorithm makes this method of computation feasible.

The author's method is very flexible and very slow. Equation (14) is in error and can be corrected, referring to equation (12). In the illustrative example (1) footnote, equation (16) does not exist and should be replaced by the parenthetical remark succeeding equation (12).

R. E. Shafer, Livermore, Calif.

LYONS, J. D.; AND NESBET, R. K. 19,439
Evaluation of integrals required in scattering theory: I. Non-exchange type integrals.
J. Computat. Phys. 4, 4 (Dec. 1969), 499–520.

Certain integrals involving spherical Bessel functions, which arise in the many-body variational approach to electron/atom scattering theory, are discussed. The paper is concerned primarily with rather elaborate classical analysis and special-function theory manipulations. However, attention is paid to combining various recurrence and other relationships between the functions involved, to obtain effective algorithms for their evaluation on a computer.

D. G. M. Anderson, Cambridge, Mass.

5.13 Interpolation; Functional Approximation

See also: 19,356; 19,447; 19,456

WATSON, G. A. 19,440
On an algorithm for nonlinear minimax approximation.
Comm. ACM 13, 3 (March 1970), 160–162.

This paper presents an application of a general, nonlinear algorithm (given by M. R. Osborne and G. A. Watson in *Computer J.* 12 (1969), 63, 68) to certain nonlinear minimax approximation problems.

The algorithm is applied to the nonlinear problem of finding a vector $\alpha = (\alpha_1, \alpha_2, \cdots, \alpha_p)^T$ which minimizes the

$$\max_{a \le x_j \le b} |f(x_j) - F(x_j, \alpha)|, \qquad j = 1, 2, \cdots, n > p$$

under the main assumption that the matrix

$$M = \left[\frac{\partial F(x_i, \alpha)}{\partial \alpha_j}\right] \begin{matrix} i = 1, 2, \cdots, n \\ j = 1, 2, \cdots, p \end{matrix}$$

has rank p. The algorithm provides a sequence of linear programming solution vectors, α^j, converging to the requested α vector.

Valuable applications of the algorithm for finding the optimal starting values for $\sqrt{x}$ and for rational approximation problems are given, and the advantages of the present algorithm with respect to some conventional methods are illustrated by some numerical examples.

I. Erdelyi, Philadelphia, Pa.

5.14 Linear Algebra

See also: 19,463

● KOLMAN, BERNARD. 19,441
Elementary linear algebra.
Macmillan Co., New York, 1970, 255 pp.

This textbook has been written for students who have completed a one-year calculus course. It thus provides the student with his first experience in postulational or axiomatic mathematics while keeping in close touch with the computational aspects of the subject. Engineering and science today are becoming more analytically oriented, that is, more mathematical in flavor, and the mere ability to manipulate matrices is no longer adequate. Linear algebra affords,