

Problem Set 4

1. In MATLAB function `firpm`, default value for LGRID parameter is 16. Design a linear phase filter with LGRID values 16, 32, 64 and 128 (help `firpm`). Filter specifications are:

$$\omega_p = 0.3\pi$$

$$\omega_s = 0.5\pi$$

$$\delta_p = 0.01$$

$$\delta_s = 0.001$$

Plot the linear scale amplitude responses, impulse responses and pole-zero diagrams. Do you notice any difference(s)? (3 points)

2. There are also additional output parameters in MATLAB `firpm` function. Investigate these output parameters. Plot the error of the filter (Use the specifications given in problem 1) and the weighted error. (2 points)

3. **EXTRA:** Design the minimum-phase FIR filter with the specifications:

$$\omega_p = 0.5\pi$$

$$\omega_s = 0.6\pi$$

$$\delta_p = 0.01$$

$$\delta_s = 0.00316$$

Plot the amplitude response (linear scale), impulse response, pole-zero diagram and group delay of the linear-phase prototype filter and the minimum-phase FIR filter.