NAG Library Routine Document

A02ACF

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

A02ACF divides one complex number, $x = (x_r, x_i)$, by a second complex number, $y = (y_r, y_i)$, returning the result in $z = (z_r, z_i)$.

2 Specification

```
SUBROUTINE A02ACF(XR, XI, YR, YI, ZR, ZI)
double precision      XR, XI, YR, YI, ZR, ZI
```

3 Description

$z = \dfrac{x}{y}$ is calculated using the following formulae:

$$\text{if } |y_r| > |y_i|, \qquad z_r = \frac{x_r + \theta x_i}{\theta y_i + y_r}, \qquad z_i = \frac{x_i - \theta x_r}{\theta y_i + y_r}, \qquad \text{where} \qquad \theta = \frac{y_i}{y_r};$$

$$\text{if } |y_r| \leq |y_i|, \qquad z_r = \frac{\phi x_r + x_i}{\phi y_r + y_i}, \qquad z_i = \frac{\phi x_i - x_r}{\phi y_r + y_i}, \qquad \text{where} \qquad \phi = \frac{y_r}{y_i}.$$

These formulae ensure that no unnecessary overflow or underflow occurs at intermediate stages of the computation.

4 References

Wilkinson J H and Reinsch C (1971) *Handbook for Automatic Computation II, Linear Algebra* Springer–Verlag

5 Parameters

1: XR – ***double precision*** *Input*
2: XI – ***double precision*** *Input*

On entry: x_r and x_i, the real and imaginary parts of x, respectively.

3: YR – ***double precision*** *Input*
4: YI – ***double precision*** *Input*

On entry: y_r and y_i, the real and imaginary parts of y, respectively.

5: ZR – ***double precision*** *Output*
6: ZI – ***double precision*** *Output*

On exit: z_r and z_i, the real and imaginary parts of z, respectively.

6 Error Indicators and Warnings

None.

7 Accuracy

The result should be correct to ***machine precision***.

8 Further Comments

The time taken by A02ACF is negligible.

This routine **must** not be called with YR $= 0.0$ and YI $= 0.0$.

9 Example

This example finds the value of $(-1.7 + 2.6i)/(-3.1 - 0.9i)$.

9.1 Program Text

```
*     A02ACF Example Program Text
*     Mark 14 Revised. NAG Copyright 1989.
*     .. Parameters ..
      INTEGER          NIN, NOUT
      PARAMETER        (NIN=5,NOUT=6)
*     .. Local Scalars ..
      DOUBLE PRECISION XI, XR, YI, YR, ZI, ZR
*     .. External Subroutines ..
      EXTERNAL         A02ACF
*     .. Executable Statements ..
      WRITE (NOUT,*) 'A02ACF Example Program Results'
      WRITE (NOUT,*)
*     Skip heading in data file
      READ (NIN,*)
      READ (NIN,*) XR, XI, YR, YI
*
*     Compute (XR,XI)/(YR,YI) = (ZR,ZI)
*
      CALL A02ACF(XR,XI,YR,YI,ZR,ZI)
*
      WRITE (NOUT,*) '   XR    XI    YR    YI      ZR       ZI'
      WRITE (NOUT,99999) XR, XI, YR, YI, ZR, ZI
*
99999 FORMAT (1X,4F6.1,2F9.4)
      END
```

9.2 Program Data

```
A02ACF Example Program Data
 -1.7  2.6 -3.1 -0.9
```

9.3 Program Results

```
 A02ACF Example Program Results

    XR    XI    YR    YI      ZR       ZI
  -1.7   2.6  -3.1  -0.9   0.2812  -0.9203
```