NAG Toolbox

nag_wav_1d_mxolap_inv (c09db)

1 Purpose

nag_wav_1d_mxolap_inv (c09db) computes the inverse one-dimensional maximal overlap discrete wavelet transform (MODWT) at a single level. The initialization function nag_wav_1d_init (c09aa) must be called first to set up the MODWT options.

2 Syntax

```
[y, ifail] = nag_wav_1d_mxolap_inv(ca, cd, n, icomm, 'lenc', lenc)
[y, ifail] = c09db(ca, cd, n, icomm, 'lenc', lenc)
```

3 Description

nag_wav_1d_mxolap_inv (c09db) performs the inverse operation of nag_wav_1d_mxolap_fwd (c09da). That is, given sets of n_c approximation coefficients and detail coefficients, computed by nag_wav_1d_mxolap_fwd (c09da) using a MODWT as set up by the initialization function nag_wav_1d_init (c09aa), on a real data array of length n, nag_wav_1d_mxolap_inv (c09db) will reconstruct the data array y_i, for $i = 1, 2, \ldots, n$, 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 Parameters

5.1 Compulsory Input Parameters

1: **ca**(**lenc**) – REAL (KIND=nag_wp) array

The n_c approximation coefficients, C_a. These will normally be the result of some transformation on the coefficients computed by nag_wav_1d_mxolap_fwd (c09da).

2: **cd**(**lenc**) – REAL (KIND=nag_wp) array

The n_c detail coefficients, C_d. These will normally be the result of some transformation on the coefficients computed by nag_wav_1d_mxolap_fwd (c09da).

3: **n** – INTEGER

n, the length of the original data array from which the wavelet coefficients were computed by nag_wav_1d_mxolap_fwd (c09da) 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_wav_1d_init (c09aa).

4: **icomm**(**100**) – INTEGER array

Contains details of the discrete wavelet transform and the problem dimension and, possibly, additional information on the previously computed forward transform.

5.2 Optional Input Parameters

1: **lenc** – INTEGER

Default: the dimension of the arrays **ca**, **cd**. (An error is raised if these dimensions are not equal.)

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_wav_1d_init (c09aa).

5.3 Output Parameters

1: **y**(**n**) – REAL (KIND=nag_wp) array

The reconstructed data based on approximation and detail coefficients C_a and C_d and the transform options supplied to the initialization function nag_wav_1d_init (c09aa).

2: **ifail** – INTEGER

ifail $= 0$ unless the function detects an error (see Section 5).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail $= 1$

On entry, array dimension **lenc** not large enough.

ifail $= 4$

On entry, **n** is inconsistent with the value passed to the initialization function.

ifail $= 6$

On entry, the initialization function nag_wav_1d_init (c09aa) 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.

ifail $= -399$

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

ifail $= -999$

Dynamic memory allocation failed.

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 10 in nag_wav_1d_mxolap_fwd (c09da).

9.1 Program Text

```
     function c09db_example

fprintf('c09db example results\n\n');

% 1d maximal overlap discrete wavelet decomposition using a Daubechies wavelet

n      = nag_int(8);
x      = [1 3 5 7 6 4 5 2];

wavnam = 'DB4';
mode   = 'Periodic';
wtrans = 'Time invariant';

% Setup for wavelet
[nwlmax, nf, nwc, icomm, ifail] = c09aa(wavnam, wtrans, mode, n);

% Compute decomposition
[ca, cd, icomm, ifail] = c09da(x, nwc, icomm);

disp('Approximation coefficients:')
fprintf('%8.4f',ca);
fprintf('\n');
disp('Detail coefficients:')
fprintf('%8.4f',cd);
fprintf('\n');

% Reconstruct
[y, ifail] = c09db(ca, cd, n, icomm);
disp('Reconstruction:')
fprintf('%8.4f',y);
fprintf('\n');
```

9.2 Program Results

```
     c09db example results

Approximation coefficients:
  2.7781  1.5146  2.2505  4.8788  6.6845  6.3423  4.7869  3.7644
Detail coefficients:
 -0.6187  0.6272  0.1883 -1.1966  1.2618  0.3354 -0.3314 -0.2660
Reconstruction:
  1.0000  3.0000  5.0000  7.0000  6.0000  4.0000  5.0000  2.0000
```