NAG Library Function Document

nag_idwt_3d (c09fbc)

1   Purpose

nag_idwt_3d (c09fbc) computes the three-dimensional inverse discrete wavelet transform (IDWT) at a single level. The initialization function nag_wfilt_3d (c09acc) must be called first to set up the DWT options.

2   Specification

```
#include <nag.h>
#include <nagc09.h>

void nag_idwt_3d (Integer m, Integer n, Integer fr, Integer lenc,
     const double c[], double b[], Integer ldb, Integer sdb,
     const Integer icomm[], NagError *fail)
```

3   Description

nag_idwt_3d (c09fbc) performs the inverse operation of function nag_dwt_3d (c09fac). That is, given sets of wavelet coefficients computed by function nag_dwt_3d (c09fac) using a DWT as set up by the initialization function nag_wfilt_3d (c09acc), on a real data array, B, nag_idwt_3d (c09fbc) will reconstruct B.

4   References

None.

5   Arguments

1:    **m** – Integer   *Input*

   On entry: the number of rows of each two-dimensional frame.

   Constraint: this must be the same as the value **m** passed to the initialization function nag_wfilt_3d (c09acc).

2:    **n** – Integer   *Input*

   On entry: the number of columns of each two-dimensional frame.

   Constraint: this must be the same as the value **n** passed to the initialization function nag_wfilt_3d (c09acc).

3:    **fr** – Integer   *Input*

   On entry: the number two-dimensional frames.

   Constraint: this must be the same as the value **fr** passed to the initialization function nag_wfilt_3d (c09acc).

4:    **lenc** – Integer   *Input*

   On entry: the dimension of the array **c**.

   Constraint: **lenc** $\geq n_{ct}$, where n_{ct} is the total number of wavelet coefficients, as returned by nag_wfilt_3d (c09acc).

5: **c[lenc]** – const double *Input*

On entry: the coefficients of the discrete wavelet transform. This will normally be the result of some transformation on the coefficients computed by function nag_dwt_3d (c09fac).

Note that the coefficients in **c** may be extracted according to type into three-dimensional arrays using nag_wav_3d_coeff_ext (c09fyc), and inserted using nag_wav_3d_coeff_ins (c09fzc).

6: **b[**dim**]** – double *Output*

Note: the dimension, *dim*, of the array **b** must be at least **ldb** × **sdb** × **fr**.

On exit: the m by n by fr reconstructed array, B, with B_{ijk} stored in **b**$[(k-1) \times$ **ldb** $\times$ **sdb** $+ (j-1) \times$ **ldb** $+ i - 1]$. The reconstruction is based on the input wavelet coefficients and the transform options supplied to the initialization function nag_wfilt_3d (c09acc).

7: **ldb** – Integer *Input*

On entry: the stride separating row elements of each of the sets of frame coefficients in the three-dimensional data stored in **b**.

Constraint: **ldb** ≥ **m**.

8: **sdb** – Integer *Input*

On entry: the stride separating corresponding coefficients of consecutive frames in the three-dimensional data stored in **b**.

Constraint: **sdb** ≥ **n**.

9: **icomm[260]** – const Integer *Communication Array*

On entry: contains details of the discrete wavelet transform and the problem dimension as setup in the call to the initialization function nag_wfilt_3d (c09acc).

10: **fail** – NagError * *Input/Output*

The NAG error argument (see Section 3.6 in the Essential Introduction).

6   Error Indicators and Warnings

NE_ALLOC_FAIL

Dynamic memory allocation failed.

NE_BAD_PARAM

On entry, argument ⟨*value*⟩ had an illegal value.

NE_INITIALIZATION

Either the communication array **icomm** has been corrupted or there has not been a prior call to the initialization function nag_wfilt_3d (c09acc).

The initialization function was called with **wtrans** = Nag_MultiLevel.

NE_INT

On entry, **fr** = ⟨*value*⟩.
Constraint: **fr** = ⟨*value*⟩, the value of **fr** on initialization (see nag_wfilt_3d (c09acc)).

On entry, **m** = ⟨*value*⟩.
Constraint: **m** = ⟨*value*⟩, the value of **m** on initialization (see nag_wfilt_3d (c09acc)).

On entry, **n** = ⟨*value*⟩.
Constraint: **n** = ⟨*value*⟩, the value of **n** on initialization (see nag_wfilt_3d (c09acc)).

NE_INT_2

On entry, **ldb** $= \langle value \rangle$ and **m** $= \langle value \rangle$.
Constraint: **ldb** $\geq$ **m**.

On entry, **lenc** $= \langle value \rangle$ and $n_{\text{ct}} = \langle value \rangle$.
Constraint: **lenc** $\geq n_{\text{ct}}$, where n_{ct} is the number of DWT coefficients returned by nag_wfilt_3d (c09acc) in argument **nwct**.

On entry, **sdb** $= \langle value \rangle$ and **n** $= \langle value \rangle$.
Constraint: **sdb** $\geq$ **n**.

NE_INTERNAL_ERROR

An internal error has occurred in this function. Check the function call and any array sizes. If the call is correct then please contact NAG for assistance.

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   Parallelism and Performance

nag_idwt_3d (c09fbc) is threaded by NAG for parallel execution in multithreaded implementations of the NAG Library.

Please consult the Users' Note for your implementation for any additional implementation-specific information.

9   Further Comments

None.

10   Example

See Section 10 in nag_dwt_3d (c09fac).