Course 18.327 and 1.130
Wavelets and Filter Banks

Matlab wavelet toolbox.

Matlab Example 3
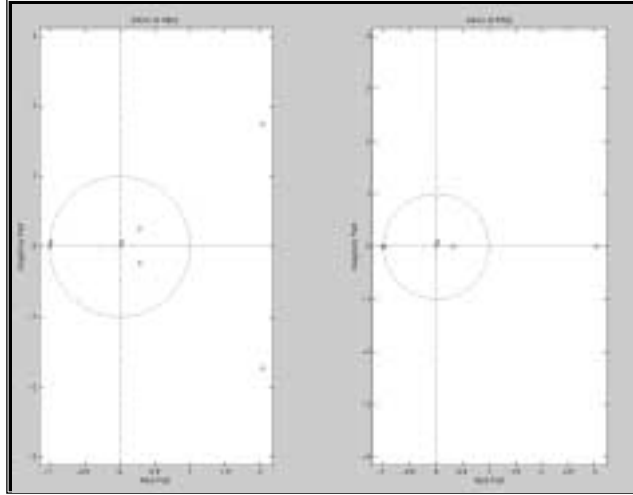
1. 1-D signal analysis

MATLAB M-file

Daubechies 9/7 pair: zeros of H_0 and F_0

```
>> example3
Zeros of H0(z)
ans =

   2.0311 + 1.7390i
   2.0311 - 1.7390i
  -1.0001 + 0.0001i
  -1.0001 - 0.0001i
  -0.9999 + 0.0001i
  -0.9999 - 0.0001i
   0.2841 + 0.2432i
   0.2841 - 0.2432i

Zeros of F0(z)
ans =

   3.0407
  -1.0010 + 0.0010i
  -1.0010 - 0.0010i
  -0.9990 + 0.0010i
  -0.9990 - 0.0010i
   0.3289
```
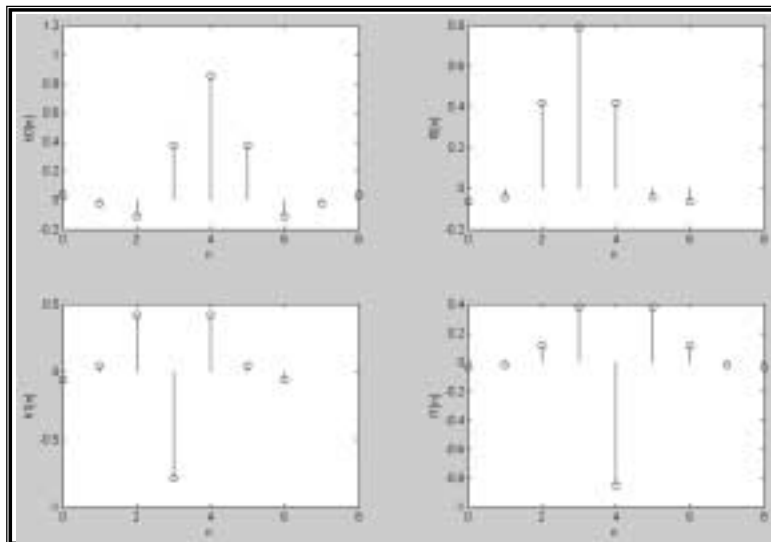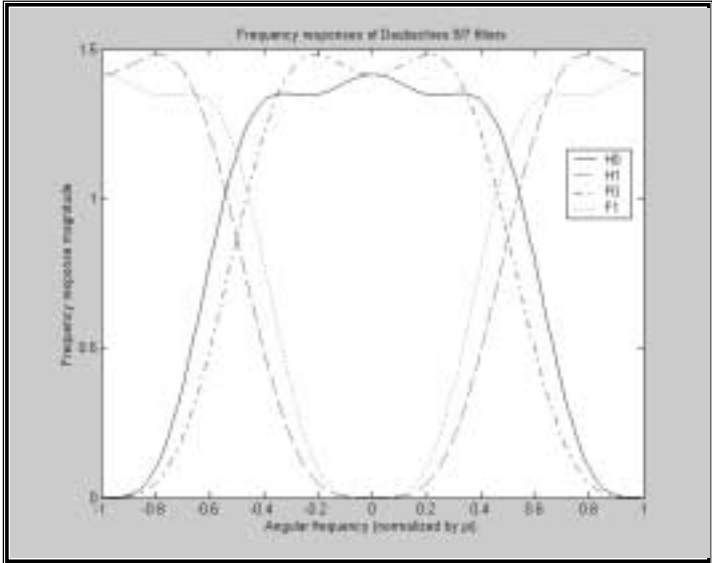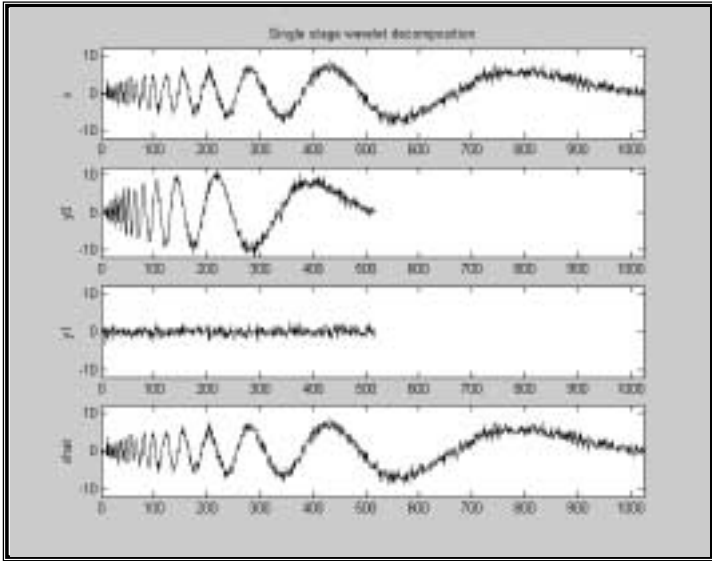

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Complete Set of Daub 9/7 Filters
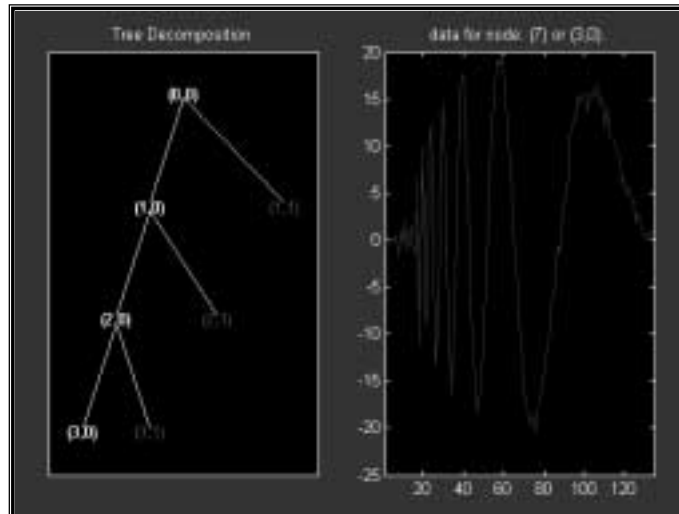

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Frequency Responses of Daub 9/7

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Single Stage Decomposition
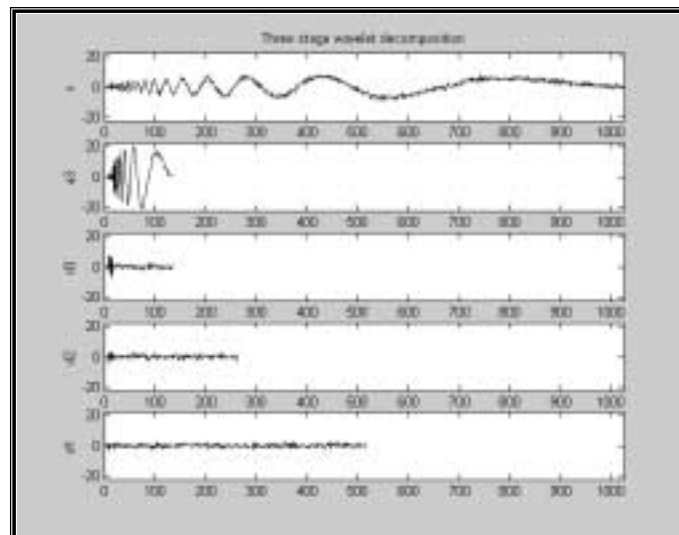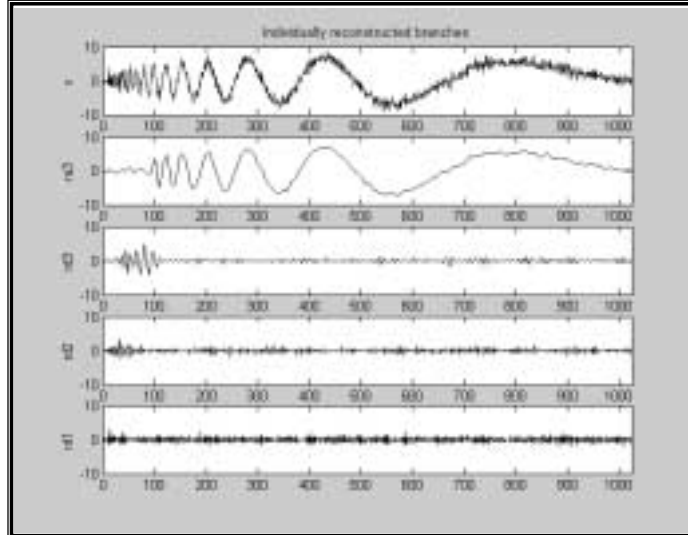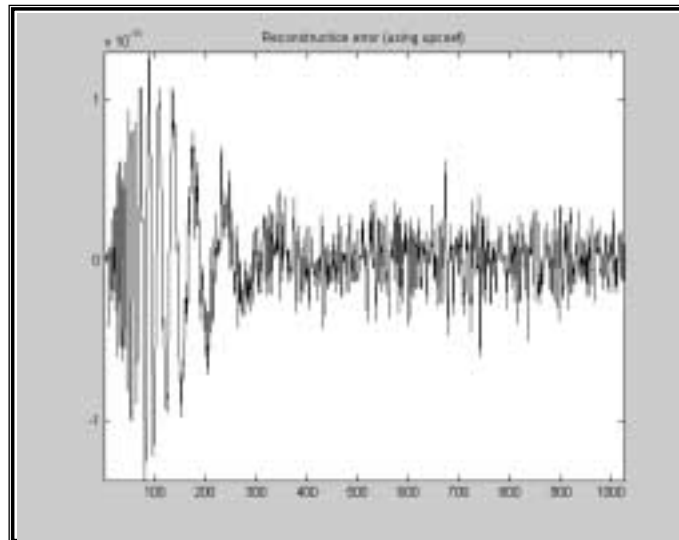

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3-Stage Decomposition

3-Stage Decomposition

Individually Reconstructed Branches
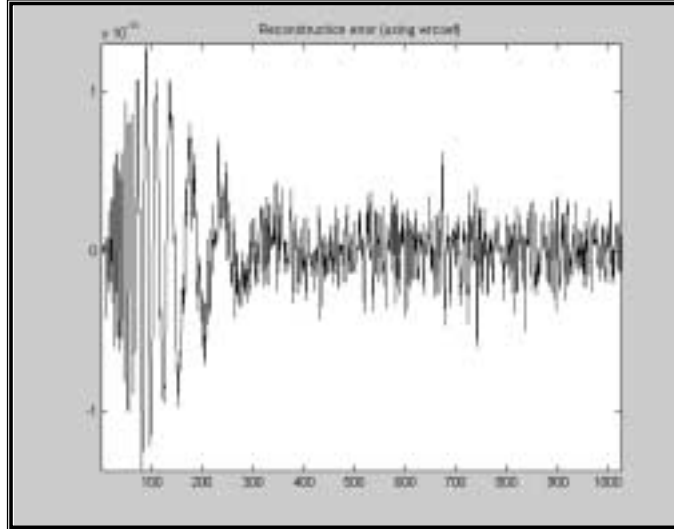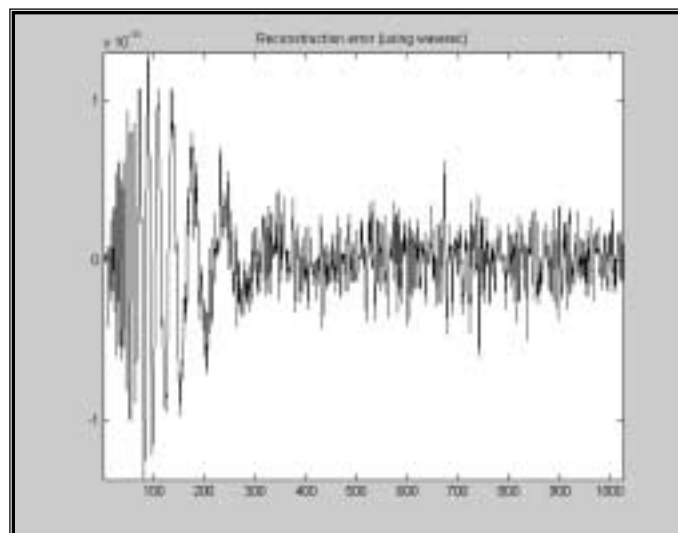
Reconstruction Error --- upcoef

Reconstruction Error --- wrcoef

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Reconstruction Error --- waverec

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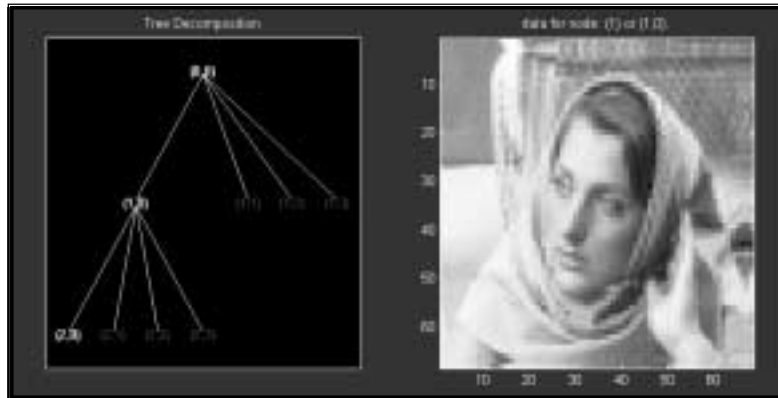# Matlab Example 4

1. **2-D image analysis**

MATLAB M-file

Original Image

Wavelet Decomposition

Single Stage Decomposition
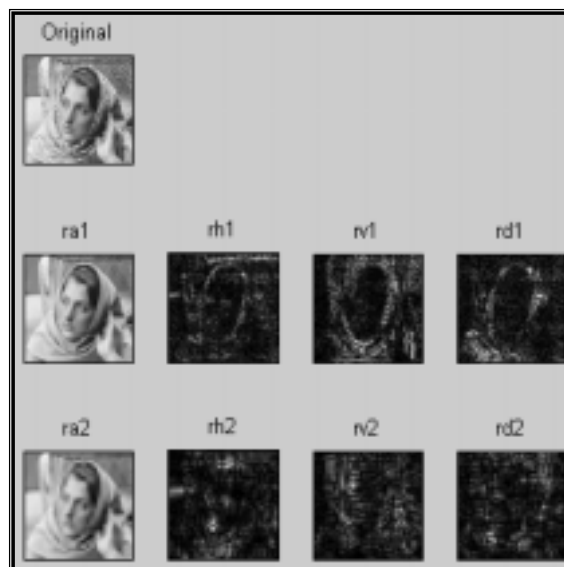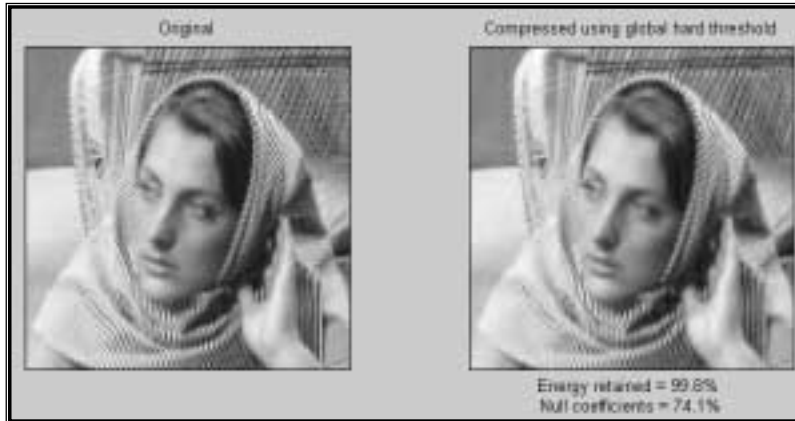
Two-Stage Decomposition

Two stage decomposition

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Reconstructed Branches

Original

ra1   rh1   rv1   rd1

ra2   rh2   rv2   rd2

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Global Hard Thresholding

Original   Compressed using global hard threshold

Energy retained = 99.8%
Null coefficients = 74.1%

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Variable Hard Thresholding

Original   Compressed using variable hard thresholds

Energy retained = 99.8%
Null coefficients = 74.3%

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