NAG Library Routine Document

C06GCF

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

C06GCF forms the complex conjugate of a sequence of n data values.

2 Specification

```
SUBROUTINE C06GCF(Y, N, IFAIL)
INTEGER           N, IFAIL
double precision  Y(N)
```

3 Description

This is a utility routine for use in conjunction with C06ECF or C06FCF to calculate inverse discrete Fourier transforms (see the C06 Chapter Introduction).

4 References

None.

5 Parameters

1: Y(N) – ***double precision*** array *Input/Output*

On entry: if Y is declared with bounds $(0 : \mathrm{N} - 1)$ in the subroutine from which C06GCF is called, then $\mathrm{Y}(j)$ must contain the imaginary part of the jth data value, for $0 \leq j \leq n - 1$.

On exit: these values are negated.

2: N – INTEGER *Input*

On entry: n, the number of data values.

Constraint: $\mathrm{N} \geq 1$.

3: IFAIL – INTEGER *Input/Output*

On entry: IFAIL must be set to 0, -1 or 1. If you are unfamiliar with this parameter you should refer to Section 3.3 in the Essential Introduction for details.

On exit: IFAIL $= 0$ unless the routine detects an error (see Section 6).

For environments where it might be inappropriate to halt program execution when an error is detected, the value -1 or 1 is recommended. If the output of error messages is undesirable, then the value 1 is recommended. Otherwise, if you are not familiar with this parameter, the recommended value is 0. **When the value -1 or 1 is used it is essential to test the value of IFAIL on exit.**

6 Error Indicators and Warnings

If on entry IFAIL $= 0$ or -1, explanatory error messages are output on the current error message unit (as defined by X04AAF).

Errors or warnings detected by the routine:

IFAIL $= 1$

On entry, N < 1.

7 Accuracy

Exact.

8 Further Comments

The time taken by C06GCF is negligible.

9 Example

This example reads in a sequence of complex data values and prints their inverse discrete Fourier transform as computed by calling C06GCF, followed by C06ECF and C06GCF again.

9.1 Program Text

```
*     C06GCF Example Program Text
*     Mark 14 Revised. NAG Copyright 1989.
*     .. Parameters ..
      INTEGER          NMAX
      PARAMETER        (NMAX=20)
      INTEGER          NIN, NOUT
      PARAMETER        (NIN=5,NOUT=6)
*     .. Local Scalars ..
      INTEGER          IFAIL, J, N
*     .. Local Arrays ..
      DOUBLE PRECISION X(0:NMAX-1), Y(0:NMAX-1)
*     .. External Subroutines ..
      EXTERNAL         C06ECF, C06GCF
*     .. Executable Statements ..
      WRITE (NOUT,*) 'C06GCF Example Program Results'
*     Skip heading in data file
      READ (NIN,*)
   20 READ (NIN,*,END=80) N
      IF (N.GT.1 .AND. N.LE.NMAX) THEN
         DO 40 J = 0, N - 1
            READ (NIN,*) X(J), Y(J)
   40    CONTINUE
         IFAIL = 1
*
         CALL C06GCF(Y,N,IFAIL)
         IF (IFAIL.EQ.0) THEN
            CALL C06ECF(X,Y,N,IFAIL)
            CALL C06GCF(Y,N,IFAIL)
*
            WRITE (NOUT,*)
            WRITE (NOUT,*)
     +        'Components of inverse discrete Fourier transform'
            WRITE (NOUT,*)
            WRITE (NOUT,*) '           Real      Imag'
            WRITE (NOUT,*)
            DO 60 J = 0, N - 1
               WRITE (NOUT,99999) J, X(J), Y(J)
   60       CONTINUE
            GO TO 20
         ELSE
```

```
            WRITE (NOUT,*)
            WRITE (NOUT,99998) ' ** C06GCF returned with IFAIL = ',
     +        IFAIL
          END IF
        ELSE
          WRITE (NOUT,*) 'Invalid value of N'
        END IF
   80 CONTINUE
*
99999 FORMAT (1X,I6,2F10.5)
99998 FORMAT (1X,A,I5)
      END
```

9.2 Program Data

```
C06GCF Example Program Data
    7
  0.34907  -0.37168
  0.54890  -0.35669
  0.74776  -0.31175
  0.94459  -0.23702
  1.13850  -0.13274
  1.32850   0.00074
  1.51370   0.16298
```

9.3 Program Results

```
 C06GCF Example Program Results

 Components of inverse discrete Fourier transform

            Real      Imag

      0   2.48361  -0.47100
      1   0.01983  -0.56496
      2  -0.14825  -0.30840
      3  -0.22506  -0.17477
      4  -0.28767  -0.05865
      5  -0.36711   0.09756
      6  -0.55180   0.49684
```