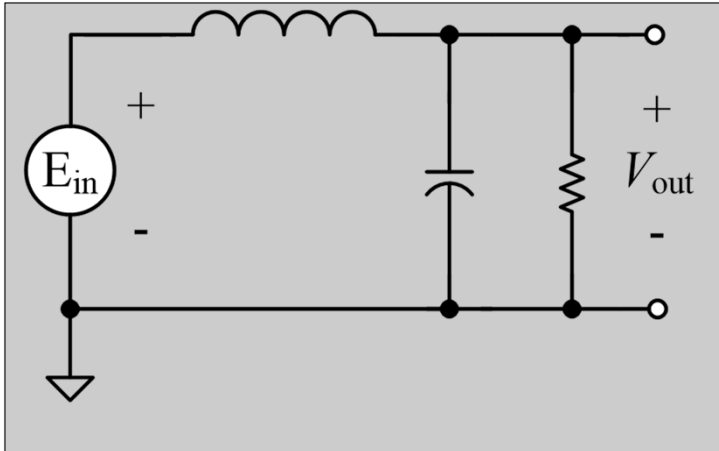
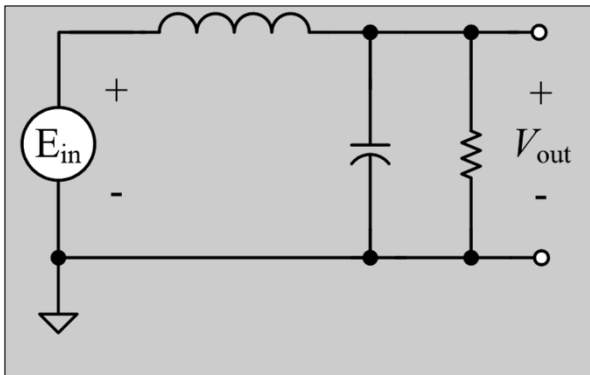


Laplace LC Low Pass Filter



1. Add the Laplace impedances.
2. Find the transfer function.

$$\frac{V_{out}}{E_{in}} = \frac{\quad}{s^2 + \quad s + \quad} \quad \text{_____ sets frequency} \quad \text{_____ sets damping}$$



Write the transfer function with numeric values

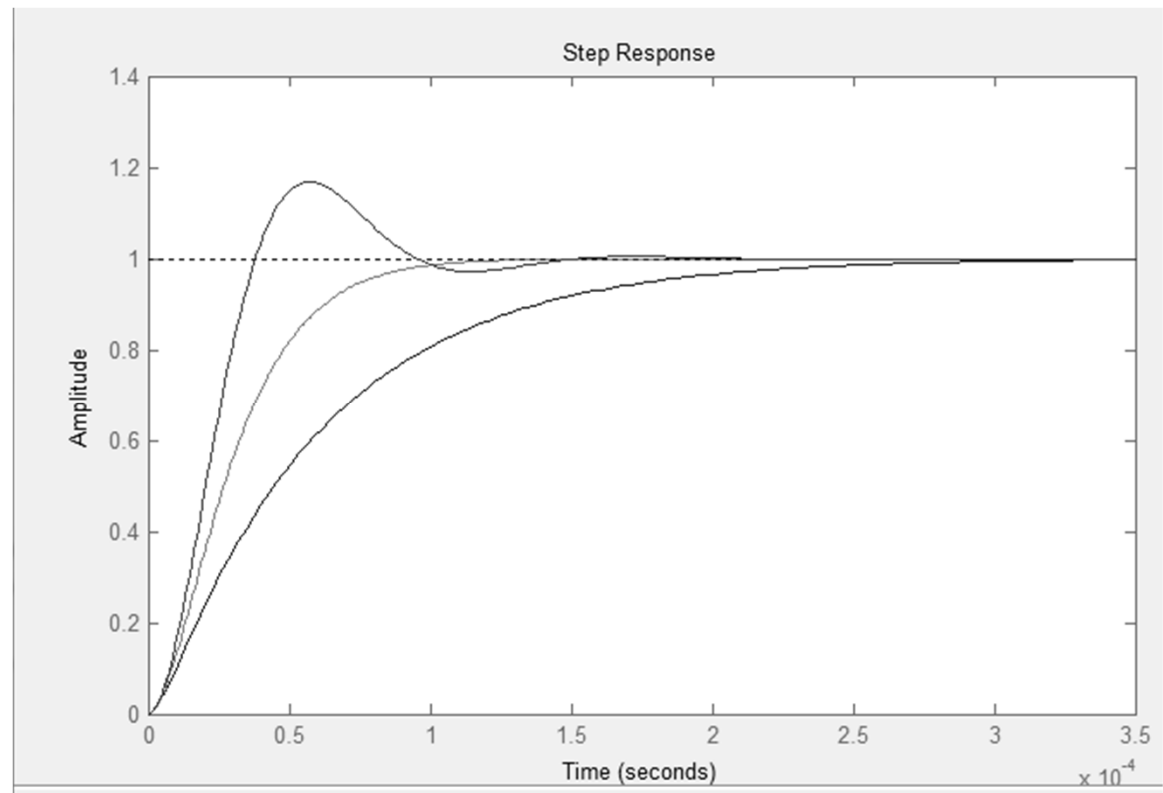
- a. $R = 8 \, \Omega$ $L = 500 \, \mu\text{H}$ $C = 0.5 \, \mu\text{F}$
- b. $R = 8 \, \Omega$ $L = 257 \, \mu\text{H}$ $C = 1.0 \, \mu\text{F}$
- c. $R = 8 \, \Omega$ $L = 125 \, \mu\text{H}$ $C = 2.0 \, \mu\text{F}$

MATLAB Analysis

```
clc
clear
s=tf('s')
R=8;
L1=500e-6;
C1=0.5e-6;

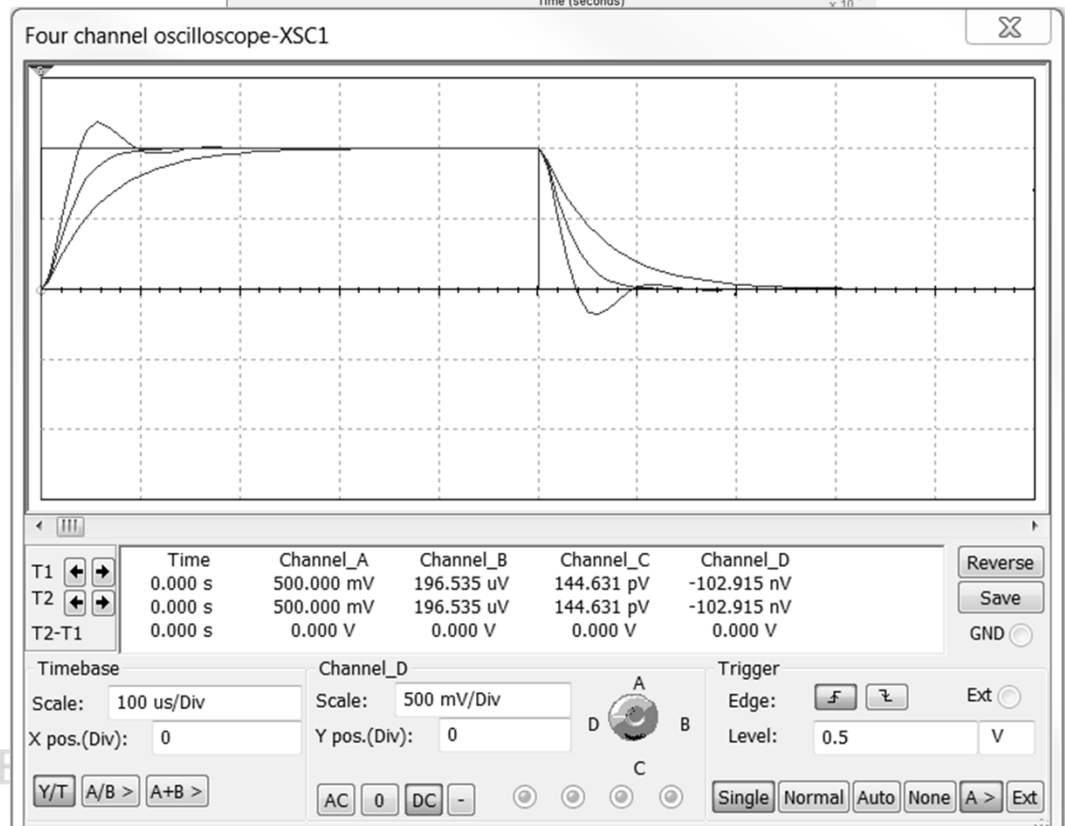
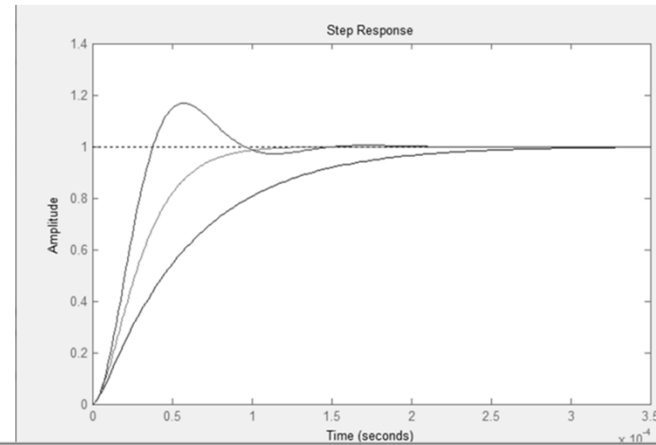
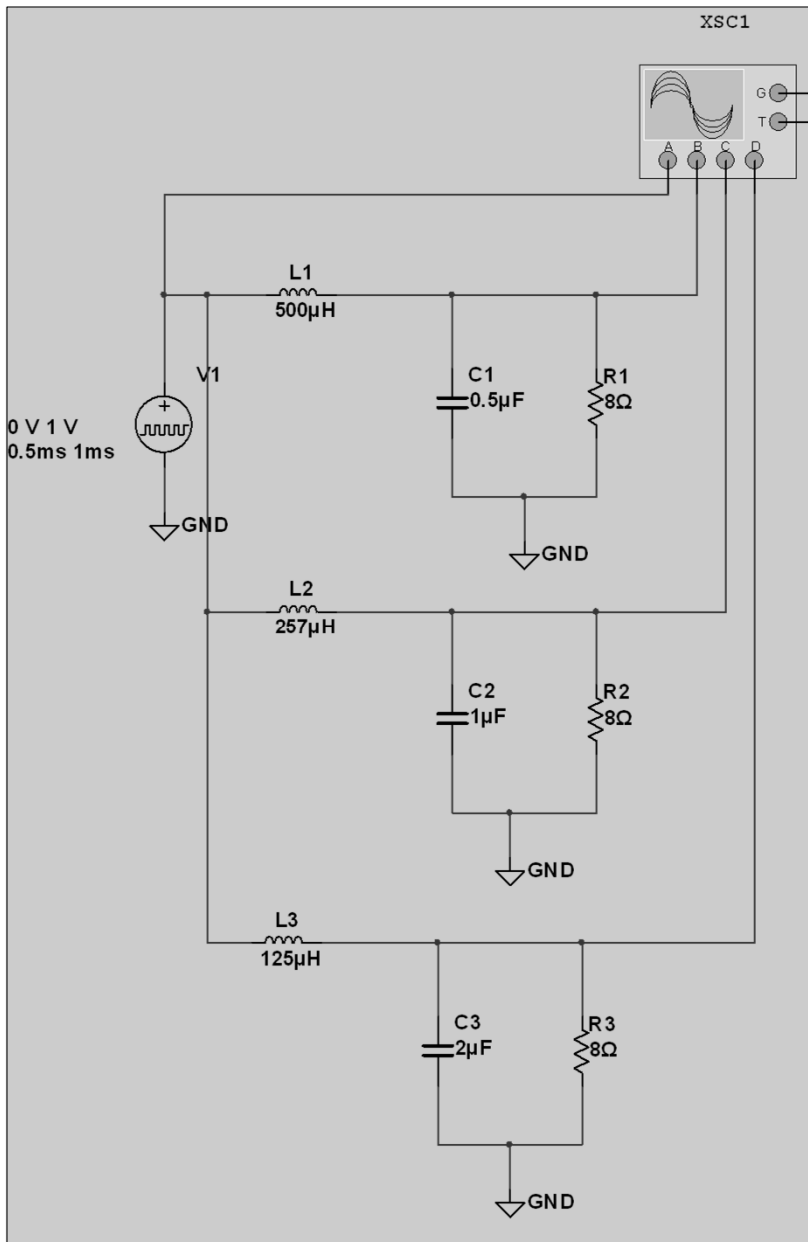
L2=257e-6;
C2=1e-6;

L3=125e-6;
C3=2e-6;
```

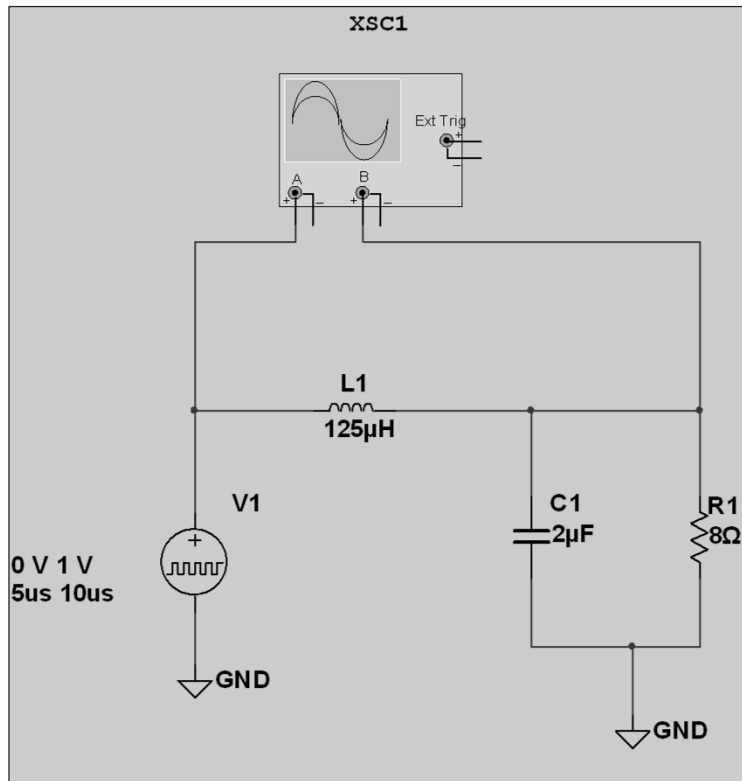


```
G1=(1/(L1*C1))/(s^2+s/(R*C1)+1/(L1*C1))
G2=(1/(L2*C2))/(s^2+s/(R*C2)+1/(L2*C2))
G3=(1/(L3*C3))/(s^2+s/(R*C3)+1/(L3*C3))
ltiview(G1,G2,G3)
```

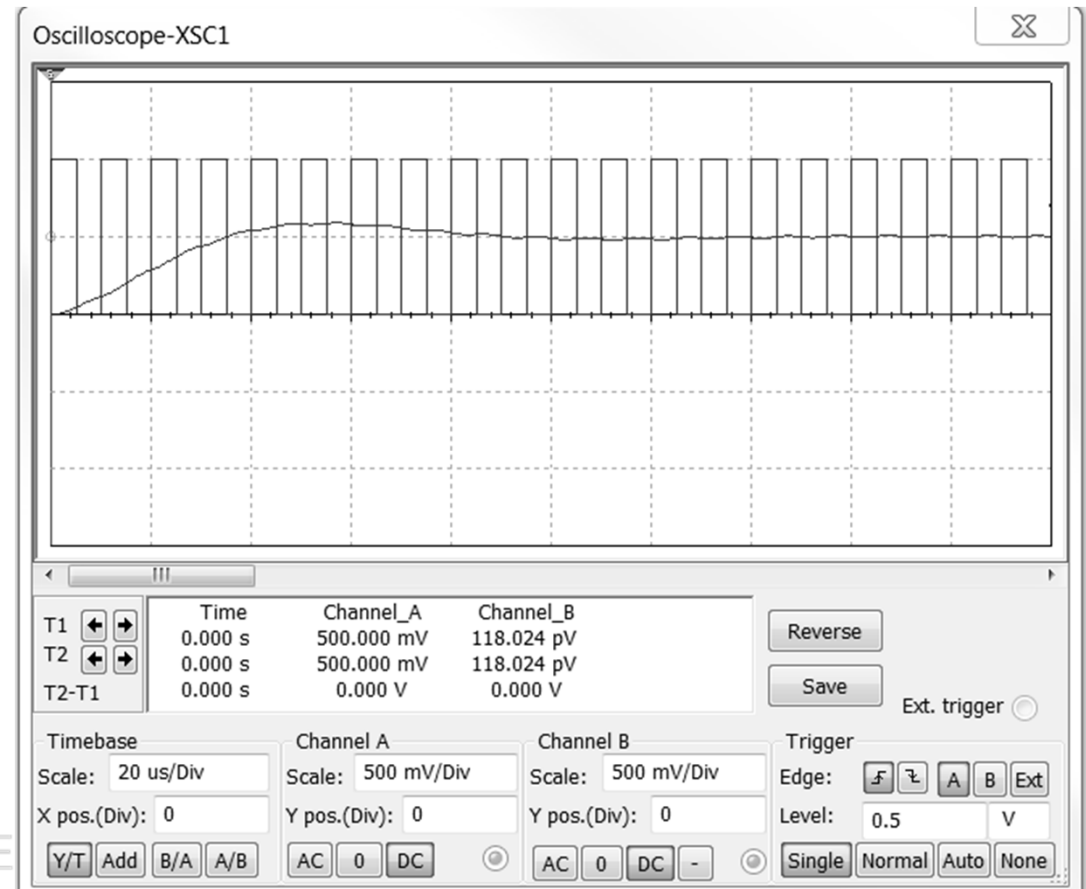
Multisim Analysis – 1 kHz

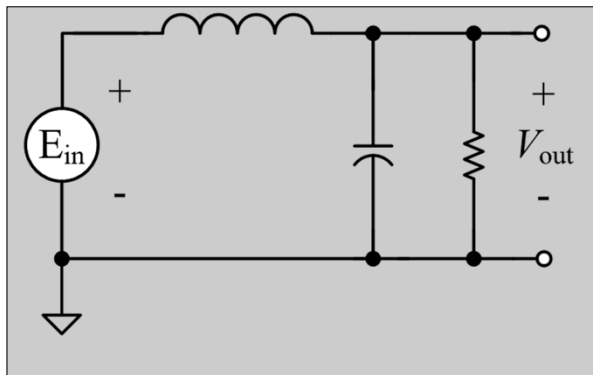


Multisim Analysis – 100 kHz



- Effect of changing ω ?
 - How?
- Effect of changing ζ ?
 - How?





Design an LC Low Pass filter with

$$R = 4 \, \Omega, \quad f_n = 10 \, \text{kHz}, \quad \xi = 0.7$$

$$\omega_n = 2\pi f_n$$

$$\frac{V_{\text{out}}}{E_{\text{in}}} = \frac{\frac{1}{LC}}{s^2 + \frac{1}{RC}s + \frac{1}{LC}}$$

$$\frac{V_{\text{out}}}{E_{\text{in}}} = \frac{\omega_n^2}{s^2 + 2\xi\omega_n s + \omega_n^2}$$

$$2\xi\omega_n = \frac{1}{RC} \quad \omega_n = \frac{1}{\sqrt{LC}}$$