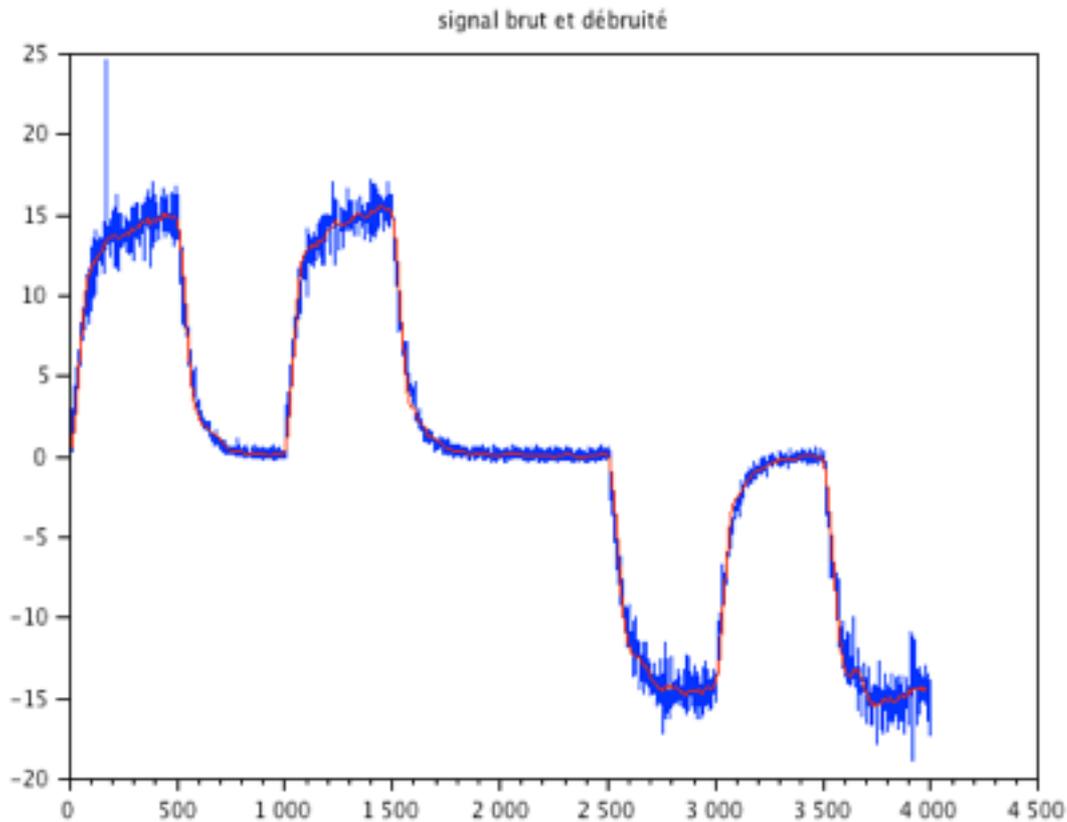


Real Time De-noising with a Left Wavelet Transform

User Manuel of the LeftWaveDenoiseFilter xcos toolbox.

1. Demonstration

This is the result of the demonstration on the satellite attitude control :



The raw signal is in blue and the de-noised signal is in red.

You may see that there is practically no delay between the jumps of the raw signal and the jumps in the de-noised signal.

When you launch the demo, you have two windows, one with the raw signal in input and one with the de-noised signal in output.

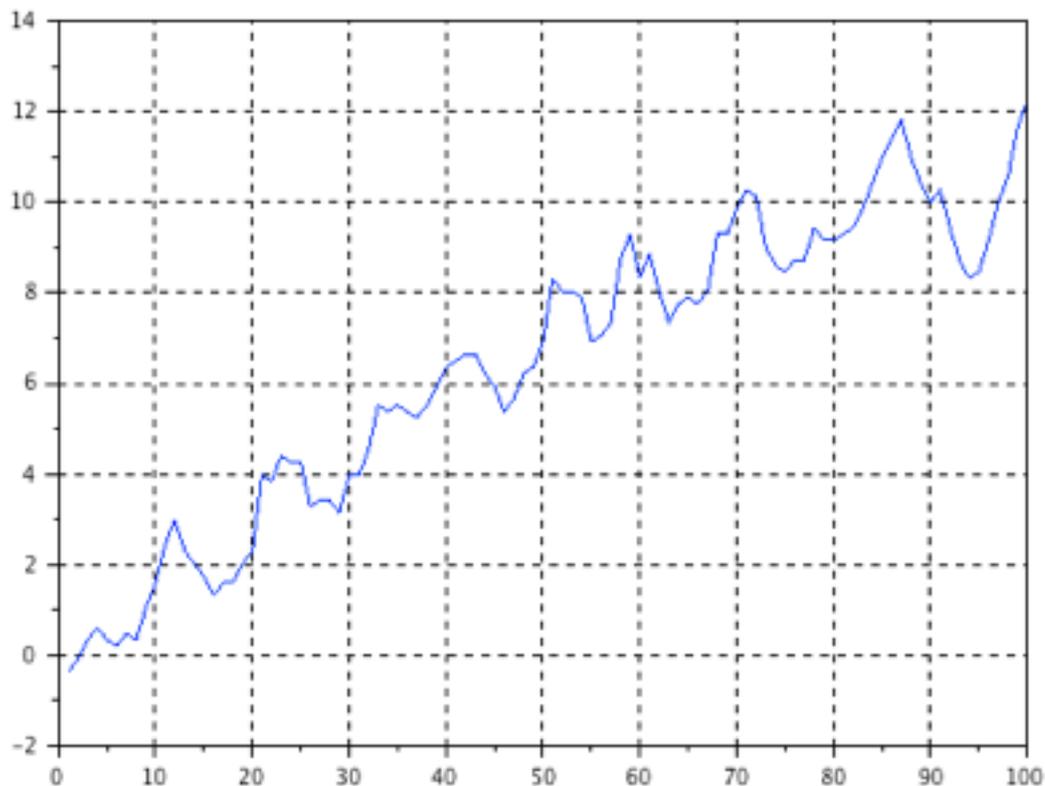
They are drawn progressively in each window, while the simulation is in progress. So that you may see that it is a realtime algorithm.

2. Parameters tuning

The parameter 'scale' is the depth of multi resolution wavelets transform. It is optimal for the value of 6, but you may test also values of 3, 4 and 5. Do not go below 3, otherwise you would not filter anything.

The delay 'delay' shall be about the period of the noise. That period may be visualized by plotting the first elements of the input signal.

For instance, for the demo example of the the satellite, the period is about of 20 samples.

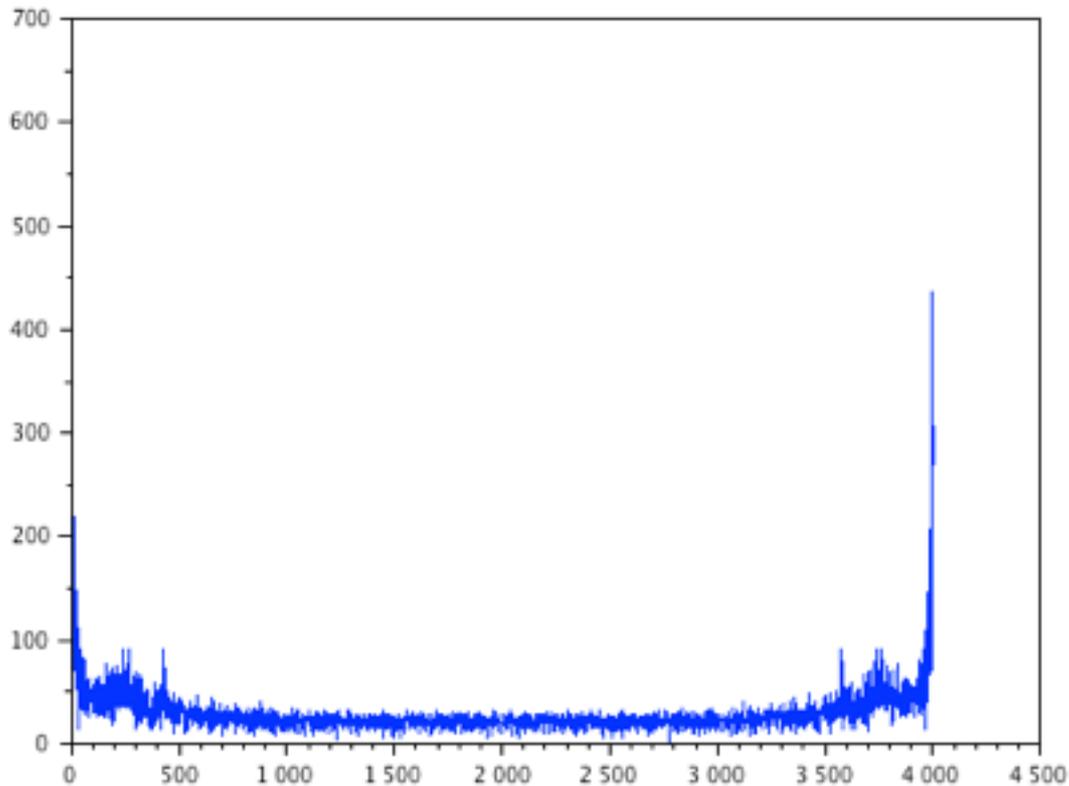


We tune then the rely to 'delay=20'.

As for the threshold, it shall be tuned to 3 or 4 times the level of the noise, calculated with a fft of the square of the signal.

For instance, with the demonstration signal GR1.scilab (to load into your scilab session, you get the vector U of the scalar inputs u. The level of noise may be visualized so :

```
--> W=fft(U.^2);  
--> W=sqrt(abs(W));  
--> figure;  
--> plot(W(20:$-20))
```

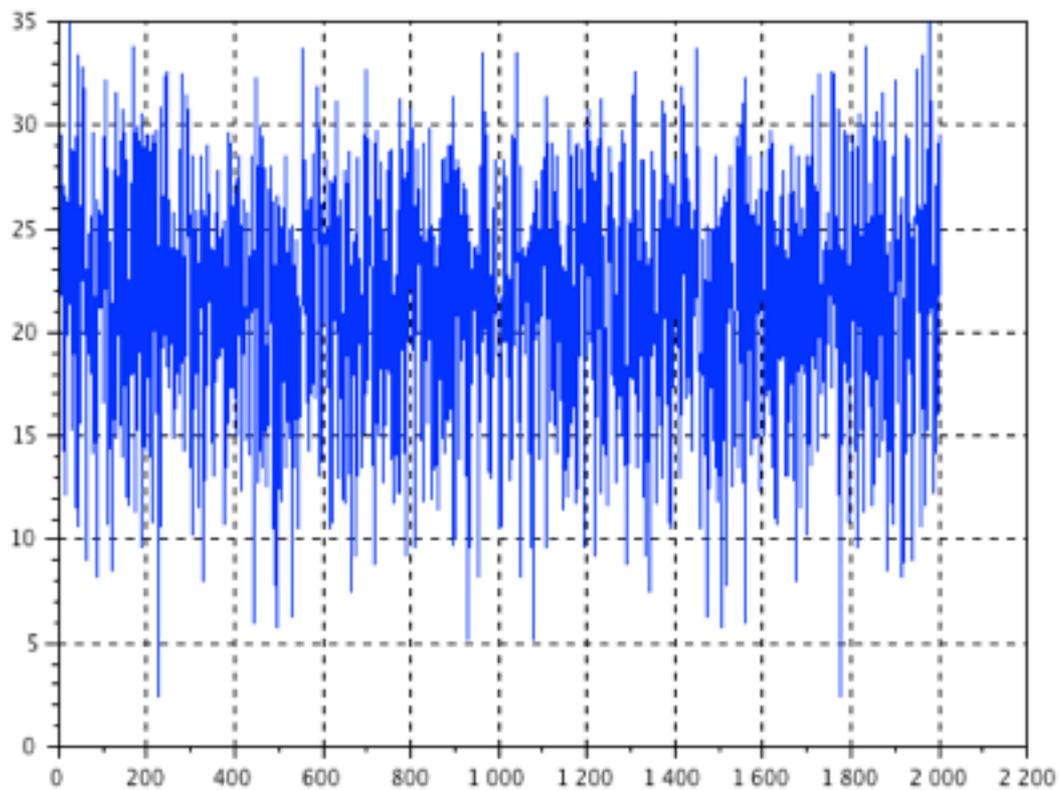


The portion of the obtained spectrum that is flat is between 1000 and 3000.

We close then the figure and type ÷

```
--> plot(W(1000:3000))  
--> xgrid
```

We obtain the following figure :



We see that the noise threshold is between 25 and 30..

A threshold of 'threshold=100' is thus OK.

It has to be noted that the exact value of the threshold is not very sensitive. The order of magnitude is the only important thing.