Math 6397 – Fall 2009 Name:

HOMEWORK #4

The goal of this homework is to compare the linear and nonlinear approximation properties of wavelets and Fourier series.

1) Use the attached matlab file `mysigex.m` to generate a signal f of length 1024 points.

2) Compute its (multilevel) Discrete Haar Transform $DHT(f)$ and its Discrete Fourier Transform $DFT(f)$ (you can use `fft.m` from Matlab).

3) Compute the linear Fourier and nonlinear Fourier approximations obtained using 64 Fourier coefficients. Call them $f_{64}^{F,\ell}$ and $f_{64}^{F,n}$, respectively. Compute the approximation errors

$$\|f_{64}^{F,\ell} - f\|_2^2, \quad \|f_{64}^{F,n} - f\|_2^2,$$

and plot the approximation functions $f_{64}^{F,\ell}$ and $f_{64}^{F,n}$.

4) Compute the nonlinear wavelet approximation, using the DHT, obtained using 64 Haar wavelet coefficients. Call it $f_{64}^{H,n}$. Compute the nonlinear wavelet approximation error

$$\|f_{64}^{W,n} - f\|_2^2,$$

and plot the approximation function $f_{64}^{W,n}$.