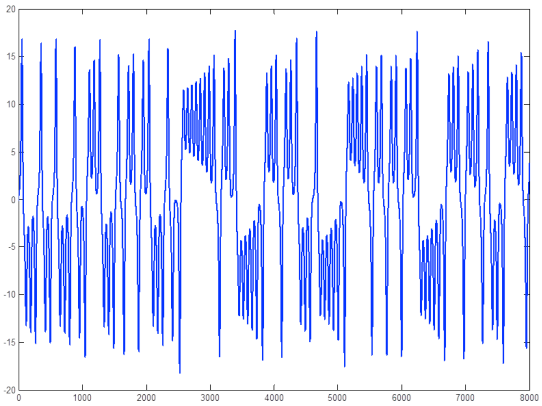
EEL 6504

Hmw # 6

Due November 24, 2015

Problem I

This problem tests a linear and nonlinear predictor for the Lorenz chaotic model of the atmosphere. The data file has 16,348 samples that represent the x coordinate of the Lorenz system. Here is a plot the data to see its structure over time and gauge the difficulty of the problem.



Your first solution should be with the trivial predictor, i.e. just assume that the next signal is equal to the current value. Find the normalized MSE between these two signals. This gives you a number to beat, because you did ZERO processing, so no matter what model based methodology you use, it MUST be better right??

Your second solution will be based on FIR filter predictor trained with LMS or with the RLS algorithm. Compare NMSE with the trivial predictor.

Your third solution will be based on the KLMS algorithm we discussed in class. Stop at iteration 5,000. Since we are interested in predicting the Lorenz system we have to find a proper embedding, i.e. instead of mapping one sample at a time we have to map a vector of samples. For the Lorenz use a vector of size 6, but you can try other values. Please select appropriately the kernel size and the learning rate for best results. Show performance (NMSE) as a function of the kernel size and compare with the previous result.

Your fourth solution should be with the QKLMS. Select the quantization step appropriately and show its effect on the prediction performance. Also present a curve of the size of the dictionary along the iterations, and compare with KLMS in terms of complexity of computation and error.