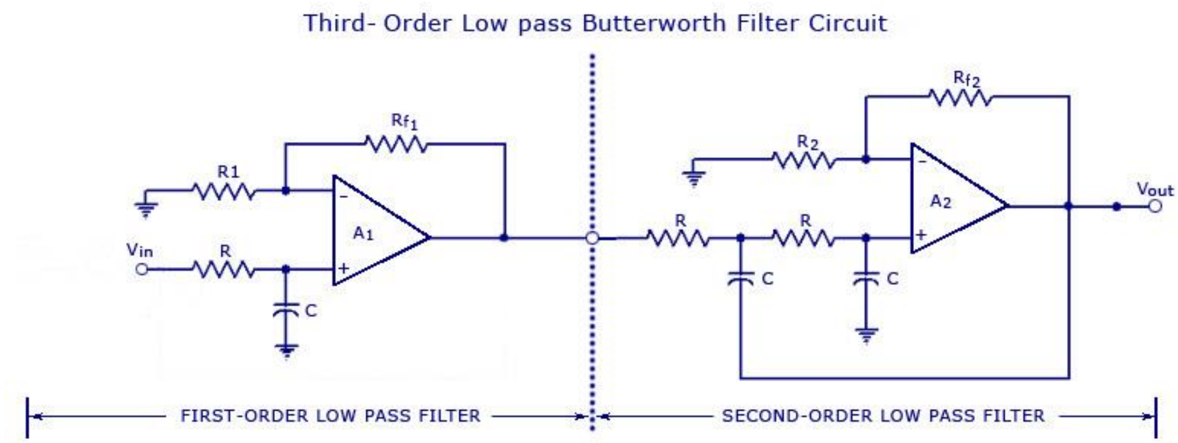
ELEC ENG 3TR4
LAB 01
FOURIER ANALYSIS

Date: 23rd, 02, 2015

Syed Naim (1066208)
Xavier John (1045578)

Filter Design

For this lab, a third order Butterworth Filter was designed. This filter provides an attenuation of approximately -35db. The configuration used for this filter is as shown in the figure below.



The values used for the various components were determined using the following calculations (on next page):

Factors of polynomials

→ First order : $(S+1)$

$$\frac{V_o}{V_i} = A_{V_o} = 3-2K$$

$$A_{V_o} = 2$$

$$\frac{R_1 + R_{f1}}{R_{f1}} = 2$$

let $R_1 = 1K\Omega$

$\therefore R_{f1} = 1K\Omega$

→ Second order: $(S^2 + 1.414S + 1)$

$$\frac{V_o}{V_i} = A_{V_o} = 3-2K$$

$$A_{V_o} = 3 - 1.414$$

$$= 1.586$$

$$\frac{R_2 + R_{f2}}{R_{f2}} = 1.586$$

let $R_2 = 1K\Omega$

$\therefore R_{f2} = 586\Omega$

So for R_1 & R_{f1} & R_2 we can use $1K\Omega$ resistor

for R_{f2} we can use two $1.2K\Omega$ resistors in parallel giving us 600Ω

→ Using a cutoff frequency of 1KHz & $C = 0.1\mu F$

we have $$f_o = \frac{1}{2\pi RC}$$

$$1 \times 10^3 = \frac{1}{2\pi R(0.1\mu F)}$$

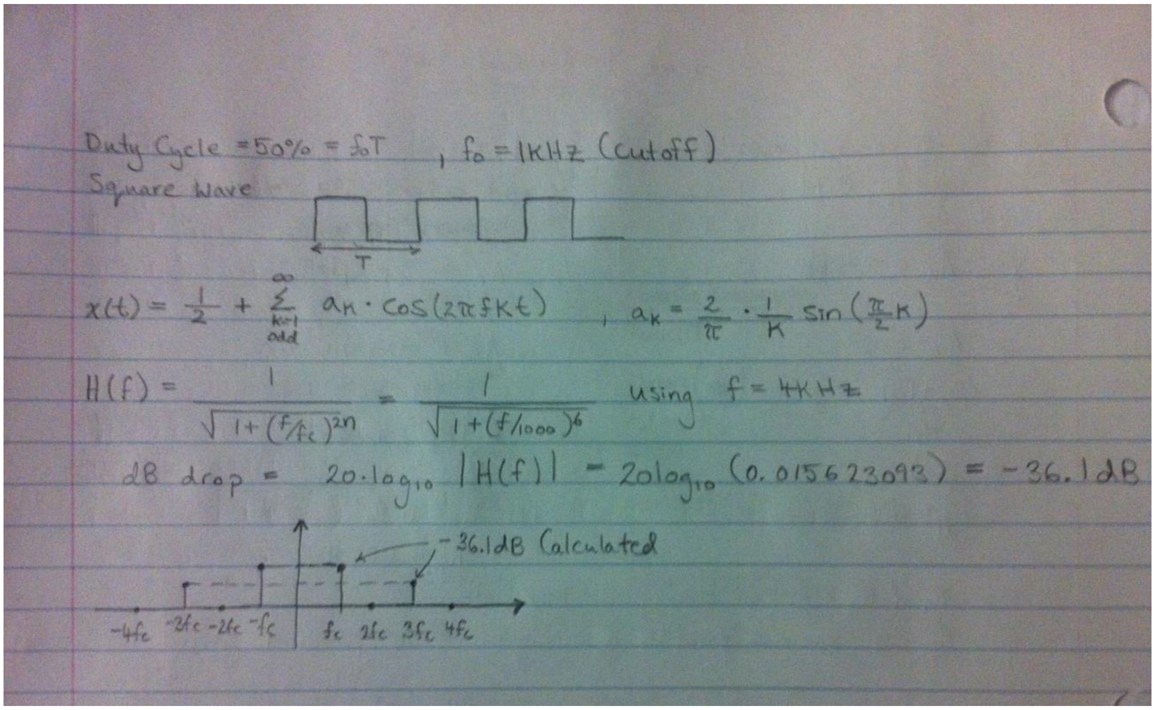
$$R = \frac{1}{2\pi(1\times10^3)(0.1\mu F)}$$

$$R = 16K\Omega$$

so for R we can use two $8.2K\Omega$ resistors in series

Results

The following is our calculated spectrum for the output waving using a 1KHz cutoff frequency for the input with 50% duty cycle:



Below is the actual output from the oscilloscope: