Advanced Digital Signal Processing
CCE 5201
Department of Communications and Computer Engineering

Laboratory Exercise 1

Use of Windows in DSP.

1. Set up a signal with three or four frequencies. (Two of them should be close e.g $\pi/12$, $\pi/3$, 16 $\pi/18$, 17 $\pi/18$). The signal should have around 20,000 samples at least.

2. Set up a random signal of equal size with various dB of energy for eventual addition to the signal.

3. Take frames from the original signal, 4096 OR 8192 points, work out the FFT, and get the spectrum.

4. Repeat, reducing the number of points down to 256 or 512 to see the spectral leakage.
Theoretically you are using a rectangular window.

5. Repeat with the frames in (3) and (4) above, but this time multiply the frame values with those of an appropriate sized hamming window.
ie $x'(n) = x(n).\ w(n)$
where w(n) has N equal to the number of points in the frame.
Again obtain the frequency response, noting the spectral leakage, and the influence on the near frequencies, compare to that with the rectangular window.

6. At this point you can introduce the noise in known db quantities, using a frame of 256, and a frame of 8192 points, and see at which point the original signal spectrum, starts getting lost in the noise spectrum.

7. Under the same conditions, examine the signal that has a Hamming window multiplication and again compare results.

You can use Simulink and Matlab functions, (particularly FFT, Hamming, and Gaussian Noise Generator).

Note: This is not a formal lab. Just an exercise that helps give you an insight on the use of windows in DSP.