

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

$z = \frac{x}{y}$ 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 $|y_r| \leq |y_i|$,

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

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
