

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

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

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

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

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 – <i>double precision</i> | <i>Input</i> |
| 2: | XI – <i>double precision</i> | <i>Input</i> |
| <i>On entry:</i> x_r and x_i , the real and imaginary parts of x , respectively. | | |
| 3: | YR – <i>double precision</i> | <i>Input</i> |
| 4: | YI – <i>double precision</i> | <i>Input</i> |
| <i>On entry:</i> y_r and y_i , the real and imaginary parts of y , respectively. | | |
| 5: | ZR – <i>double precision</i> | <i>Output</i> |
| 6: | ZI – <i>double precision</i> | <i>Output</i> |
| <i>On exit:</i> 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
