L. S. BARK, L. N. BOLSHEV, P. I. KUZNETSOV AND A. P. CHERENKOV, *Tables of the Rayleigh-Rice Distributions*, Computation Center USSR, Academy of Sciences USSR 28, 1964. 2.80 r. xxviii + 246 pp.

Review by D. B. OWEN

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This volume consists of 28 pages of introduction and 245 pages of tables. The principal function tabulated is

$$Q(u, v) = (2\pi)^{-1} \iint_{x^2+y^2 \geqq u^2} \exp[-\tfrac{1}{2}\{(x-v)^2 + y^2\}]\, dx\, dy.$$

One interpretation of this function is that it gives the probability of falling outside a circle of radius $u$, centered at the origin when a random observation is taken from a bivariate normal distribution with means $v$ and 0, standard deviations one, and correlation zero. This function is referred to as the $Q$-function, as the offset circle probabilities for the circular normal distribution, as the circular coverage function, and by other names in the English literature. One Russian name for the $Q$-function is given in the title of the book. It is a form of noncentral chi-square with two degrees of freedom, and is related to the Lommel functions of two variables. Large tables presently available to the Western World have not been widely distributed. The Operations Analysis Group of Bell Aircraft Corporation issued Report No. 02-949-106 during June, 1956, under the title, "Table of Circular Normal Probabilities." The Rand Corporation also issued two or more tables of this function or closely related functions. Aside from these, the tabulations have been small enough to appear in standard journals. The reader is referred to papers by Lowe [5] DiDonato and Jarnagin [1] and [2] and Gilliland [3] for further information. These references also refer to other earlier work. The uses for this function are numerous, including heat flow and ion exchange and in the analysis of transient behavior of transmission lines. It also has uses in steady-state analysis of certain antenna problems as well as in several probability and statistics problems.

The introduction[1] contains an excellent summary of the different probabilistic interpretations which may be applied to the $Q$-function, including a review of most, but not all, of Western literature on the subject. One omission is the paper by Harold Ruben [6], which deals with the closely related problem of the distribution of quadratic forms. The introduction points out the relationship of the $Q$-function to the distribution of quadratic forms in two dimensions, but does not exploit it as DiDonato and Jarnagin [3] did. It is very informative and well-written as compared to introductions which usually accompany tables. The computation work also appears to have been expertly done.

The table of $Q(u, v)$ is for $u = 0(0.02) \cdots$ (until $Q$ is zero to 6 decimal places)

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[1] The translation was done by Mr. Leslie Cohn (University of Chicago), to whom I express appreciation and thanks.