

NAG Library Function Document

nag_imldwt (c09cdc)

1 Purpose

nag_imldwt (c09cdc) computes the inverse one-dimensional multi-level discrete wavelet transform (DWT). This function reconstructs data from (possibly filtered or otherwise manipulated) wavelet transform coefficients calculated by nag_mldwt (c09ccc) from an original set of data. The initialization function nag_wfilt (c09aac) must be called first to set up the DWT options.

2 Specification

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

```
void nag_imldwt (Integer nwl, Integer lenc, const double c[], Integer n,
                double y[], const Integer icomm[], NagError *fail)
```

3 Description

nag_imldwt (c09cdc) performs the inverse operation of nag_mldwt (c09ccc). That is, given a set of wavelet coefficients, computed by nag_mldwt (c09ccc) using a DWT as set up by the initialization function nag_wfilt (c09aac), on a real data array of length n , nag_imldwt (c09cdc) will reconstruct the data array y_i , for $i = 1, 2, \dots, n$, from which the coefficients were derived.

4 References

None.

5 Arguments

- 1: **nwl** – Integer *Input*
On entry: the number, n_l , of levels to be used in the inverse multi-level transform. The number of levels must be the same as the number used in the computation of the wavelet coefficients.
Constraint: **nwl** must be unchanged from the value chosen from the preceding call to nag_mldwt (c09ccc).
- 2: **lenc** – Integer *Input*
On entry: the dimension of the array **c** as declared in the function from which nag_imldwt (c09cdc) is called.
Constraint: **lenc** $\geq n_c$, where n_c is the number of approximation and detail coefficients that correspond to a transform with **nwl** levels and is unchanged from the preceding call to nag_mldwt (c09ccc).
- 3: **c[lenc]** – const double *Input*
On entry: the coefficients of a multi-level wavelet transform of the dataset.

If $n(a_{n_l})$ and $n(d_i)$, for $i = n_l, n_l - 1, \dots, 1$, are the numbers of approximation and detail coefficients, then setting $k_1 = n(a_{n_l})$ and $k_{j+1} = n(a_{n_l}) + \sum_{i=1}^j n(d_{n_l-i+1})$, for $j = 1, 2, \dots, n_l$, the coefficients are stored in **c** as follows:

c[0 : $k_1 - 1$]

Contains the level n_l approximation coefficients, a_{n_l} .

c[k_1 : $k_2 - 1$]

Contains the level n_l detail coefficients d_{n_l} .

c[k_j : $k_{j+1} - 1$]

Contains the level $n_l - j + 1$ detail coefficients, for $j = 2, \dots, n_l$.

The values $n(a_{n_l})$ and $n(d_{n_l-i+1})$, for $i = 1, 2, \dots, n_l$ are contained in **dwtle** which is produced as output by a preceding call to **nag_mldwt** (c09ccc). See **nag_mldwt** (c09ccc) for details.

- 4: **n** – Integer *Input*
On entry: n , the length of the data array, y , to be reconstructed.
Constraint: This must be the same as the value **n** passed to the initialization function **nag_wfilt** (c09aac).
- 5: **y**[**n**] – double *Output*
On exit: the dataset reconstructed from the multi-level wavelet transform coefficients and the transformation options supplied to the initialization function **nag_wfilt** (c09aac).
- 6: **icomm**[100] – const Integer *Communication Array*
On entry: contains details of the discrete wavelet transform and the problem dimension for the forward transform previously computed by **nag_mldwt** (c09ccc).
- 7: **fail** – NagError * *Input/Output*
The NAG error argument (see Section 3.6 in the Essential Introduction).

6 Error Indicators and Warnings

NE_ARRAY_DIM_LEN

On entry, **lenc** is set too small : **lenc** = $\langle value \rangle$, **lenc** \geq $\langle value \rangle$.

NE_BAD_PARAM

On entry, argument $\langle value \rangle$ had an illegal value.

NE_INITIALIZATION

Either the initialization routine has not been called first or array **icomm** has been corrupted.

Either the initialization routine was called with **wtrans** = Nag_Singlelevel or array **icomm** has been corrupted.

On entry, **n** is inconsistent with the value passed to the initialization routine : **n** = $\langle value \rangle$, **n** should be $\langle value \rangle$.

NE_INT

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

Constraint: **nwl** \geq 1.

NE_INT_2

On entry, **nwl** is larger than the number of levels computed by the preceding call to nag_mldwt (c09ccc) : **nwl** = *<value>*, expected = *<value>*.

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 Further Comments

None.

9 Example

See Section 9 in nag_mldwt (c09ccc).
