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William M. McKeeman, University of California, Santa Cruz; James Horning, University of Toronto; David Wortman, Stanford University.

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Number 96

AUTOMATIC PROGRAMMING, NUMERICAL METHODS AND FUNCTIONAL ANALYSIS

Edited by V. N. Faddeeva

332 pages; List Price \$22.40; Member Price \$16.80

This volume of the Proceedings of the Steklov Institute of Mathematics consists mainly of studies carried out at the laboratory of approximate calculations of the Leningrad Branch of the Mathematical Institute of the Academy of Sciences of the USSR. Two studies by E. A. Volkov, whose subject lies within the scope of this volume, were carried out at the Theory of Func-

tions section of the Institute. Six papers on automatic programming are devoted to the further development of the automatic programming system designed at the LBMI under the direction of Academician L. V. Kantorovič. The authors of these papers are L. V. Kantorovič, K. V. Šahbazjan, M. M. Lebedinskiĭ, T. N. Smirnova, and V. S. Sohranskaja. Nine of the papers dealing with numerical methods have diverse subjects, and the authors are D. K. Faddeev, V. N. Kublanovskaja, V. N. Faddeeva, M. N. Jakovlev, E. A. Volkov, L. N. Dovbyš, A. P. Kubanskaja, and L. T. Savinova. The final two papers, written by V. P. Il'in and N. K. Nikol'skiĭ, are devoted to functional analysis.

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The editorial committee would welcome readers' comments about this microfiche feature. Please send comments to Professor Eugene Isaacson, MATHEMATICS OF COMPUTATION, Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, New York 10012.

Mathematics of Computation

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**TABLES OF
GAUSSIAN QUADRATURE RULES
FOR THE CALCULATION OF FOURIER COEFFICIENTS**

By

WALTER GAUTSCHI

Writing Fourier coefficients in the form

$$\frac{1}{2\pi} \int_{-\pi}^{\pi} f(x) \frac{\cos(mx)}{\sin(mx)} dx = \int_{-1}^1 f(\pi x) c_m(x) dx - \int_{-1}^1 f(\pi x) s_m(x) dx,$$

where

$$c_m(x) = \frac{1}{2}(1 + \cos m\pi x), \quad s_m(x) = \frac{1}{2}(1 + \sin m\pi x), \quad m = 0, 1, 2, \dots,$$

are (nonnegative) weight functions, the integrals on the right may be approximated by appropriately weighted Gaussian quadrature rules,

$$\int_{-1}^1 f(\pi x) c_m(x) dx = \sum_{r=1}^n \lambda_r^{(n)} f(\pi \xi_r^{(n)}).$$

Table 3 (pp. T1-T24) relates to the weight function $c_m(x)$, and gives 12D values of $\xi_r^{(n)}$, $\pi \xi_r^{(n)}$, $\lambda_r^{(n)}$ for $n = 1(1)8, 16, 32$ and $m = 1(1)12$. Only the nonnegative abscissas and corresponding weights are listed, the others being obtainable from the symmetry relations $\xi_{n+1-r}^{(n)} = -\xi_r^{(n)}$, $\lambda_{n+1-r}^{(n)} = \lambda_r^{(n)}$, $r = 1, 2, \dots, n$.

Table 4 (pp. T25-T50) relates to the weight function $s_m(x)$, and contains 12D values of $\xi_r^{(n)}$, $\pi \xi_r^{(n)}$, $\lambda_r^{(n)}$ for $n = 1(1)8, 16, 32$ and $m = 0(1)12$.

The tables were computed in single precision floating point arithmetic on the CDC 6500 computer, using the methods described in the article "On the construction of Gaussian quadrature rules from modified moments" by the same author. (Cf., in particular, section 5(ii).)