Polytechnic University of the Philippines
Department of Computer Engineering

Digital Signal Processing

CMPE 30244

MP3
Frequency Response and Passive Filters using Multisim

Submitted by:

_____

Submitted to:

_____

Date Submitted:

_____

OBJECTIVES

- To reinforce the concepts behind filter circuits and frequency response
- To reinforce the idea of a phasor
  - To understand and use phasor circuit analysis
- To reinforce the procedure of deriving a transfer function
- To graphically demonstrate the effects of different passive component configurations on different ranges of frequency

MATERIALS

- The lab assignment (this document)
- Your lab parts
- Printouts (required) of the below documents:
  - Pre-lab analyses
  - Multisim screenshots e-mailed to course e-mail
- Graph paper.

INTRODUCTION

In this experiment we will analytically determine and measure the frequency response of networks containing resistors, ac sources, and energy storage elements (inductors and capacitors).

Given an input sinusoidal voltage, we will analyze the circuit using the frequency-domain method to determine the phasor of output voltage in the ac steady state. The response function is defined as the ratio of the output and input voltage phasors. It is a function of the input frequency and the values of the circuit elements (resistors, inductors, capacitors).

We start with examples of a few filter circuits to illustrate the concept.

RC Low-Pass Filter:

Consider the series combination in Fig 1 of the resistor R and the capacitor C, connected to an input signal represented by ac voltage source of frequency ω.

$$v_{in}(t) = V_s \cos(\omega t + \theta_I) \quad (1)$$

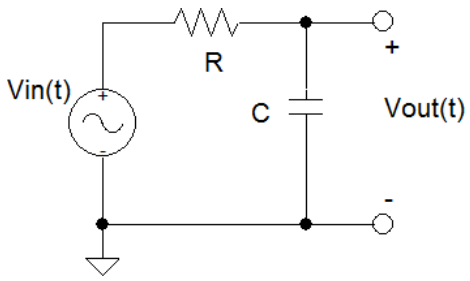

Figure 1 – Low-pass filter.

Suppose we are interested in monitoring the voltage across the capacitor. We designate this voltage as the output voltage. We know that it will be a sinusoid of frequency ω. Thus,

$$v_{out}(t) = V_o \cos(\omega t + \theta_o) \quad (2)$$