

EE 502 Spring 2003

HW Assignment 5

Assigned: Wednesday, 26 March 2003

Due: Friday, 4 April 2003

Simulation Problem

Part 1

A digital lowpass filter is to be designed according to the following guidelines:

Sample rate (f_s): 48 kHz

Passband:

0 – 5 kHz; 0 dB nominal gain; +0.05 dB max gain; -0.05 dB min gain

Stopband:

6 kHz – 24 kHz; -50dB max gain

Choose a design method that meets the specifications with the lowest order (length) FIR filter. INCLUDE EVIDENCE that your design meets the specifications.

Part 2

Implement a direct form version of the FIR filter you designed in Part 1 and determine the filter output when the input is a rectangular pulse:

$$x[n] = u[n] - u[n - 1000]$$

Be sure to choose an “interesting” range of n for your simulation.

Part 3

Now implement the filter using the “overlap add” method using a DFT. Choose a block length that is not more than twice the length of the FIR response. Determine the filter output when the input is the rectangular pulse of Part 2, and compare the output to the direct form output. Comment on the results.