A02ACF – NAG Fortran Library Routine Document

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

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

If $|y_r| > |y_i|$,

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

If $|y_r| \le |y_i|$,

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

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

4 References

[1] 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
```