

NAG Library Routine Document

F06FAF

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

F06FAF computes the cosine of the angle between two real vectors.

2 Specification

```
FUNCTION F06FAF (N, J, TOLX, X, INCX, TOLY, Y, INCY)
REAL (KIND=nag_wp) F06FAF
INTEGER          N, J, INCX, INCY
REAL (KIND=nag_wp) TOLX, X(*), TOLY, Y(*)
```

3 Description

F06FAF returns, via the function name, the cosine of the angle between two n -element real vectors x and y , given by the expression

$$\frac{x^T y}{\|x\|_2 \|y\|_2}.$$

If $1 \leq j \leq n$, y is taken to be the unit vector e_j , in which case the array Y is not referenced.

If $\|x\|_2 \leq tol_x$, the routine returns 2.0; if $\|x\|_2 > tol_x$ but $\|y\|_2 \leq tol_y$, the routine returns -2.0 ; otherwise the value returned is in the range $(-1.0, 1.0)$.

4 References

None.

5 Arguments

- 1: N – INTEGER *Input*
On entry: n , the number of elements in x and y .
- 2: J – INTEGER *Input*
On entry: if the vector y is supplied in Y, J should be set to 0. Otherwise, J specifies the index j of the unit vector e_j to be used as y .
- 3: TOLX – REAL (KIND=nag_wp) *Input*
On entry: the value tol_x , used to determine whether $\|x\|_2$ is effectively zero.
If TOLX is negative, the value zero is used.
- 4: X(*) – REAL (KIND=nag_wp) array *Input*
Note: the dimension of the array X must be at least $\max(1, 1 + (N - 1) \times |INCX|)$.
On entry: the n -element vector x .
If $INCX > 0$, x_i must be stored in $X(1 + (i - 1) \times INCX)$, for $i = 1, 2, \dots, N$.
If $INCX < 0$, x_i must be stored in $X(1 - (N - i) \times INCX)$, for $i = 1, 2, \dots, N$.

Intermediate elements of X are not referenced.

- 5: INCX – INTEGER *Input*
On entry: the increment in the subscripts of X between successive elements of x .
- 6: TOLY – REAL (KIND=nag_wp) *Input*
On entry: the value $toly$, used to determine whether $\|y\|_2$ is effectively zero.
If TOLY is negative, the value zero is used.
- 7: Y(*) – REAL (KIND=nag_wp) array *Input*
Note: the dimension of the array Y must be at least $\max(1, 1 + (N - 1) \times |\text{INCY}|)$.
On entry: if $1 \leq J \leq N$, Y is not referenced. Otherwise, Y holds the vector y .
If $\text{INCY} > 0$, y_i must be stored in $Y(1 + (i - 1) \times \text{INCY})$, for $i = 1, 2, \dots, N$.
If $\text{INCY} < 0$, y_i must be stored in $Y(1 - (N - i) \times \text{INCY})$, for $i = 1, 2, \dots, N$.
Intermediate elements of Y are not referenced.
- 8: INCY – INTEGER *Input*
On entry: the increment in the subscripts of Y between successive elements of y .

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Parallelism and Performance

F06FAF is not threaded in any implementation.

9 Further Comments

None.

10 Example

None.
