UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Department of Electrical and Computer Engineering

ECE 498MH SIGNAL AND IMAGE ANALYSIS

Homework 1

Fall 2014

Assigned: Thursday, 1/19/2017

Due: Thursday, 1/26/2017

Reading: 1–40

Do **one** of the following two problems, and submit by 12:30pm 1/26/2017. Homework will be handed back on 1/31/2017. If you don't like your grade, then you can hand in the **other** problem for a grade, no later than 2/7/2017.

Problem 1.1

Find the magnitude, frequency, and phase shift of the cosine $x(t)$.

$$x(t) = \cos\left(2\pi\left(1000t + \frac{1}{12}\right)\right) + \sin\left(2\pi\left(1000t - \frac{1}{6}\right)\right)$$

Solve this problem in two different ways. Show your work, for both methods, and show that both give the same result: (1) Create three sampled time axes, one above another. In the first two, plot thirteen samples of each of the two component sinusoids, at a sampling frequency of $F_s = 12,000$Hz. In the last axis, add the first two axes. Estimate the magnitude, frequency, and phase shift of the cosine in the last axes by eye. (2) Use the phasor method. Plot the two input phasors and the one output phasor, specifying both real part and imaginary part.

Problem 1.2

Find the magnitude, frequency, and phase offset of the sinusoid $x(t)$.

$$x(t) = \cos\left(2\pi\left(255t - \frac{5}{12}\right)\right) + \sin\left(2\pi\left(255t + \frac{1}{3}\right)\right)$$

Solve this problem in two different ways. Show your work, for both methods, and show that both give the same result: (1) Create three sampled time axes, one above another. In the first two, plot thirteen samples of each of the two component sinusoids, at a sampling frequency of $F_s = 3060$Hz. In the last axis, add the first two axes. Estimate the magnitude, frequency, and phase shift of the cosine in the last axes by eye. (2) Use the phasor method. Plot the two input phasors and the one output phasor, specifying both real part and imaginary part.