

Problem Set IV

1. Write a Matlab function to test for perfect reconstruction of any four given filters $H_0(z)$, $H_1(z)$, $F_0(z)$, $F_1(z)$. You should test the aliasing cancellation and the distortion elimination condition.
2. Let $p_0[n] = \frac{1}{2048}[-5 \ 0 \ 49 \ 0 \ -245 \ 0 \ 1225 \ 2048 \ 1225 \ 0 \ -245 \ 0 \ 49 \ 0 \ -5]$.
 - (a) Is $P_0(z)$ a halfband filter? Find and plot its zeros.
 - (b) Distribute the zeros of $P_0(z)$ such that $H_0(z)$ and $F_0(z)$ are time-reversal filters with real coefficients. In other words, these choices yield orthogonal filter banks. Find all possible solutions.
 - (c) For each solution above, plot the time and frequency responses of all 4 filters. Verify perfect reconstruction using your Matlab function in Problem 1.
 - (d) Verify orthogonality and shift-orthogonality of each of your filter banks.

Due date: **Friday Oct. 5** in class