nag_multiple_conjugate_hermitian (c06gqc)

1. Purpose

nag_multiple_conjugate_hermitian (c06gqc) forms the complex conjugates of m Hermitian sequences, each containing n data values.

2. Specification

```
#include <nag.h>
#include <nagc06.h>

void nag_multiple_conjugate_hermitian(Integer m, Integer n, double x[],
     NagError *fail)
```

3. Description

This is a utility routine for use in conjunction with nag_fft_multiple_real (c06fpc) and nag_fft_multiple_hermitian (c06fqc) to calculate inverse discrete Fourier transforms.

4. Parameters

m

Input: the number of Hermitian sequences to be conjugated, m.
Constraint: $\mathbf{m} \geq 1$.

n

Input: the number of data values in each Hermitian sequence, n.
Constraint: $\mathbf{n} \geq 1$.

x[m∗n]

Input: the m data sequences must be stored in **x** consecutively. If the n data values z_j^p are written as $x_j^p + iy_j^p$, $p = 1, 2 \ldots, m$, then for $0 \leq j \leq n/2$, x_j^p is contained in $\mathbf{x}[(p-1) * n + j]$, and for $1 \leq j \leq (n-1)/2$, y_j^p is contained in $\mathbf{x}[(p-1) * n + n - j]$.
Output: the imaginary parts y_j^p are negated. The real parts x_j^p are not referenced.

fail

The NAG error parameter, see the Essential Introduction to the NAG C Library.

5. Error Indications and Warnings

NE_INT_ARG_LT

On entry, **m** must not be less than 1: $\mathbf{m} = \langle value \rangle$.
On entry, **n** must not be less than 1: $\mathbf{n} = \langle value \rangle$.

6. Further Comments

6.1. Accuracy

Exact.

7. See Also

nag_fft_multiple_real (c06fpc)
nag_fft_multiple_hermitian (c06fqc)

8. Example

This program reads in sequences of real data values which are assumed to be Hermitian sequences of complex data stored in Hermitian form. The sequences are expanded into full complex form using nag_multiple_hermitian_to_complex (c06gsc) and printed. The sequences are then conjugated (using nag_multiple_conjugate_hermitian) and the conjugated sequences are expanded into complex form using nag_multiple_hermitian_to_complex (c06gsc) and printed out.

8.1. Program Text

```
/* nag_multiple_conjugate_hermitian(c06gqc) Example Program
 *
 * Copyright 1990 Numerical Algorithms Group.
 *
 * Mark 1, 1990.
 */

#include <nag.h>
#include <stdio.h>
#include <nag_stdlib.h>
#include <nagc06.h>

#define MMAX  5
#define NMAX 20

main()
{
  Integer i, j, m, n;
  double u[MMAX*NMAX], v[MMAX*NMAX], x[MMAX*NMAX];

  Vprintf("c06gqc Example Program Results\n");
  /* Skip heading in data file */
  Vscanf("%*[^\n]");
  while (scanf("%ld%ld", &m, &n)!=EOF)
    if (m<=MMAX && n<=NMAX)
      {
        Vprintf("\n\nm = %2ld  n = %2ld\n", m, n);
        /* Read in data and print out. */
        for (j = 0; j<m; ++j)
          for (i = 0; i<n; ++i)
            Vscanf("%lf", &x[j*n + i]);
        Vprintf("\nOriginal data values\n\n");
        for (j = 0; j<m; ++j)
          {
            Vprintf("    ");
            for (i = 0; i<n; ++i)
              Vprintf("%10.4f%s", x[j*n + i],
                      (i%6==5 && i!=n-1 ? "\n     " : ""));
            Vprintf("\n");
          }
        /* Convert Hermitian form data to full complex */
        c06gsc(m, n, x, u, v, NAGERR_DEFAULT);
        Vprintf("\nOriginal data written in full complex form\n\n");
        for (j = 0; j<m; ++j)
          {
            Vprintf("Real");
            for (i = 0; i<n; ++i)
              Vprintf("%10.4f%s", u[j*n + i],
                      (i%6==5 && i!=n-1 ? "\n     " : ""));
            Vprintf("\nImag");
            for (i = 0; i<n; ++i)
              Vprintf("%10.4f%s", v[j*n + i],
                      (i%6==5 && i!=n-1 ? "\n     " : ""));
            Vprintf("\n\n");
          }
        /* Calculate conjugates of Hermitian data */
        c06gqc(m, n, x, NAGERR_DEFAULT);
        Vprintf("\nConjugated data values\n\n");
        for (j = 0; j<m; ++j)
          {
            Vprintf("    ");
            for (i = 0; i<n; ++i)
              Vprintf("%10.4f%s", x[j*n + i],
                      (i%6==5 && i!=n-1 ? "\n     " : ""));
            Vprintf("\n");
          }
        /* Convert conjugated Hermitian data to full complex */
        c06gsc(m, n, x, u, v, NAGERR_DEFAULT);
```

```
        Vprintf("\nConjugated data written in full complex form\n\n");
        for (j = 0; j<m; ++j)
          {
            Vprintf("Real");
            for (i = 0; i<n; ++i)
              Vprintf("%10.4f%s", u[j*n + i],
                      (i%6==5 && i!=n-1 ? "\n     " : ""));
            Vprintf("\nImag");
            for (i = 0; i<n; ++i)
              Vprintf("%10.4f%s", v[j*n + i],
                      (i%6==5 && i!=n-1 ? "\n     " : ""));
            Vprintf("\n\n");
          }
      }
    else
      {
        Vfprintf(stderr,"\nInvalid value of m or n.\n\n");
        exit(EXIT_FAILURE);
      }
  exit(EXIT_SUCCESS);
}
```

8.2. Program Data

```
c06gqc Example Program Data
     3     6
     0.3854    0.6772    0.1138    0.6751    0.6362    0.1424
     0.5417    0.2983    0.1181    0.7255    0.8638    0.8723
     0.9172    0.0644    0.6037    0.6430    0.0428    0.4815
```

8.3. Program Results

```
c06gqc Example Program Results

m =   3  n =   6

Original data values

        0.3854    0.6772    0.1138    0.6751    0.6362    0.1424
        0.5417    0.2983    0.1181    0.7255    0.8638    0.8723
        0.9172    0.0644    0.6037    0.6430    0.0428    0.4815

Original data written in full complex form

Real    0.3854    0.6772    0.1138    0.6751    0.1138    0.6772
Imag    0.0000    0.1424    0.6362    0.0000   -0.6362   -0.1424

Real    0.5417    0.2983    0.1181    0.7255    0.1181    0.2983
Imag    0.0000    0.8723    0.8638    0.0000   -0.8638   -0.8723

Real    0.9172    0.0644    0.6037    0.6430    0.6037    0.0644
Imag    0.0000    0.4815    0.0428    0.0000   -0.0428   -0.4815


Conjugated data values

        0.3854    0.6772    0.1138    0.6751   -0.6362   -0.1424
        0.5417    0.2983    0.1181    0.7255   -0.8638   -0.8723
        0.9172    0.0644    0.6037    0.6430   -0.0428   -0.4815

Conjugated data written in full complex form

Real    0.3854    0.6772    0.1138    0.6751    0.1138    0.6772
Imag    0.0000   -0.1424   -0.6362    0.0000    0.6362    0.1424

Real    0.5417    0.2983    0.1181    0.7255    0.1181    0.2983
Imag    0.0000   -0.8723   -0.8638    0.0000    0.8638    0.8723

Real    0.9172    0.0644    0.6037    0.6430    0.6037    0.0644
Imag    0.0000   -0.4815   -0.0428    0.0000    0.0428    0.4815
```