NAG Fortran Library Routine Document

G01MTF

Note: before using this routine, please read the Users' Note for your implementation to check the interpretation of ***bold italicised*** terms and other implementation-dependent details.

1 Purpose

G01MTF returns the value of the Landau density function $\phi(\lambda)$, via the routine name.

2 Specification

double precision `FUNCTION G01MTF (X)`
double precision `X`

3 Description

G01MTF evaluates an approximation to the Landau density function $\phi(\lambda)$ given by

$$\phi(\lambda) = \frac{1}{2\pi i}\int_{c-i\infty}^{c+i\infty} \exp(\lambda s + s\ln s)ds,$$

where c is an arbitrary real constant, using piecewise approximation by rational functions. Further details can be found in Kölbig and Schorr (1984).

To obtain the value of $\phi'(\lambda)$, G01RTF can be used.

4 References

Kölbig K S and Schorr B (1984) A program package for the Landau distribution *Comp. Phys. Comm.* **31** 97–111

5 Parameters

1: X – ***double precision*** *Input*

On entry: the argument λ of the function.

6 Error Indicators and Warnings

There are no failure exits from this routine.

7 Accuracy

At least 7 significant digits are usually correct, but occasionally only 6. Such accuracy is normally considered to be adequate for applications in experimental physics.

Because of the asymptotic behaviour of $\phi(\lambda)$, which is of the order of $\exp[-\exp(-\lambda)]$, underflow may occur on some machines when λ is moderately large and negative.

8 Further Comments

None.

9 Example

The example program evaluates $\phi(\lambda)$ at $\lambda = 0.5$, and prints the results.

9.1 Program Text

Note: the listing of the example program presented below uses ***bold italicised*** terms to denote precision-dependent details. Please read the Users' Note for your implementation to check the interpretation of these terms. As explained in the Essential Introduction to this manual, the results produced may not be identical for all implementations.

```
*     G01MTF Example Program Text
*     Mark 21 Release. NAG Copyright 2004.
*     .. Parameters ..
      INTEGER          NIN, NOUT
      PARAMETER        (NIN=5,NOUT=6)
*     .. Local Scalars ..
      DOUBLE PRECISION X, Y
*     .. External Functions ..
      DOUBLE PRECISION G01MTF
      EXTERNAL         G01MTF
*     .. Executable Statements ..
      WRITE (NOUT,*) 'G01MTF Example Program Results'
*     Skip heading in data file
      READ (NIN,*)
      WRITE (NOUT,*)
      WRITE (NOUT,*) '  X          Y'
      WRITE (NOUT,*)
   20 READ (NIN,*,END=40) X
*
*     Compute the value of the Landau density function
*
      Y = G01MTF(X)
*
      WRITE (NOUT,99999) X, Y
      GO TO 20
   40 STOP
*
99999 FORMAT (1X,F4.1,3X,1P,D12.4)
      END
```

9.2 Program Data

```
G01MTF Example Program Data
 0.5  : Value of X
```

9.3 Program Results

```
 G01MTF Example Program Results

   X          Y

  0.5     1.6523D-01
```