NAG Fortran 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)
real              XR, XI, YR, YI, ZR, ZI
```

3 Description

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

if $|y_r| > |y_i|$,

$$z_r = \frac{x_r + \theta x_i}{\theta y_i + y_r}, \quad z_i = \frac{x_i - \theta x_r}{\theta y_i + y_r}, \quad \text{where} \quad \theta = \frac{y_i}{y_r};$$

If $|y_r| \leq |y_i|$,

$$z_r = \frac{\phi x_r + x_i}{\phi y_r + y_i}, \quad z_i = \frac{\phi x_i - x_r}{\phi y_r + y_i}, \quad \text{where} \quad \phi = \frac{y_r}{y_i}.$$

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 – **real**   *Input*
2:    XI – **real**   *Input*

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

3:    YR – **real**   *Input*
4:    YI – **real**   *Input*

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

5:    ZR – **real**   *Output*
6:    ZI – **real**   *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 the routine is negligible.

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

9 Example

To find 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 ..
      real              XI, XR, YI, YR, ZI, ZR
*     .. External Subroutines ..
      EXTERNAL          A02ACF
*     .. Executable Statements ..
      WRITE (NOUT,*) 'A02ACF Example Program Results'
*     Skip heading in data file
      READ (NIN,*)
      READ (NIN,*) XR, XI, YR, YI
*
      CALL A02ACF(XR,XI,YR,YI,ZR,ZI)
*
      WRITE (NOUT,*)
      WRITE (NOUT,*) '   XR    XI    YR    YI       ZR        ZI'
      WRITE (NOUT,99999) XR, XI, YR, YI, ZR, ZI
      STOP
*
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
```