

EE610/CPE690 Model-Based Design  
Homework #1

Due Date: 2 Sep 09

1) Model an FIR filter in discrete components for the below impulse response. Use a direct form transposed structure (Ref Ch8 of Mitra Book).

3.078818e-2  
1.676712e-17  
-8.370295e-2  
-1.699610e-17  
0.310355  
-0.5  
0.310355  
-1.699610e-17  
-8.370295e-2  
1.676712e-17  
3.078818e-2

Identify the following:

- Filter response (i.e. lowpass, highpass, bandpass...).
- Group Delay

Use the Simulink sinusoid generator to explore the filter and its various scopes to view the outputs.

2) Model the below Radar Range Equation in Simulink. Create a subsystem from the model with all variables as inputs to the subsystem.

$$\sigma^2 = 10 \cdot \text{Log}_{10} \left( \frac{(4\pi)^3 \cdot R^4 \cdot f_T^2 \cdot P_R}{P_T \cdot 10^{G_T/10} \cdot 10^{G_R/10} \cdot c^2} \right)$$

Where:  $G_T$  – Transmit Antenna Gain in dB

$G_R$  – Receive Antenna Gain in dB

$R$  – Range to the target in m

$f_T$  – Transmit carrier frequency (Hz)

$P_T$  – Transmit Peak Power (W)

$P_R$  – Reflected power from target (W)

$c = 299792458$  m/s (Speed of Light) - *NOTE: This is a constant*

$\sigma^2$  – Radar Cross Section in dBsm (dB square meters)