NAG Fortran 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
real              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) – ***real*** array *Input/Output*

On entry: if Y is declared with bounds $(0 : \mathrm{N} - 1)$ in the (sub)program 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: the number of data values, n.

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

3: IFAIL – INTEGER *Input/Output*

On entry: IFAIL must be set to 0, -1 or 1. Users who are unfamiliar with this parameter should refer to Chapter P01 for details.

On exit: $\mathrm{IFAIL} = 0$ 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, for users 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 $= 1$

N < 1.

7 Accuracy

Exact.

8 Further Comments

The time taken by the routine is negligible.

9 Example

This program 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

Note: the listing of the example program presented below uses ***bold italicised*** terms to denote precision-dependent details. Please read the Users' Note for your implementation to check the interpretation of these terms. As explained in the Essential Introduction to this manual, the results produced may not be identical for all implementations.

```
*     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 ..
      real             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 = 0
*
         CALL C06GCF(Y,N,IFAIL)
         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,*) 'Invalid value of N'
      END IF
   80 STOP
*
99999 FORMAT (1X,I6,2F10.5)
      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
```