ENEE 434 Homework 4
Due Tu 03/08/05

For this homework there are three representations of the same z-domain transfer function:

$$H(z)=\frac{0.1z^3+z^2-0.144z^1-1.44}{z^3-0.3z^2+0.09z^1+0.013}=H1(z)$$

$$=\left(\frac{0.1z+1}{z+0.1}\right)\left(\frac{z^2-1.44}{z^2-0.4z^1+0.13}\right)=H21*H22(z)=H2(z)$$

$$=\left(\frac{0.1z+1}{z+0.1}\right)\left(\frac{z-1.2}{z-(0.2+j0.3)}\right)\left(\frac{z+1.2}{z-(0.2-j0.3)}\right)=H21(z)*H13(z)*H31(z)=H3(z)$$

#1. 75 points (linear digital filter)

a. Set up Matlab m-files, h1.m, h21.m, h22.m, h13.m, h31.m for each of the respective sub-transfer functions to be realized by a linear delay neural network. For grading purposes call the five neural networks respectively neth1, neth21, neth22, neth13, neth31.
b. By self substitutions of sim(.) check the cascade of neural networks determined by the above three representations of H(z) on the almost triangular input P=num2cell([0 0 0 -1.2:0.1:1.2 1.1:-0.1:-1.2]) with initial delay outputs Ai={[0] [1.3] [2.6] [3.9]}'. Determine and compare the respective outputs Y1, Y2, and Y3. Plot these outputs and P versus the sample time index t.
c. Discuss the advantage and disadvantage of each form of realization.

#2. 25 points (nonlinear digital filter)

a. For the realization H1(z) change the second activation function from purelin to tansig.
b. Compare the new output, Ynonlin, to Y1 of problem 1 with the same input P.
c. For h1.m insert the training function 'trainlm' giving h1n.m, of neural network neth1n, and train this nonlinear realization on the above P with T the output Y1 found in problem 1b.
d. Discuss your results.

Suggested to do (not for grading and not to be handed in at this point)

Derive the activation function for the MOS differential pair given in the first homework set, correcting any errors. Set up an m-file for it allowing the desired parameter inputs.