

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Electrical and Computer Engineering
ECE 498MH SIGNAL AND IMAGE ANALYSIS

Homework 10
Fall 2014

Assigned: Thursday, 4/6/2017

Due: Thursday, 4/13/2017

Reading: 394–415

Do **one** of the following two problems, and submit by 11:59pm 4/13/2017 (on Compass, if you don't hand it in during class). Homework will be returned on 4/18/2017. If you don't like your grade, then you can hand in the **other** problem for a grade, no later than 4/25/2017.

Problem 10.1

Suppose you have a signal $x[n] = s[n] + v[n]$ corrupted by a narrowband noise, $v[n]$, at the frequency 0.06π .

- Find $H(z)$ for a notch filter, with a notch at 0.06π , and a bandwidth of $B = 0.01\pi$ radians/sample.
- Sketch the magnitude frequency response $|H(\omega)|$. Show the notch, show roughly the bandwidth of the notch, and show that it's $|H(\omega)| \approx 1$ at other frequencies.
- Write the LCCDE that implements this filter.

Problem 10.2

Suppose you have a signal $x[n] = s[n] + v[n]$ corrupted by a narrowband noise, $v[n]$, at the frequency $2\pi/3$.

- Find $H(z)$ for a notch filter, with a notch at $2\pi/3$, and a bandwidth of $B = \ln(0.9)$ radians/sample.
- Sketch the magnitude frequency response $|H(\omega)|$. Show the notch, show roughly the bandwidth of the notch, and show that it's $|H(\omega)| \approx 1$ at other frequencies.
- Write the LCCDE that implements this filter.