

## NAG Library Routine Document

### F06AAF (DROTG)

**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

F06AAF (DROTG) generates a real Givens plane rotation.

#### 2 Specification

SUBROUTINE F06AAF (A, B, C, S)

REAL (KIND=nag\_wp) A, B, C, S

The routine may be called by its BLAS name *drotg*.

#### 3 Description

F06AAF (DROTG) generates a real Givens plane rotation with parameters  $c$  and  $s$ , such that, given real  $a$  and  $b$ :

$$\begin{pmatrix} c & s \\ -s & c \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} d \\ 0 \end{pmatrix}.$$

The routine computes  $c$ ,  $s$  and  $d$  as follows:

$$d = \sigma \sqrt{a^2 + b^2};$$

$$c = \begin{cases} a/d, & \text{if } d \neq 0, \\ 1, & \text{if } d = 0, \end{cases} \quad s = \begin{cases} b/d, & \text{if } d \neq 0, \\ 0, & \text{if } d = 0, \end{cases}$$

where  $\sigma = \begin{cases} \text{sign } a, & \text{if } |a| > |b|, \\ \text{sign } b, & \text{if } |a| \leq |b|. \end{cases}$

The routine also computes the value  $z$  defined as

$$z = \begin{cases} s, & \text{if } |s| < c \text{ or } c = 0, \\ 1/c, & \text{if } 0 < |c| \leq s. \end{cases}$$

This enables  $c$  and  $s$  to be reconstructed from the single value  $z$  as

$$c = \begin{cases} \sqrt{1 - z^2}, & \text{if } |z| \leq 1, \\ 1/z, & \text{if } |z| > 1, \end{cases} \quad s = \begin{cases} z, & \text{if } |z| \leq 1, \\ \sqrt{1 - c^2}, & \text{if } |z| > 1. \end{cases}$$

To apply the plane rotation to a pair of real vectors, call F06EPF (DROT); to apply it to a pair of complex vectors, call F06KPF (ZDROT).

#### 4 References

None.

#### 5 Arguments

1: A – REAL (KIND=nag\_wp)

*Input/Output*

*On entry:* the value  $a$ , the first element of the vector which determines the rotation.

*On exit:* the value  $d$ .

- 2: B – REAL (KIND=nag\_wp) *Input/Output*  
*On entry:* the value  $b$ , the second element of the vector which determines the rotation.  
*On exit:* the value  $z$ , from which  $c$  and  $s$  can be reconstructed.
- 3: C – REAL (KIND=nag\_wp) *Output*  
*On exit:* the value  $c$ , the cosine of the rotation.
- 4: S – REAL (KIND=nag\_wp) *Output*  
*On exit:* the value  $s$ , the sine of the rotation.

## 6 Error Indicators and Warnings

None.

## 7 Accuracy

Not applicable.

## 8 Parallelism and Performance

F06AAF (DROTG) is not threaded in any implementation.

## 9 Further Comments

None.

## 10 Example

None.

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