DESIGN A PD controller for a given rlc circuit to IMPROVE it’s SETTLING TIME.

Team Member:

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Introduction:

We can reduce the settling time by using A PD controller.

We have reduced the settling time of the RLC circuit by 1/2.

Ts(new)=Ts*(1/2)

What is controller

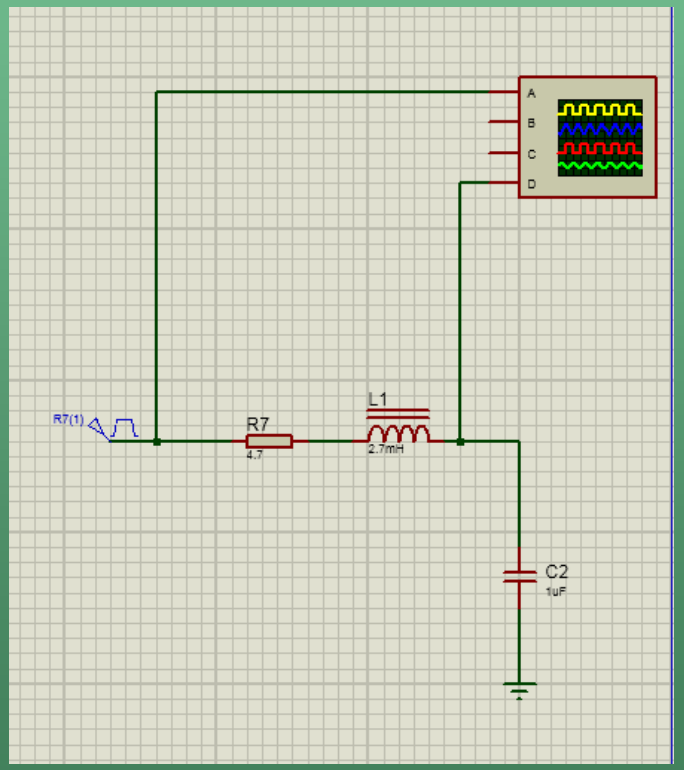
- A controller is a device that generates an output signal based on the input signal it receives

- The input signal is actually an error signal ,which is the difference between the measured variable and the desired value

What Is PD Controller?

- A proportional derivative controller (PD controller), as its name indicates, is a controller with a “proportional action” and a “derivative action”.
- The proportional action is an action proportional to the variable controlled or its error (difference between the desired value and the actual value of the controlled variable); this basically means that a gain multiplies either the variable or its error compared to the desired value.
- The derivative action is an action that implies the derivative of the controlled variable. This usually means that the variable is derived, then multiplied by a gain

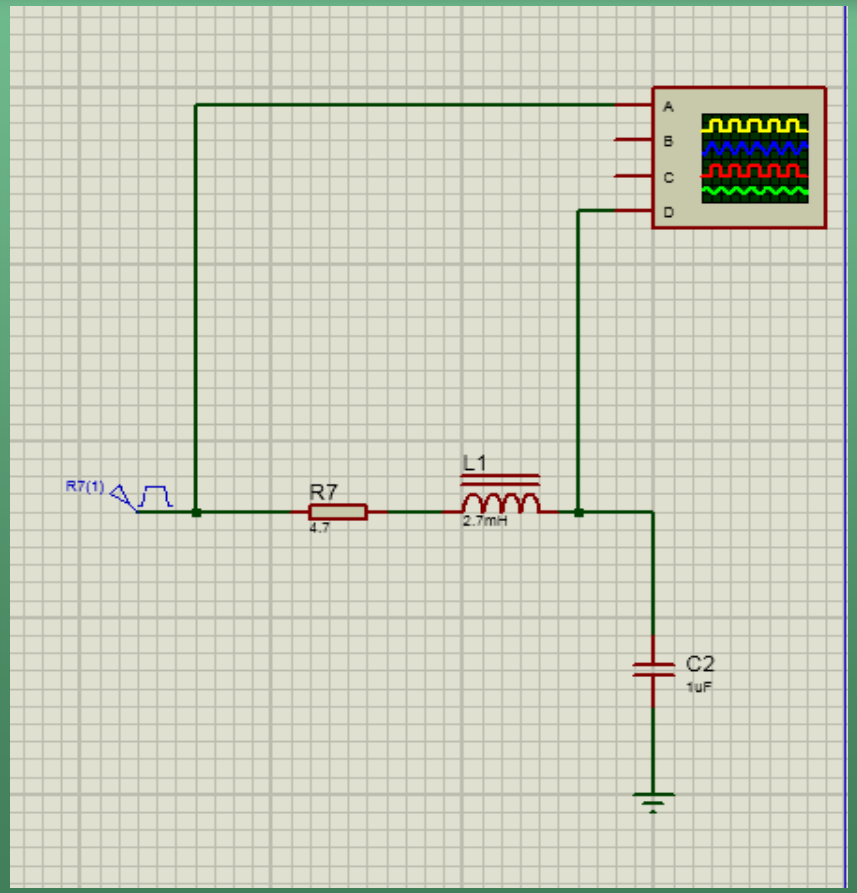
Given RLC Circuit:

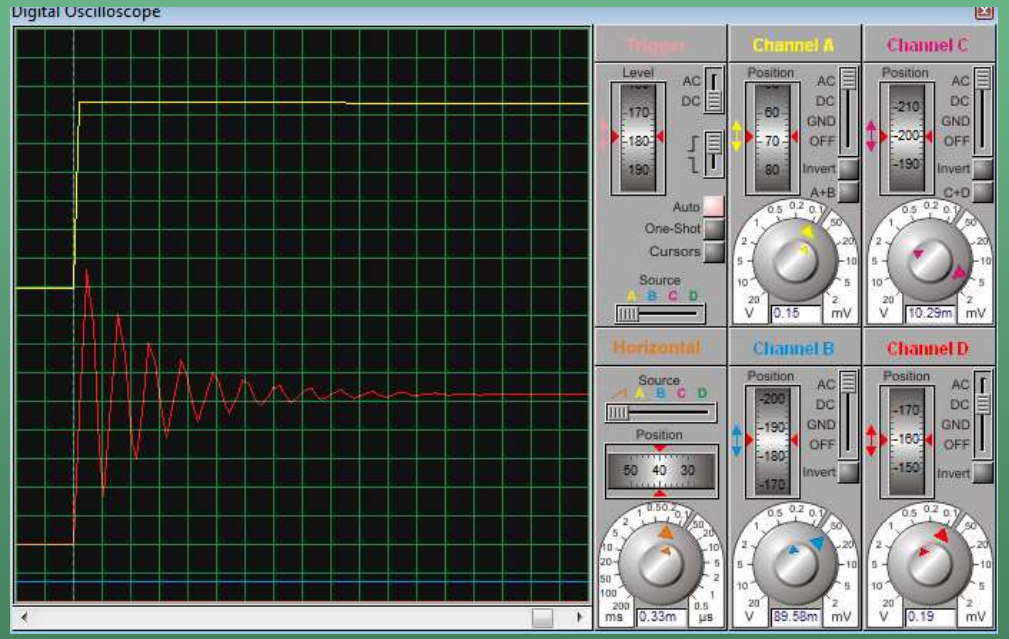


Procedure:

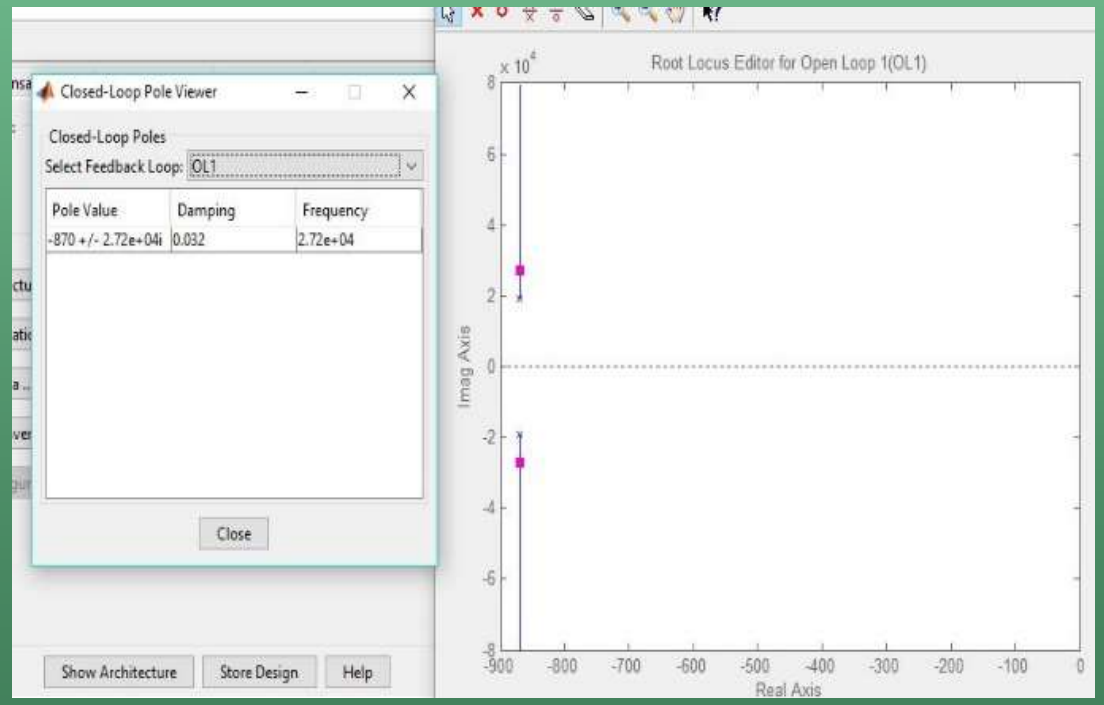
1. Using SISO Design tool, create the design for a unity negative feedback system with G(s) and plot the root locus.
2. Draw the zeta line for required overshoot. Select the closed-loop pole at the intersection of shadowed region and the root locus.
3. Calculate the imaginary part, ωd and real part, σd of the compensated dominant pole from the two-third value of uncompensated peak time and half of uncompensated settling time.
4. Find the Zc by calculating the pole angle.
5. Put the value of Zc in pole/zero .

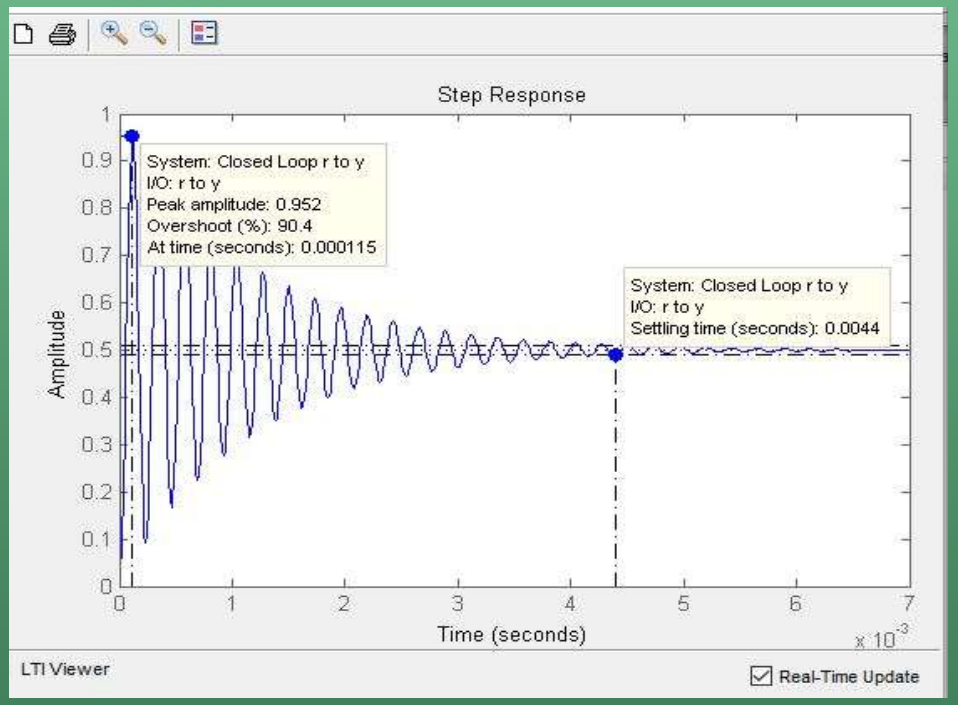
Uncompensated In Proteus :





Uncompensated In MATLAB:





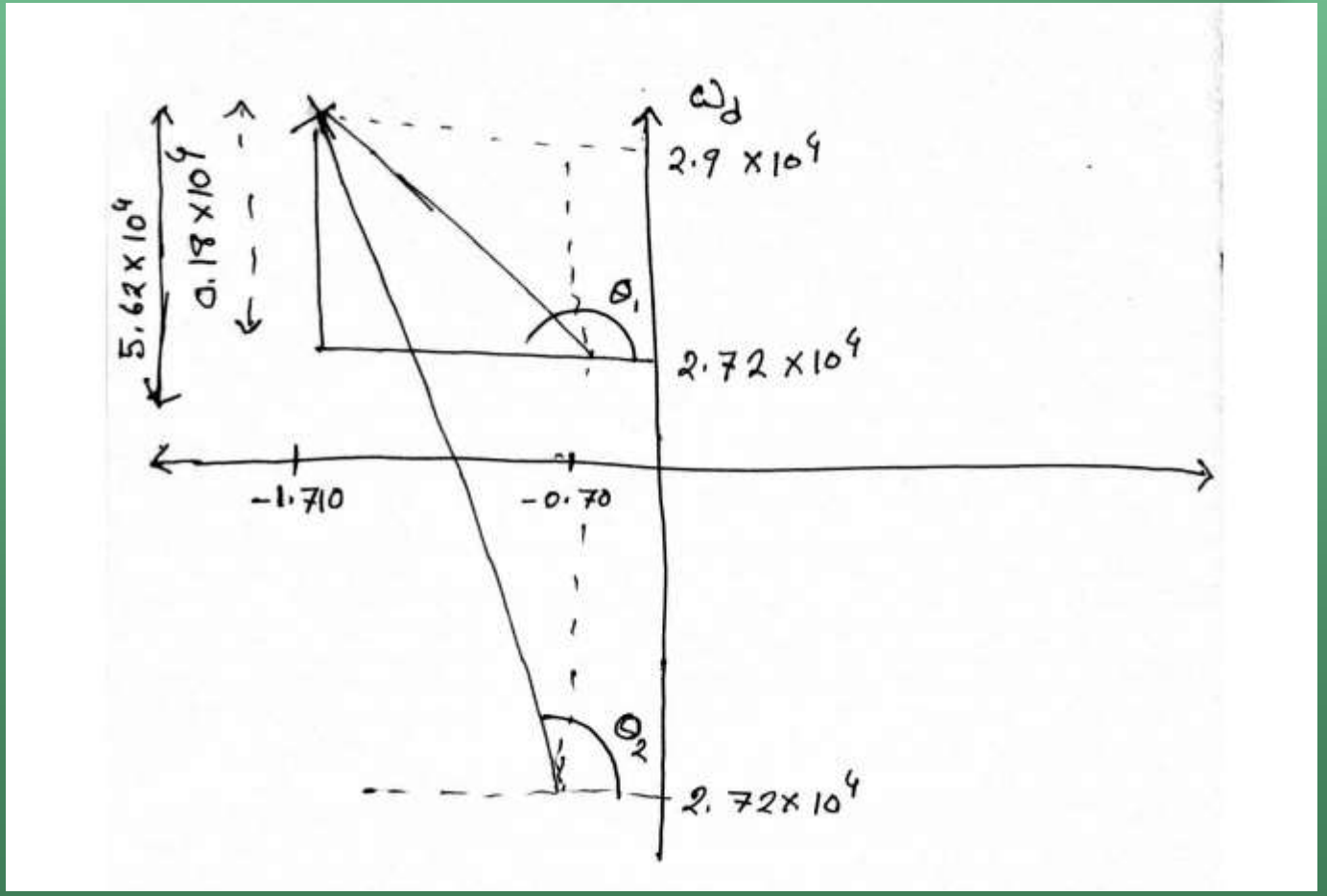
Uncompensated-Compensated(Calculation):

$$G_p = \frac{\frac{1}{LC}}{s^2 + \frac{R}{L}s + \frac{1}{LC}}$$

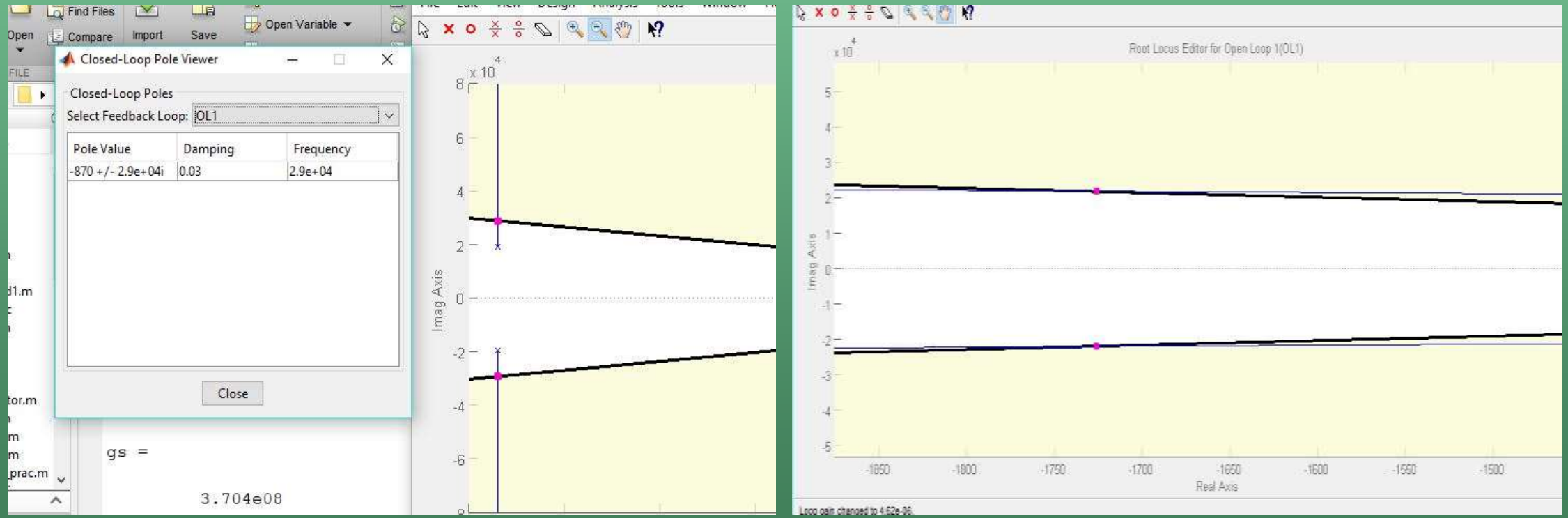
Same Over Shoot

$$Maintain\ Pick\ Time\ \frac{T_p}{2}$$

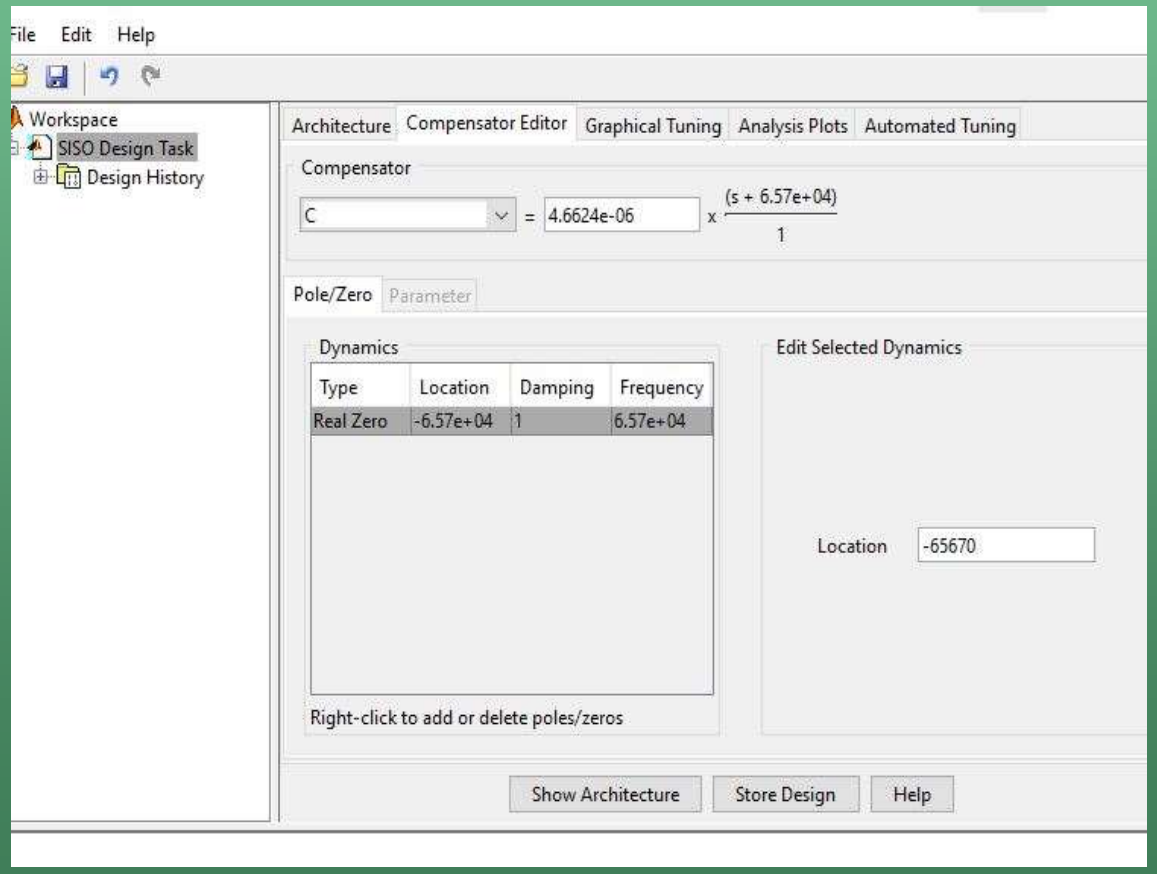
$$\theta_1 = 113.51^0$$
$$\theta_2 = 90.83^0$$
$$\theta_{zc} = 24.4^0$$
$$z_c = 65670.15$$

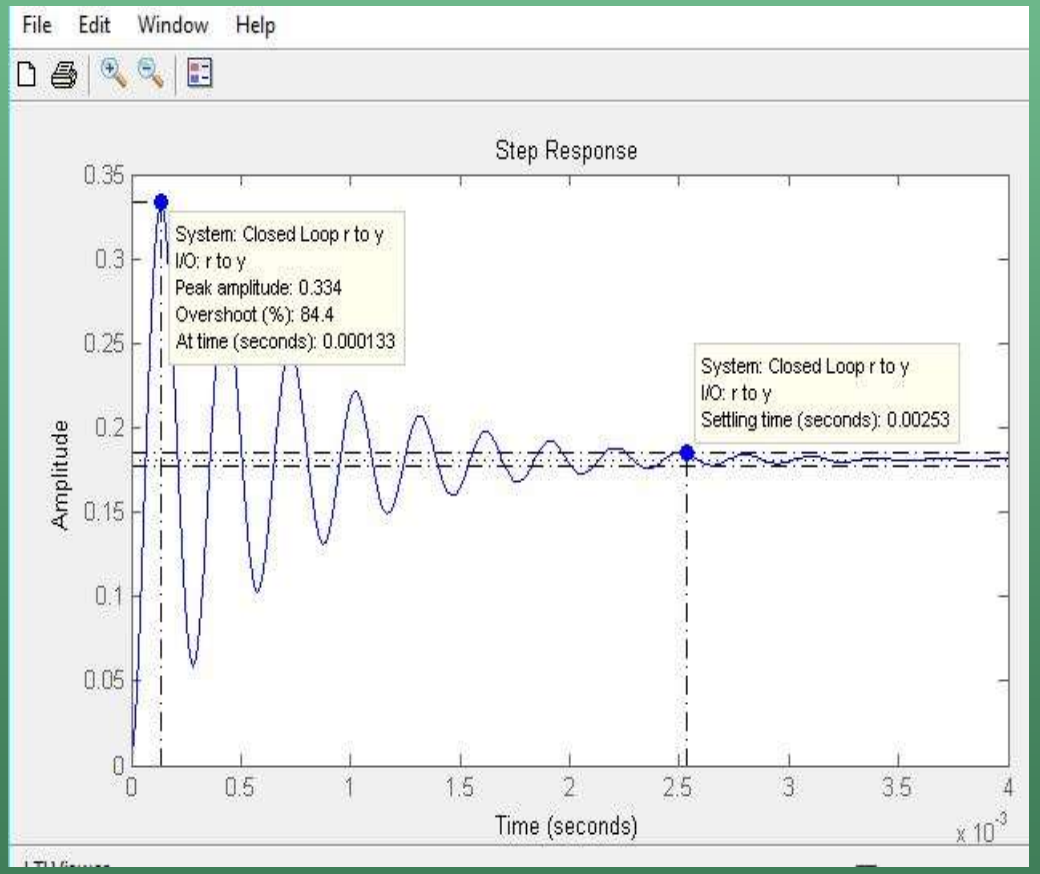


Compensated In MATLAB:



Compensated In Matlab:



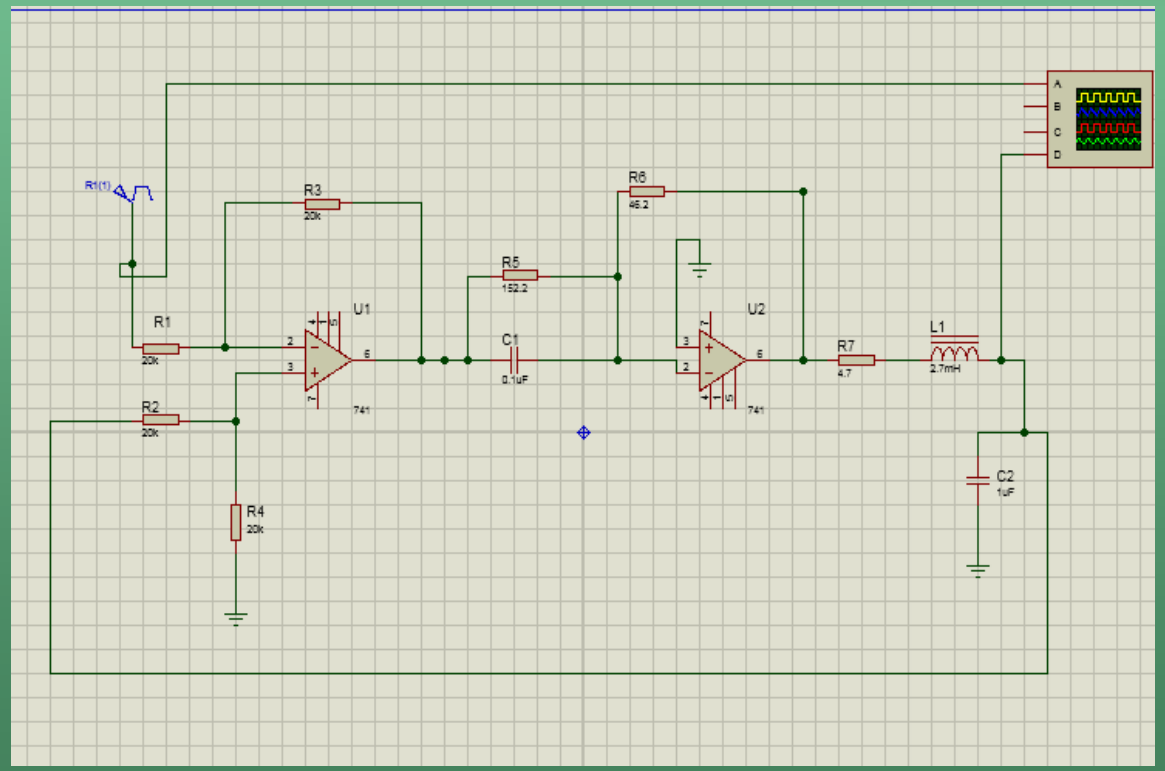


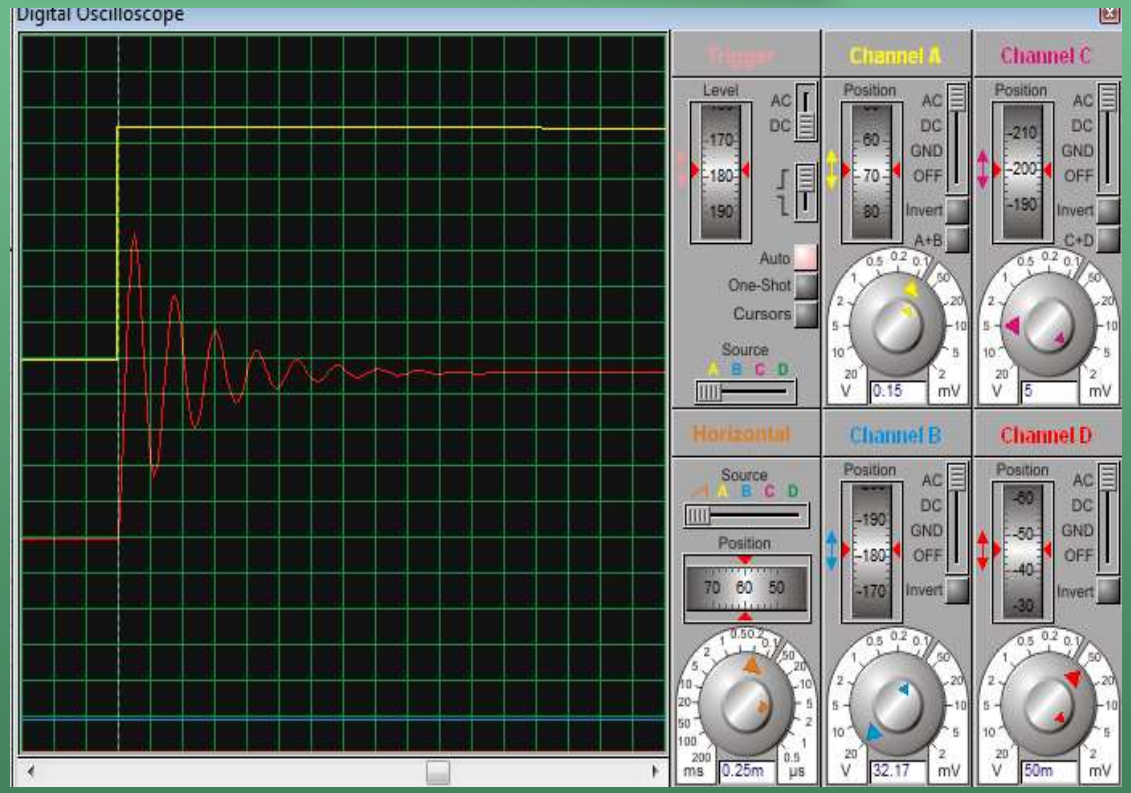
Design pd :

- **PD=K(S+Zc) = $R_2C(s+1/R_1C)$**
- **K=4.66*10^-6** (from matlab)
- **Zc= 65670.15** (from hand calculation)

- 1/R1*c=Z c=65670.15 Let, C=0.1uF R2*C=4.66*10^-6
- R1=1/(C*Zc) =152.2ohm ohm R2=46.25

Implement Circuit In Proteus:






Thank you!
grammarly