

STICHTING
MATHEMATISCH CENTRUM
2e BOERHAAVESTRAAT 49
AMSTERDAM

AFDELING TOEGEPASTE WISKUNDE

Technical Note TN 28

Table of the function $B(k, \varphi) = \int_0^{\varphi} \frac{\cos^2 \varphi}{(1-k^2 \sin^2 \varphi)^{\frac{3}{2}}} d\varphi$

by

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November 1962

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In this note a table in 11 decimals, from the function

$$B(k, \varphi) = \int_0^{\varphi} \frac{\cos^2 \varphi}{(1 - k^2 \sin^2 \varphi)^{\frac{1}{2}}} d\varphi, \text{ is published, where}$$

$$k = \sin \{1^\circ (1^\circ) 45^\circ\} \text{ and } \varphi = \sin \{1^\circ (1^\circ) 90^\circ\}.$$

The computation in 12 decimals, floating point, was carried out on the X1 computer of the Mathematical Centre.

This function is related to the Incomplete Elliptic Integrals of the first and second kind, resp. $F(k, \varphi)$ and $E(k, \varphi)$, by

$$(1) \quad B(k, \varphi) = \frac{1}{k^2} [E(k, \varphi) - k'^2 F(k, \varphi)].$$

For $k > \frac{1}{2} \sqrt{2}$ this relation gives a method for computing $B(k, \varphi)$ from tables of F and E .

For $k \leq \frac{1}{2} \sqrt{2}$ however, this method fails, as the denominator and numerator of (1) become small, so that loss of significant figures will occur. In report TW 94^{*)} we therefore developed a method which can be used for calculating $B(k, \varphi)$ independent of F and E .

With this method the following table was obtained. Checking test-values for $k > \frac{1}{2} \sqrt{2}$ with values calculated from (1), we found an absolute error, not greater than 5 units in the 12th decimal. So we have good reason to hope that the error of the 11th decimal, the last decimal of the following numbers, will be at most one unit.

^{*)} This report will be published in Numerische Mathematik.

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alpha, phi

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