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Submitter :
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Clausen Function

Function subprograms RCLAUS and DCLAUS calculate the Clausen function

$$\mathrm{Cl}_2(x) \;=\; -\int_0^x \ln\left|2\sin\frac{t}{2}\right|\,dt \;=\; \sum_{k=1}^{\infty}\frac{\sin kx}{k^2}$$

for real arguments x.

On CDC and Cray computers, the double-precision version DCLAUS is not available.

Structure:

FUNCTION subprograms
User Entry Names: RCLAUS, DCLAUS

Usage:

In any arithmetic expression,

RCLAUS(X) or DCLAUS(X) has the value $\mathrm{Cl}_2(\mathtt{X})$,

where RCLAUS is of type REAL, DCLAUS is of type DOUBLE PRECISION, and X has the same type as the function name.

Method:

For $0 \le x \le \pi$, the function is approximated by truncated Chebyshev series. For x outside this range, the relations $\mathrm{Cl}_2(\pi+x) = -\mathrm{Cl}_2(\pi-x)$ and $\mathrm{Cl}_2(2n\pi \pm x) = \pm\mathrm{Cl}_2(x)$ are used.

Accuracy:

RCLAUS (except on CDC and Cray computers) has full single-precision accuracy in the interval $0 \le x \le 2\pi$. For most values of the argument $\mathtt{X} \in [0, 2\pi]$, DCLAUS (and RCLAUS on CDC and Cray computers) has an accuracy of approximately one significant digit less than the machine precision. Accuracy is lost near the zero of $\mathrm{Cl}_2(x)$ at $x = \pi$ and for large values of $|x|$.

References:

1. K.S. Kölbig, Chebyshev coefficients for the Clausen function $\mathrm{Cl}_2(x)$, J. Comput. Appl. Math. **64** (1995) 295–297.

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