

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)
```

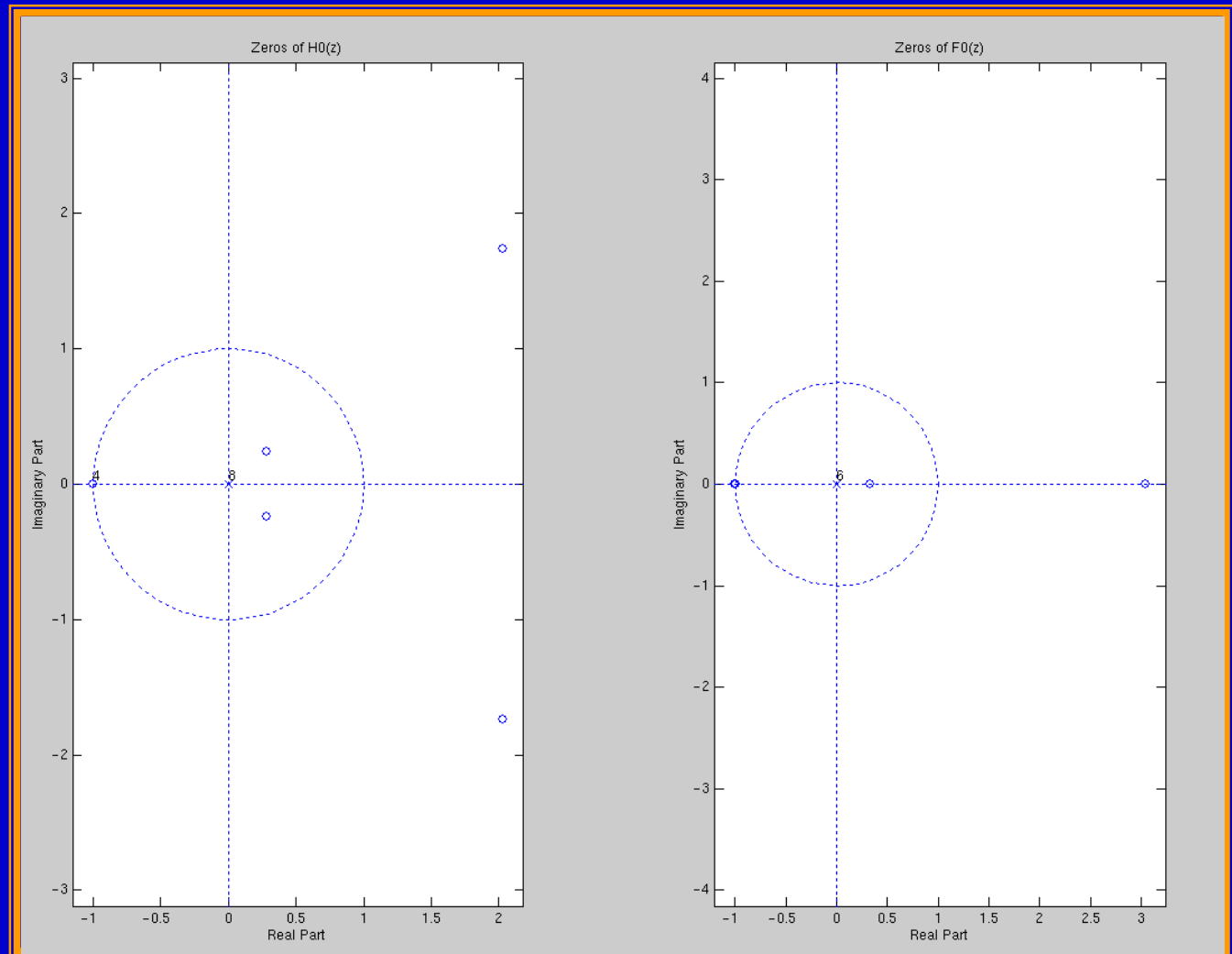
```
ans =
```

```
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
```

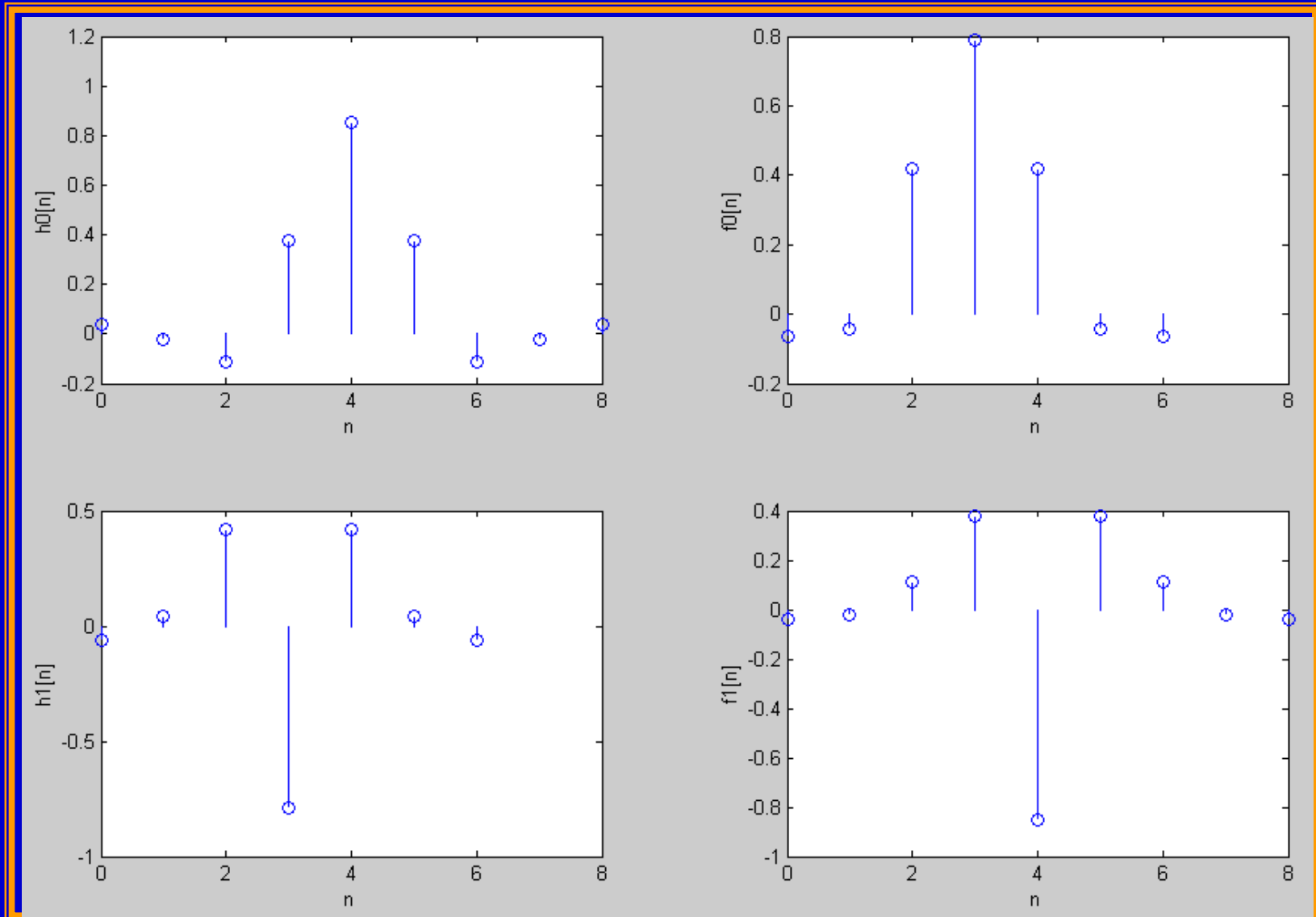
```
Zeros of F0(z)
```

```
ans =
```

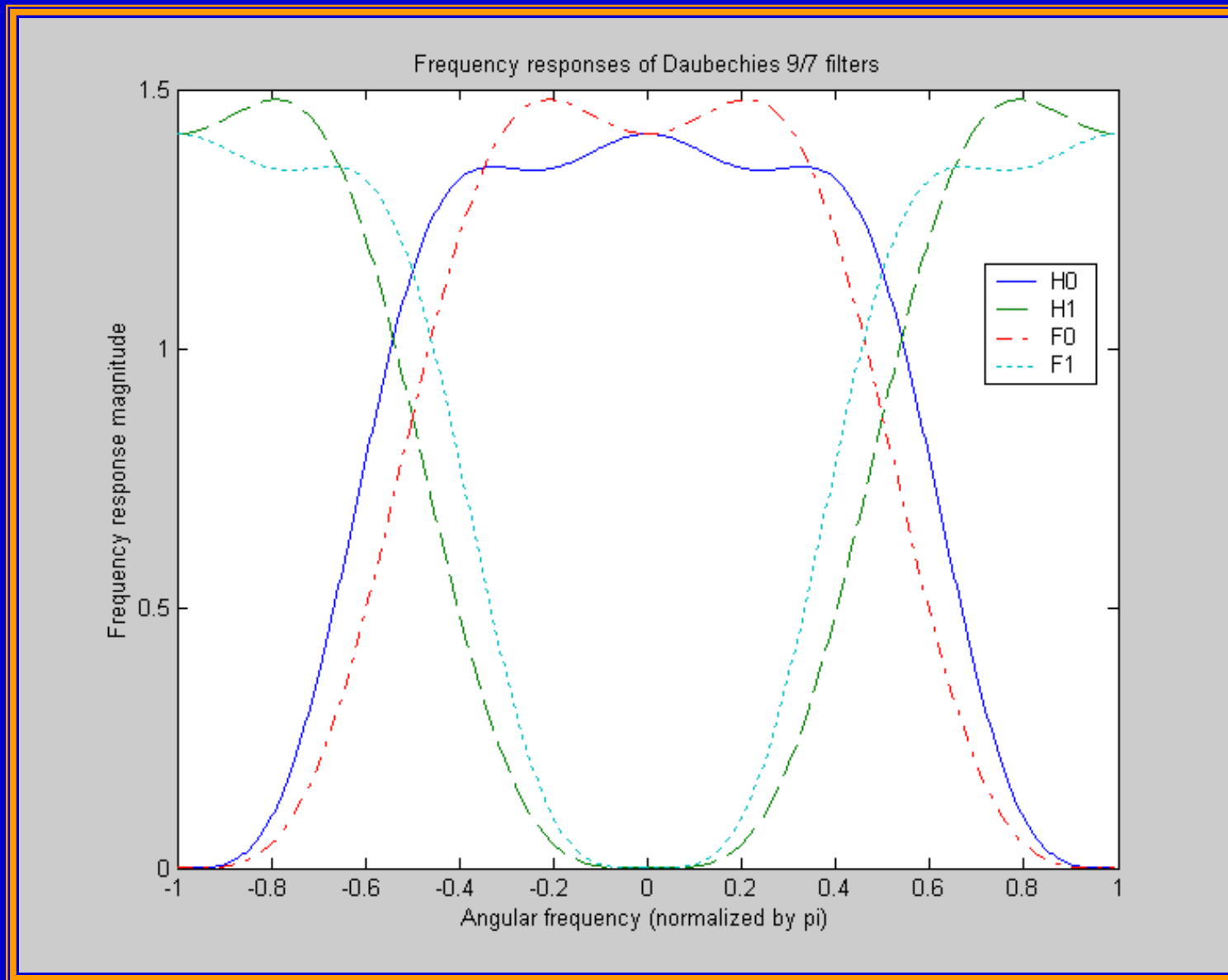
```
3.0407  
-1.0010 + 0.0010i  
-1.0010 - 0.0010i  
-0.9990 + 0.0010i  
-0.9990 - 0.0010i  
0.3289
```



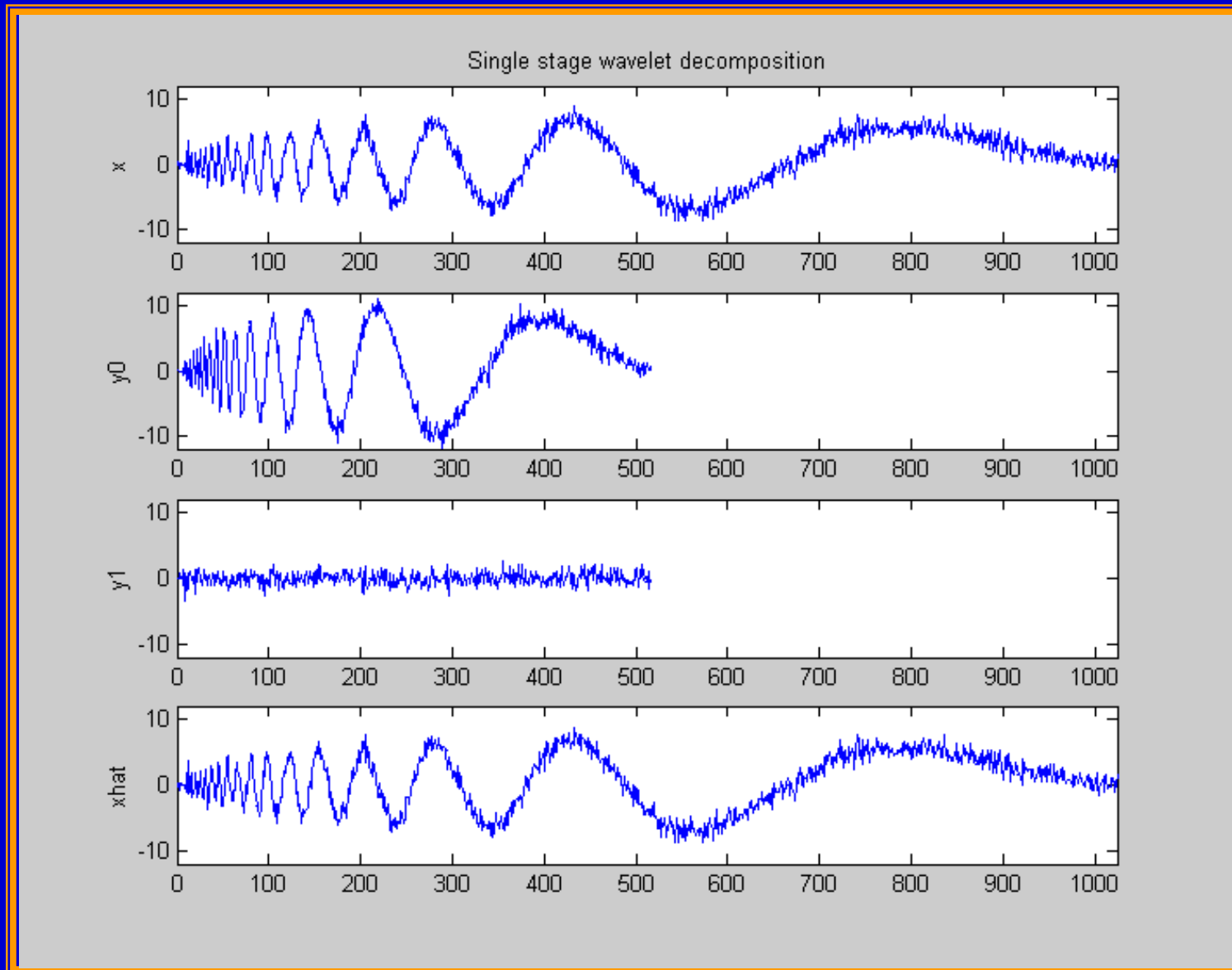
Complete Set of Daub 9/7 Filters



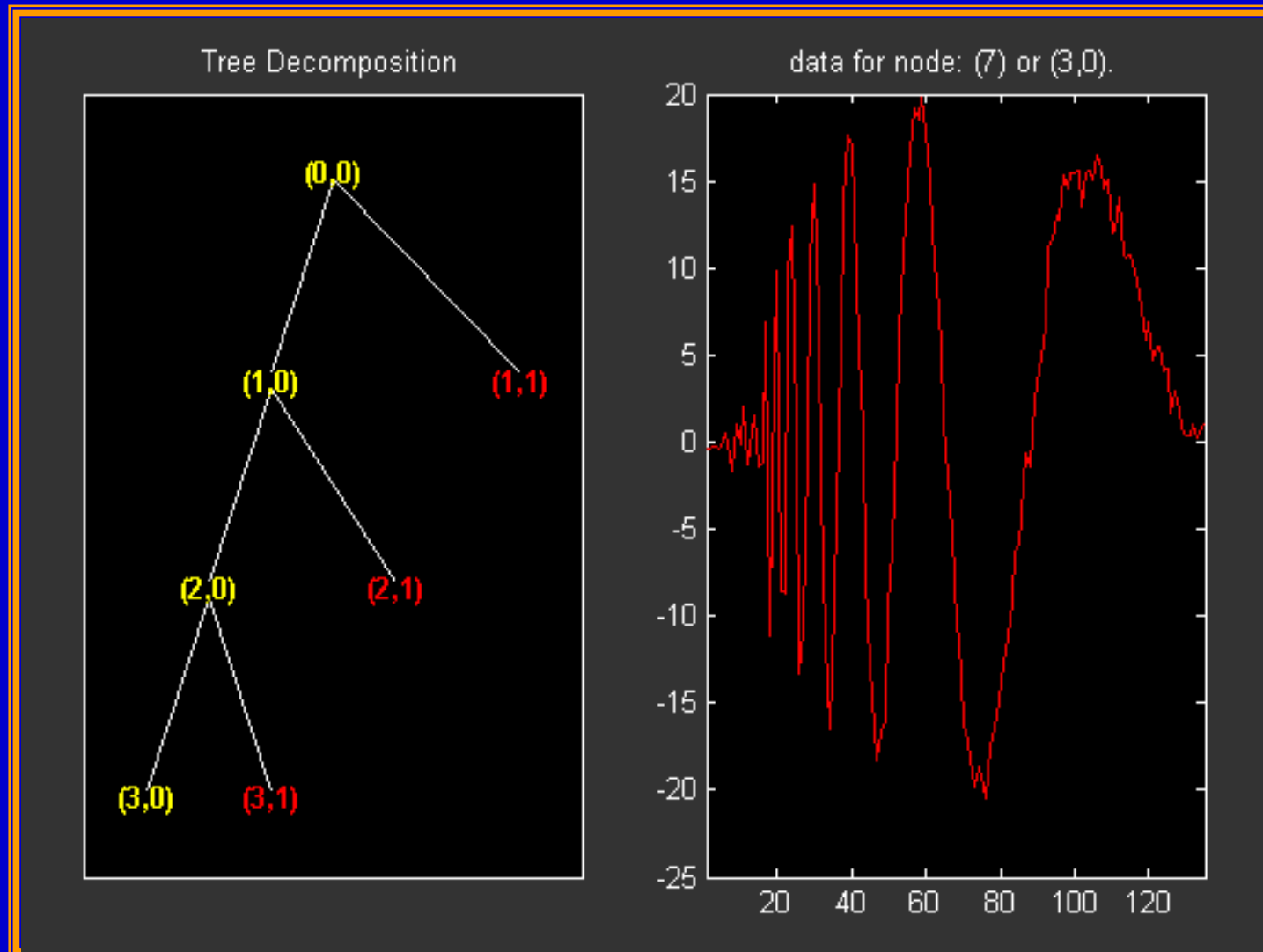
Frequency Responses of Daub 9/7



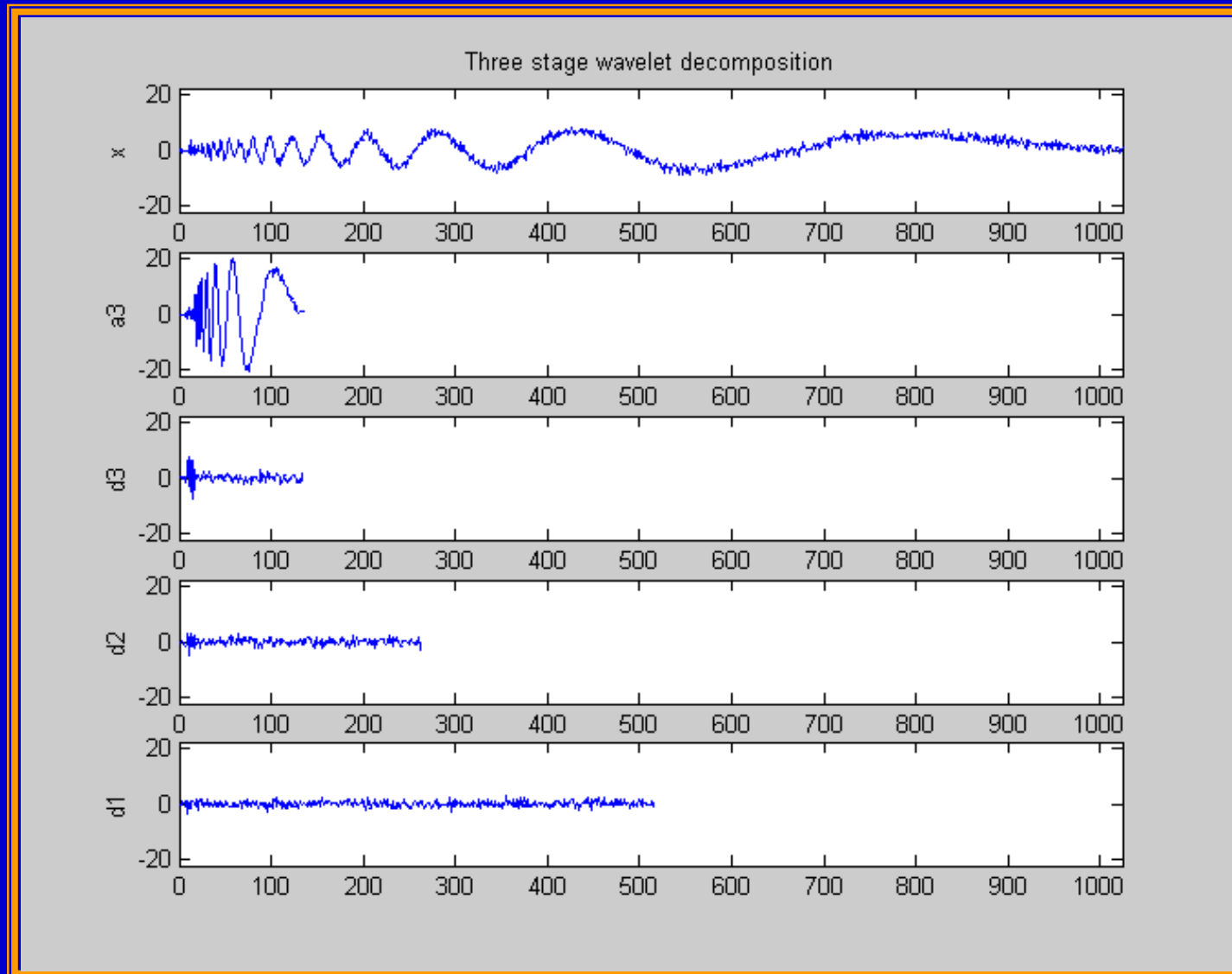
Single Stage Decomposition



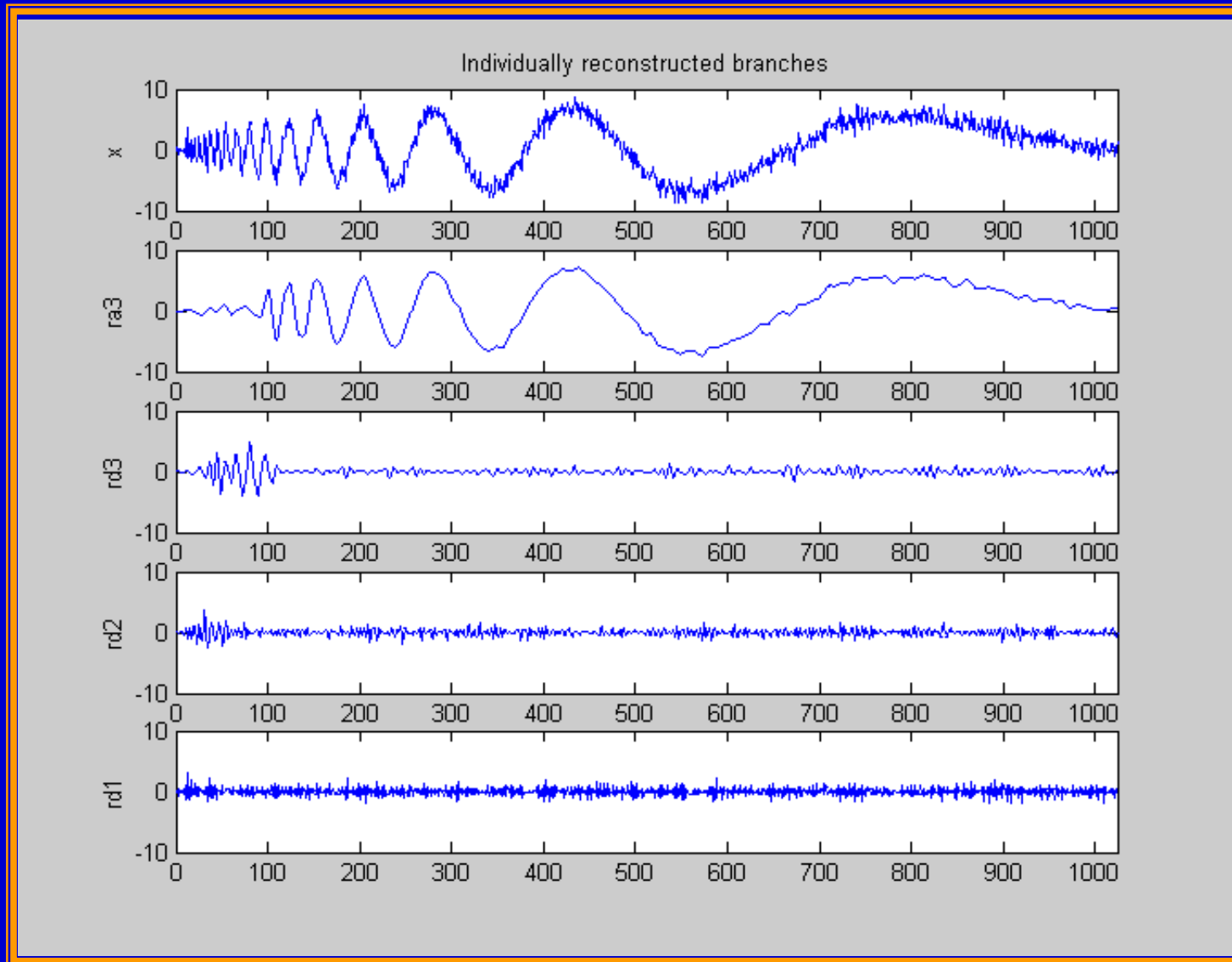
3-Stage Decomposition



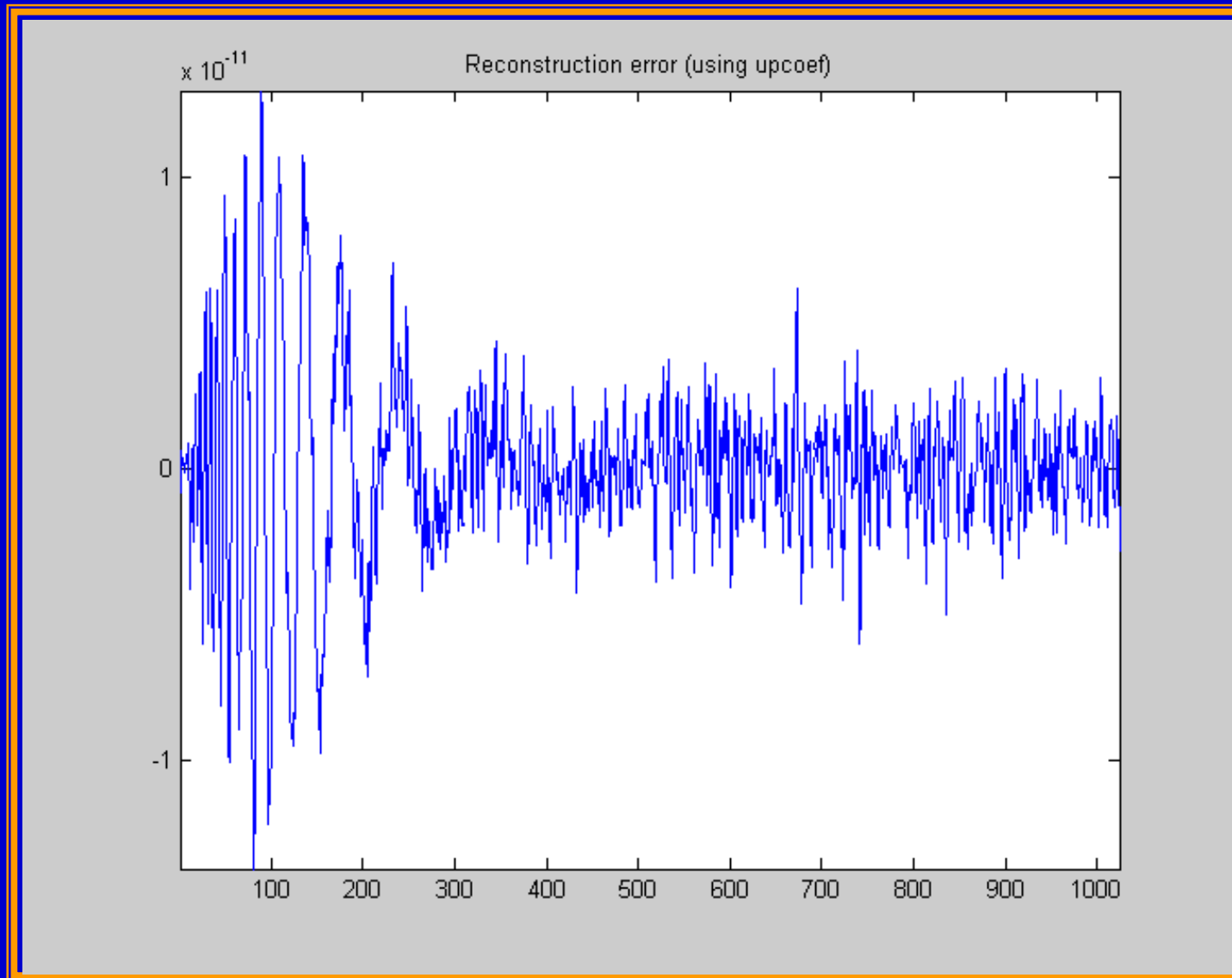
3-Stage Decomposition



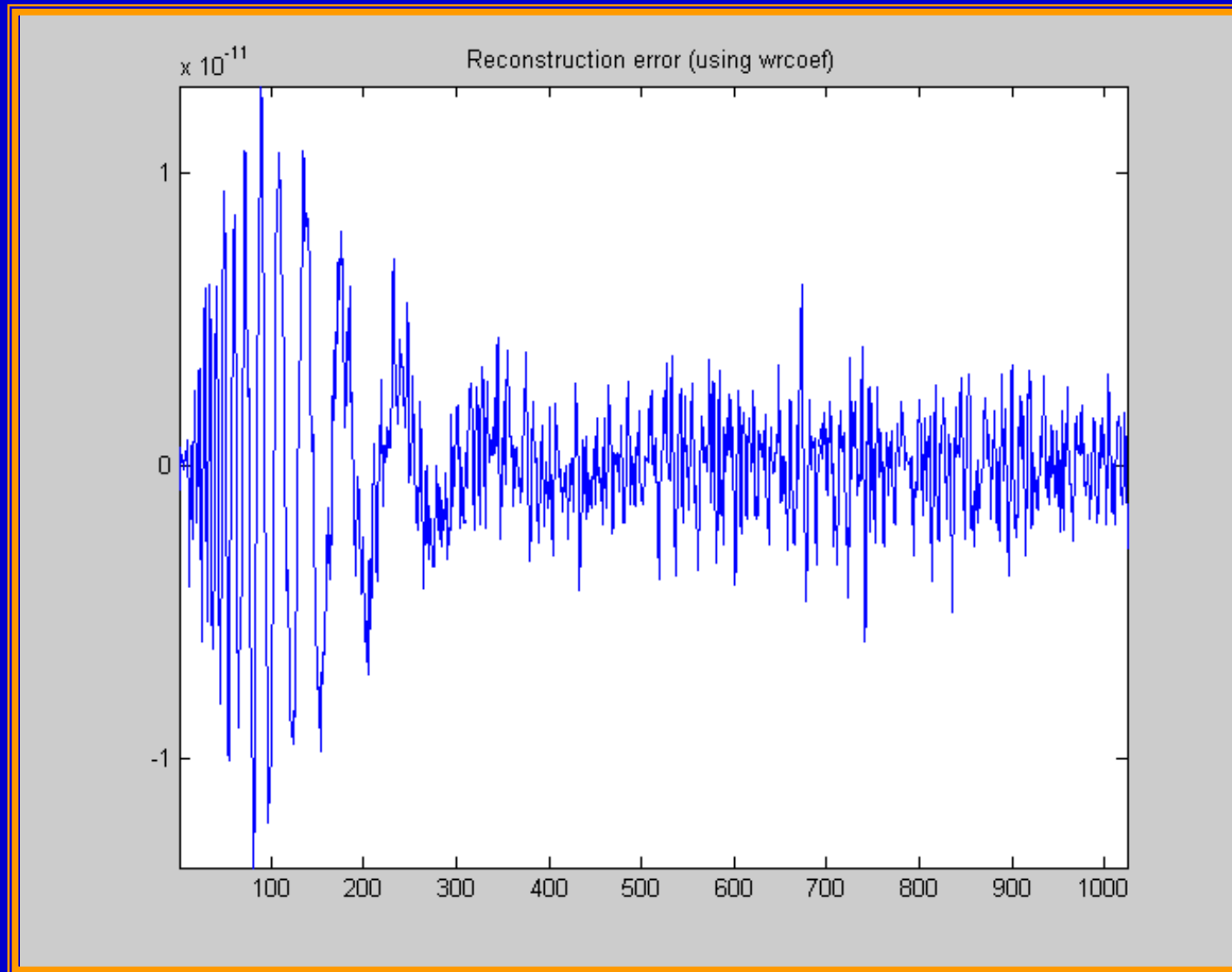
Individually Reconstructed Branches



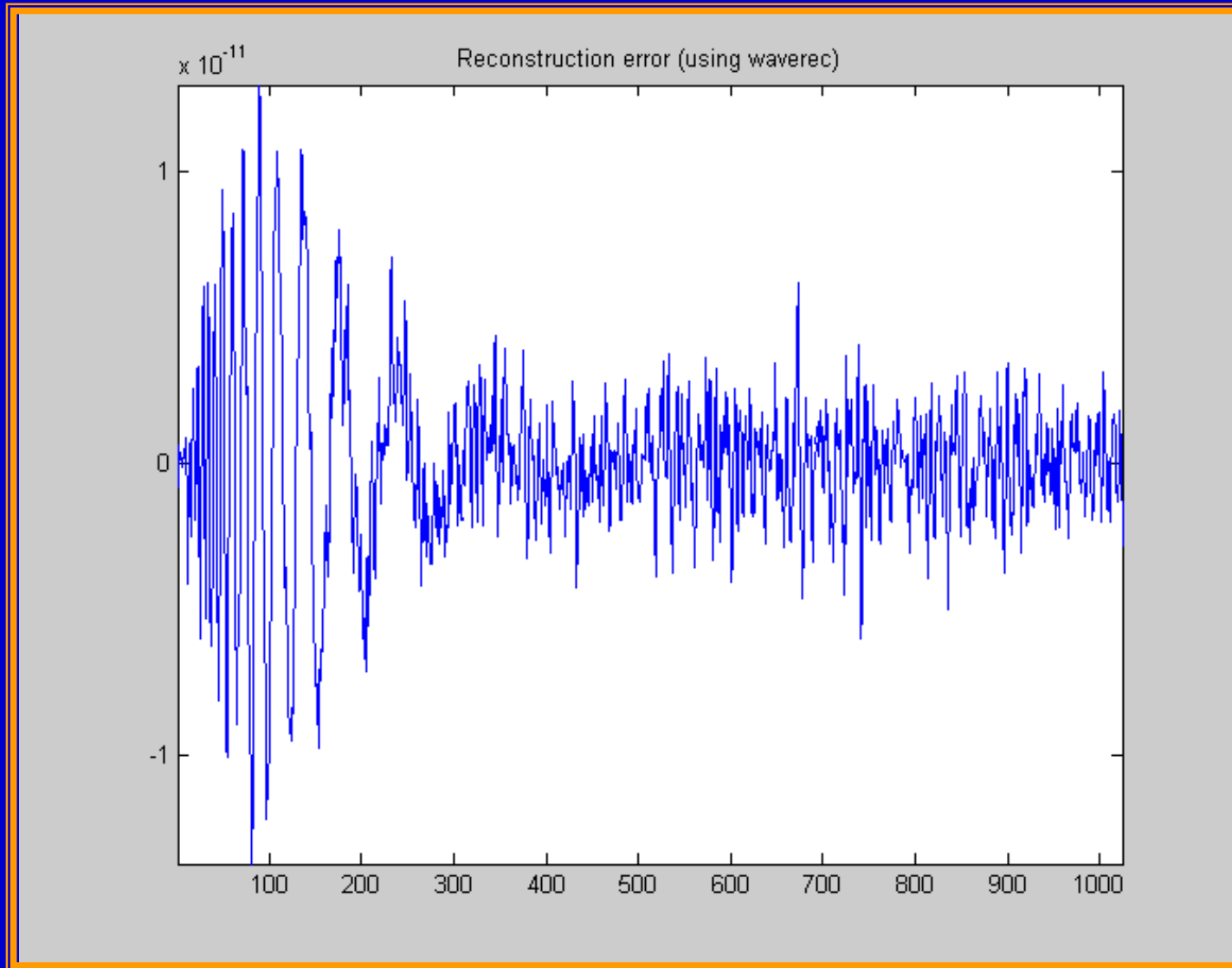
Reconstruction Error --- upcoef



Reconstruction Error --- wrcoef



Reconstruction Error --- waverec



Matlab Example 4

1. 2-D image analysis

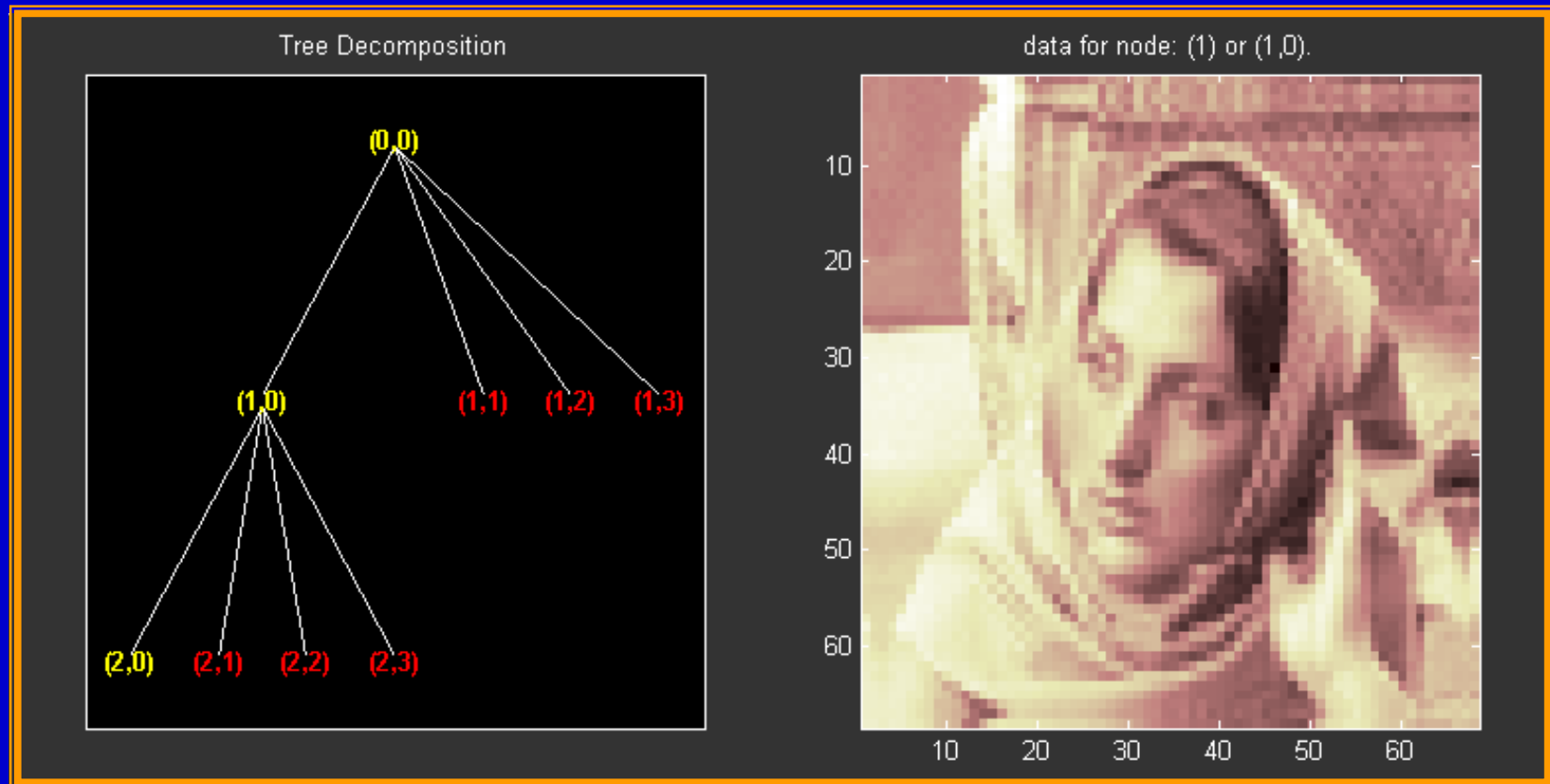


MATLAB M-file

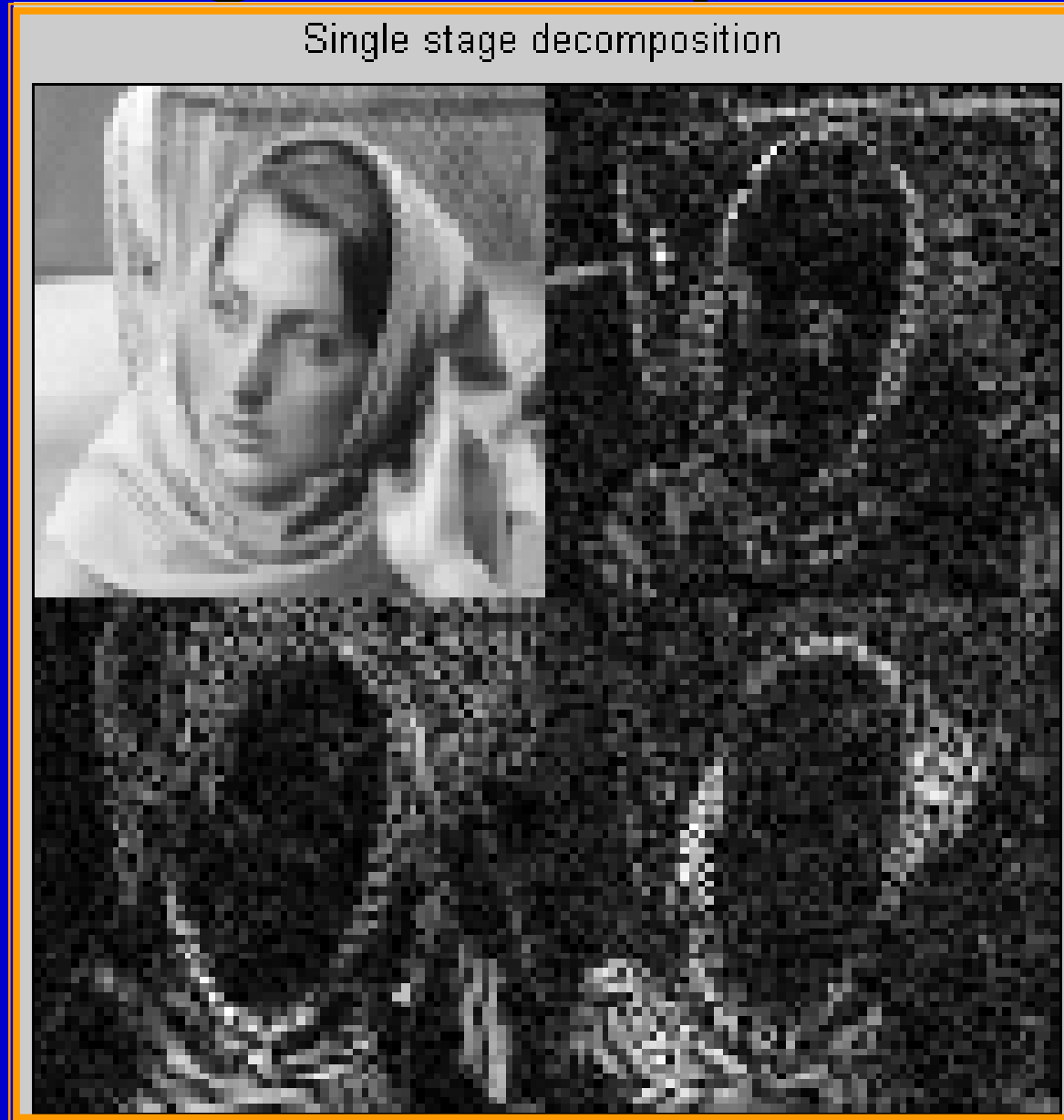
Original Image



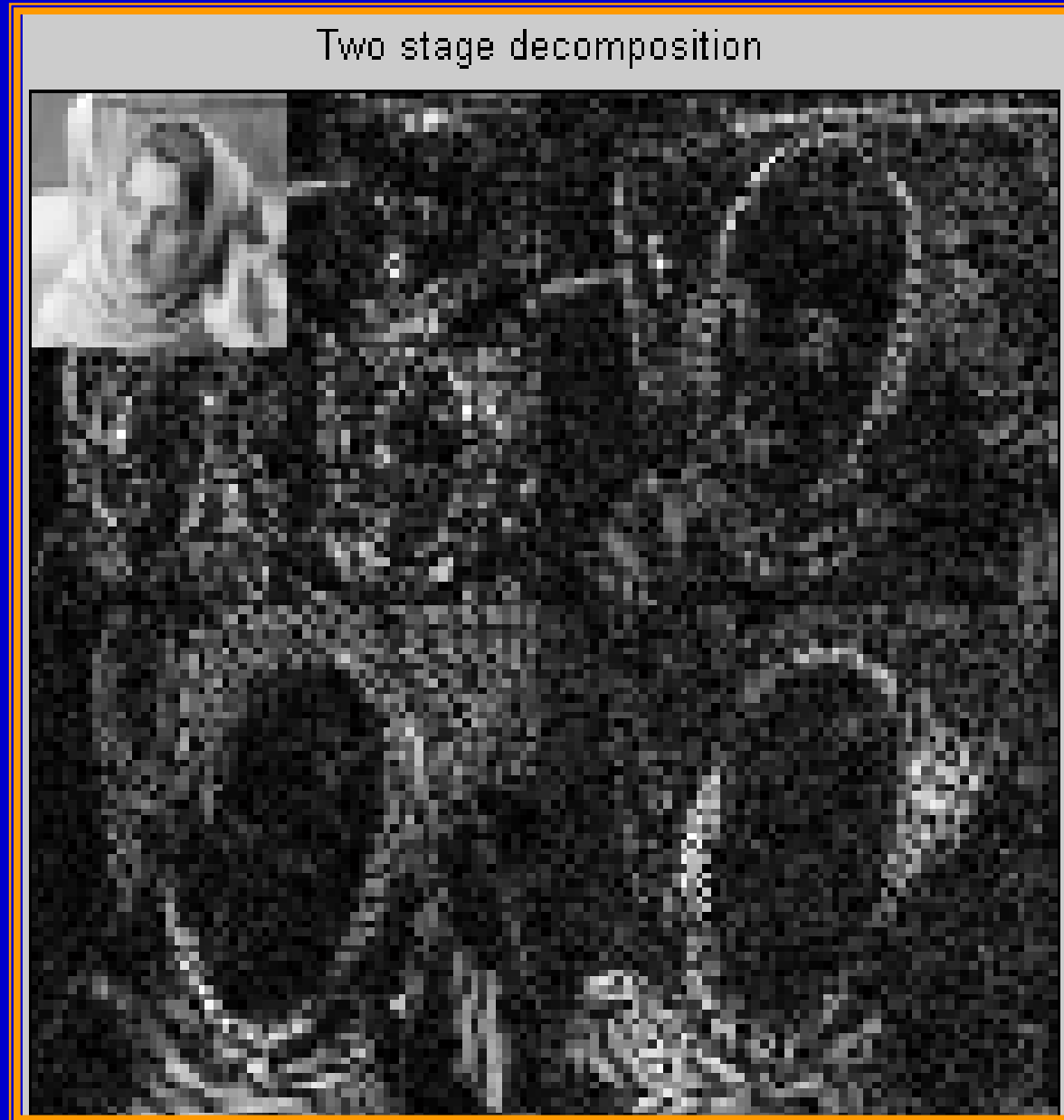
Wavelet Decomposition



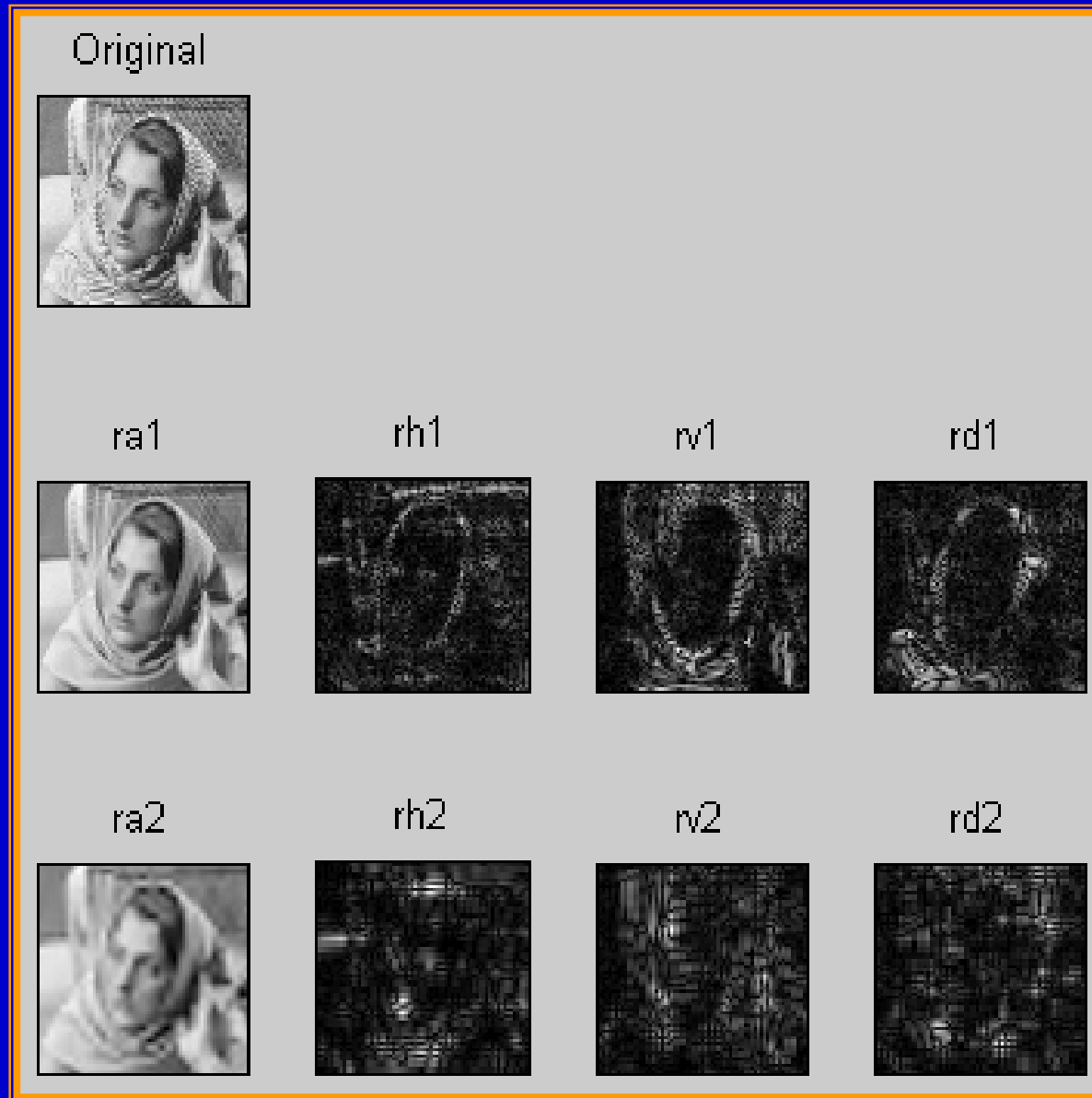
Single Stage Decomposition



Two-Stage Decomposition



Reconstructed Branches



Global Hard Thresholding

Original



Compressed using global hard threshold



Energy retained = 99.8%
Null coefficients = 74.1%

Variable Hard Thresholding

Original



Compressed using variable hard thresholds



Energy retained = 99.8%
Null coefficients = 74.3%