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Summation of Chebyshev Series

Function subprograms RCHSUM and DCHSUM compute, for real arguments x in the specified intervals, one of the following four sums:

$$S(x) = \sum_{n=0}^{N} c_n T_n(x) \qquad (-1 \le x \le 1) \tag{1}$$

$$S(x) = \sum_{n=0}^{N} c_n T_{2n}(x) \qquad (-1 \le x \le 1) \tag{2}$$

$$S(x) = \sum_{n=0}^{N} c_n T_{2n+1}(x) \qquad (-1 \le x \le 1) \tag{3}$$

$$S(x) = \sum_{n=0}^{N} c_n T_n^*(x) \qquad (0 \le x \le 1) \tag{4}$$

where $T_n(x)$ is the Chebyshev polynomial of degree n and $T_n^*(x) = T_n(2x-1)$.
On CDC and Cray computers, the double-precision version DCHSUM is not available.

Structure:

FUNCTION subprograms
User Entry Names: RCHSUM, DCHSUM
Obsolete User Entry Names: CHSUM $\equiv$ RCHSUM

Usage:

In any arithmetic expression,

`RCHSUM(MODE,C,N,X)` or `DCHSUM(MODE,C,N,X)`

has the value of the sum selected by MODE. RCHSUM is of type REAL, and DCHSUM is of type DOUBLE PRECISION. C and X have the same type as the function name. MODE and N are of type INTEGER.

MODE Type of sum to be evaluated (MODE $=$ 1, 2, 3, 4).

C One-dimensional array with dimension (0:d), d $\ge$ N, containing the coefficients $c_0, c_1, \ldots, c_N$.

N Limit N of summation.

X Argument x.

Notes:

Note that some authors use a different definition for the constant term in (1), (2) and (4), i.e. $c_0/2$ instead of c_0. Here, the definition of Ref. 1 is used.

References:

1. Y.L. Luke, Mathematical functions and their approximations, (Academic Press, New York 1975)
2. C.W. Clenshaw, Chebyshev series for mathematical functions, Mathematical Tables, Vol.5 (National Physical Laboratory, London, 1962).

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