

# 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  $\mathbf{ldb} \times \mathbf{sdb} \times \mathbf{fr}$ .  
*On exit:* the *m* by *n* by *fr* reconstructed array, *B*, with  $B_{ijk}$  stored in  $\mathbf{b}[(k-1) \times \mathbf{ldb} \times \mathbf{sdb} + (j-1) \times \mathbf{ldb} + i - 1]$ . 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:*  $\mathbf{ldb} \geq \mathbf{m}$ .
- 8: **sdb** – Integer *Input*  
*On entry:* the stride separating corresponding coefficients of consecutive frames in the three-dimensional data stored in **b**.  
*Constraint:*  $\mathbf{sdb} \geq \mathbf{n}$ .
- 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.  
 See Section 3.2.1.2 in the Essential Introduction for further information.

### NE\_BAD\_PARAM

On entry, argument  $\langle \text{value} \rangle$  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** =  $\langle \text{value} \rangle$ .  
 Constraint: **fr** =  $\langle \text{value} \rangle$ , the value of **fr** on initialization (see nag\_wfilt\_3d (c09acc)).

On entry, **m** =  $\langle \text{value} \rangle$ .  
 Constraint: **m** =  $\langle \text{value} \rangle$ , the value of **m** on initialization (see nag\_wfilt\_3d (c09acc)).

On entry, **n** =  $\langle value \rangle$ .

Constraint: **n** =  $\langle value \rangle$ , 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  $n_{ct}$  =  $\langle value \rangle$ .

Constraint: **lenc**  $\geq n_{ct}$ , 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.

An unexpected error has been triggered by this function. Please contact NAG.

See Section 3.6.6 in the Essential Introduction for further information.

## NE\_NO\_LICENCE

Your licence key may have expired or may not have been installed correctly.

See Section 3.6.5 in the Essential Introduction for further information.

## 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 X06 Chapter Introduction for information on how to control and interrogate the OpenMP environment used within this function. Please also 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).

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