

NAG Toolbox for MATLAB

a02ac

1 Purpose

a02ac 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 Syntax

```
[zr, zi] = a02ac(xr, xi, yr, yi)
```

3 Description

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

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

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

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

5.1 Compulsory Input Parameters

1: **xr** – double scalar

2: **xi** – double scalar

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

3: **yr** – double scalar

4: **yi** – double scalar

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

5.2 Optional Input Parameters

None.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

- 1: **zr** – double scalar
- 2: **zi** – double scalar

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 a02ac is negligible.

This function **must** not be called with **yr** = 0.0 and **yi** = 0.0.

9 Example

```
xr = -1.7;  
xi = 2.6;  
yr = -3.1;  
yi = -0.9;  
[zr, zi] = a02ac(xr, xi, yr, yi)  
  
zr =  
    0.2812  
zi =  
   -0.9203
```