NAG Library Routine Document

C09FBF

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

C09FBF computes the three-dimensional inverse discrete wavelet transform (IDWT) at a single level. The initialization routine C09ACF must be called first to set up the DWT options.

2   Specification

```
SUBROUTINE C09FBF (M, N, FR, LENC, C, B, LDB, SDB, ICOMM, IFAIL)

INTEGER          M, N, FR, LENC, LDB, SDB, ICOMM(260), IFAIL
REAL (KIND=nag_wp) C(LENC), B(LDB,SDB,FR)
```

3   Description

C09FBF performs the inverse operation of routine C09FAF. That is, given sets of wavelet coefficients computed by routine C09FAF using a DWT as set up by the initialization routine C09ACF, on a real data array, B, C09FBF will reconstruct B.

4   References

None.

5   Parameters

1:   M – INTEGER   *Input*

On entry: the first dimension of the output data: the number of rows of each two-dimensional frame.

Constraint: this must be the same as the value M passed to the initialization routine C09ACF.

2:   N – INTEGER   *Input*

On entry: the second dimension of the output data: the number of columns of each two-dimensional frame.

Constraint: this must be the same as the value N passed to the initialization routine C09ACF.

3:   FR – INTEGER   *Input*

On entry: the third dimension of the output data: the number two-dimensional frames.

Constraint: this must be the same as the value FR passed to the initialization routine C09ACF.

4:   LENC – INTEGER   *Input*

On entry: the dimension of the array C as declared in the (sub)program from which C09FBF is called.

Constraint: $\mathrm{LENC} \geq n_{\mathrm{ct}}$, where n_{ct} is the total number of wavelet coefficients, as returned by C09ACF.

5:     C(LENC) – REAL (KIND=nag_wp) array   *Input*

       On entry: the coefficients of the discrete wavelet transform. This will normally be the result of
       some transformation on the coefficients computed by routine C09FAF.

6:     B(LDB,SDB,FR) – REAL (KIND=nag_wp) array   *Output*

       On exit: the m by n by fr reconstructed array, B, based on the input wavelet coefficients and the
       transform options supplied to the initialization routine C09ACF.

7:     LDB – INTEGER   *Input*

       On entry: the first dimension of the array B as declared in the (sub)program from which C09FBF is
       called.

       Constraint: LDB $\geq$ M.

8:     SDB – INTEGER   *Input*

       On entry: the second dimension of the array B as declared in the (sub)program from which C09FBF
       is called.

       Constraint: SDB $\geq$ N.

9:     ICOMM(260) – INTEGER array   *Communication Array*

       On entry: contains details of the discrete wavelet transform and the problem dimension as setup in
       the call to the initialization routine C09ACF.

10:    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.

       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.**

       On exit: IFAIL $= 0$ unless the routine detects an error or a warning has been flagged (see
       Section 6).

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, FR $= \langle value \rangle$.
       Constraint: FR $= \langle value \rangle$, the value of FR on initialization (see C09ACF).

       On entry, M $= \langle value \rangle$.
       Constraint: M $= \langle value \rangle$, the value of M on initialization (see C09ACF).

       On entry, N $= \langle value \rangle$.
       Constraint: N $= \langle value \rangle$, the value of N on initialization (see C09ACF).

IFAIL $= 2$

       On entry, LDB $= \langle value \rangle$ and M $= \langle value \rangle$.
       Constraint: LDB $\geq$ M.

On entry, SDB = $\langle value \rangle$ and N = $\langle value \rangle$.
Constraint: SDB $\geq$ N.

IFAIL = 3

On entry, LENC = $\langle value \rangle$ and n_{ct} = $\langle value \rangle$.
Constraint: LENC $\geq n_{ct}$, where n_{ct} is the number of DWT coefficients returned by C09ACF in parameter NWCT.

IFAIL = 6

Either the initialization routine has not been called first or the communication array ICOMM has been corrupted.

The initialization routine was called with WTRANS = 'M'.

IFAIL = -999

Dynamic memory allocation failed.

7 Accuracy

The accuracy of the wavelet transform depends only on the floating point operations used in the convolution and downsampling and should thus be close to ***machine precision***.

8 Further Comments

None.

9 Example

See Section 9 in C09FAF.

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