

# NAG Library Routine Document

## C09DBF

**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

C09DBF computes the inverse one-dimensional maximal overlap discrete wavelet transform (MODWT) at a single level. The initialization routine C09AAF must be called first to set up the MODWT options.

### 2 Specification

```
SUBROUTINE C09DBF (LENC, CA, CD, N, Y, ICOMM, IFAIL)
  INTEGER          LENC, N, ICOMM(100), IFAIL
  REAL (KIND=nag_wp) CA(LENC), CD(LENC), Y(N)
```

### 3 Description

C09DBF performs the inverse operation of C09DAF. That is, given sets of  $n_c$  approximation coefficients and detail coefficients, computed by C09DAF using a MODWT as set up by the initialization routine C09AAF, on a real data array of length  $n$ , C09DBF 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 as declared in the (sub)program from which C09DBF is called.  
*Constraint:*  $LENC \geq n_c$ , where  $n_c$  is the value returned in NWC by the call to the initialization routine C09AAF.
- 2: CA(LENC) – REAL (KIND=nag\_wp) array *Input*  
*On entry:* the  $n_c$  approximation coefficients,  $C_a$ . These will normally be the result of some transformation on the coefficients computed by C09DAF.
- 3: CD(LENC) – REAL (KIND=nag\_wp) array *Input*  
*On entry:* the  $n_c$  detail coefficients,  $C_d$ . These will normally be the result of some transformation on the coefficients computed by C09DAF.
- 4: N – INTEGER *Input*  
*On entry:*  $n$ , the length of the original data array from which the wavelet coefficients were computed by C09DAF and the length of the data array Y that is to be reconstructed by this routine.  
*Constraint:* This must be the same as the value N passed to the initialization routine C09AAF.

- 5: Y(N) – REAL (KIND=nag\_wp) array *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 routine C09AAF.
- 6: ICOMM(100) – INTEGER array *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: IFAIL – INTEGER *Input/Output*  
*On entry:* IFAIL must be set to 0, -1 or 1. If you are unfamiliar with this argument you should refer to Section 3.4 in How to Use the NAG Library and its Documentation 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 argument, 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, array dimension LENC not large enough: LENC = *value* but must be at least *value*.

IFAIL = 4

On entry, N is inconsistent with the value passed to the initialization routine: N = *value*, N should be *value*.

IFAIL = 6

On entry, the initialization routine C09AAF has not been called first or it has not been called with WTRANS = 'T', or the communication array ICOMM has become corrupted.

IFAIL = -99

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

See Section 3.9 in How to Use the NAG Library and its Documentation for further information.

IFAIL = -399

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

See Section 3.8 in How to Use the NAG Library and its Documentation for further information.

IFAIL = -999

Dynamic memory allocation failed.

See Section 3.7 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

C09DBF is not threaded in any implementation.

## 9 Further Comments

None.

## 10 Example

See Section 10 in C09DAF.

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