

# NAG Library Function Document

## nag\_imodwt (c09dbc)

### 1 Purpose

nag\_imodwt (c09dbc) computes the inverse one-dimensional maximal overlap discrete wavelet transform (MODWT) at a single level. The initialization function nag\_wfilt (c09aac) must be called first to set up the MODWT options.

### 2 Specification

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

void nag_imodwt (Integer lenc, const double ca[], const double cd[],
                Integer n, double y[], const Integer icomm[], NagError *fail)
```

### 3 Description

nag\_imodwt (c09dbc) performs the inverse operation of nag\_modwt (c09dac). That is, given sets of  $n_c$  approximation coefficients and detail coefficients, computed by nag\_modwt (c09dac) using a MODWT as set up by the initialization function nag\_wfilt (c09aac), on a real data array of length  $n$ , nag\_imodwt (c09dbc) will reconstruct the data array  $y_i$ , for  $i = 1, 2, \dots, n$ , from which the coefficients were derived.

### 4 References

Percival D B and Walden A T (2000) *Wavelet Methods for Time Series Analysis* Cambridge University Press

### 5 Arguments

- 1: **lenc** – Integer *Input*  
*On entry:* the dimension of the arrays **ca** and **cd**.  
*Constraint:* **lenc**  $\geq n_c$ , where  $n_c$  is the value returned in **nwc** by the call to the initialization function nag\_wfilt (c09aac).
- 2: **ca[lenc]** – const double *Input*  
*On entry:* the  $n_c$  approximation coefficients,  $C_a$ . These will normally be the result of some transformation on the coefficients computed by nag\_modwt (c09dac).
- 3: **cd[lenc]** – const double *Input*  
*On entry:* the  $n_c$  detail coefficients,  $C_d$ . These will normally be the result of some transformation on the coefficients computed by nag\_modwt (c09dac).
- 4: **n** – Integer *Input*  
*On entry:*  $n$ , the length of the original data array from which the wavelet coefficients were computed by nag\_modwt (c09dac) and the length of the data array **y** that is to be reconstructed by this function.  
*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 reconstructed data based on approximation and detail coefficients  $C_a$  and  $C_d$  and the transform 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 and, possibly, additional information on the previously computed forward transform.
- 7: **fail** – NagError \* *Input/Output*  
The NAG error argument (see Section 2.7 in How to Use the NAG Library and its Documentation).

## 6 Error Indicators and Warnings

### NE\_ALLOC\_FAIL

Dynamic memory allocation failed.

See Section 2.3.1.2 in How to Use the NAG Library and its Documentation for further information.

### NE\_ARRAY\_DIM\_LEN

On entry, array dimension **lenc** not large enough: **lenc** =  $\langle value \rangle$  but must be at least  $\langle value \rangle$ .

### NE\_BAD\_PARAM

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

### NE\_INITIALIZATION

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

On entry, the initialization function `nag_wfilt` (c09aac) has not been called first or it has not been called with **wtrans** = Nag\_MODWTSingle, or the communication array **icomm** has become corrupted.

### 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 2.7.6 in How to Use the NAG Library and its Documentation for further information.

### NE\_NO\_LICENCE

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

See Section 2.7.5 in How to Use the NAG Library and its Documentation 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_imodwt` (c09dbc) is not threaded in any implementation.

## **9 Further Comments**

None.

## **10 Example**

See Section 10 in nag\_modwt (c09dac).

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