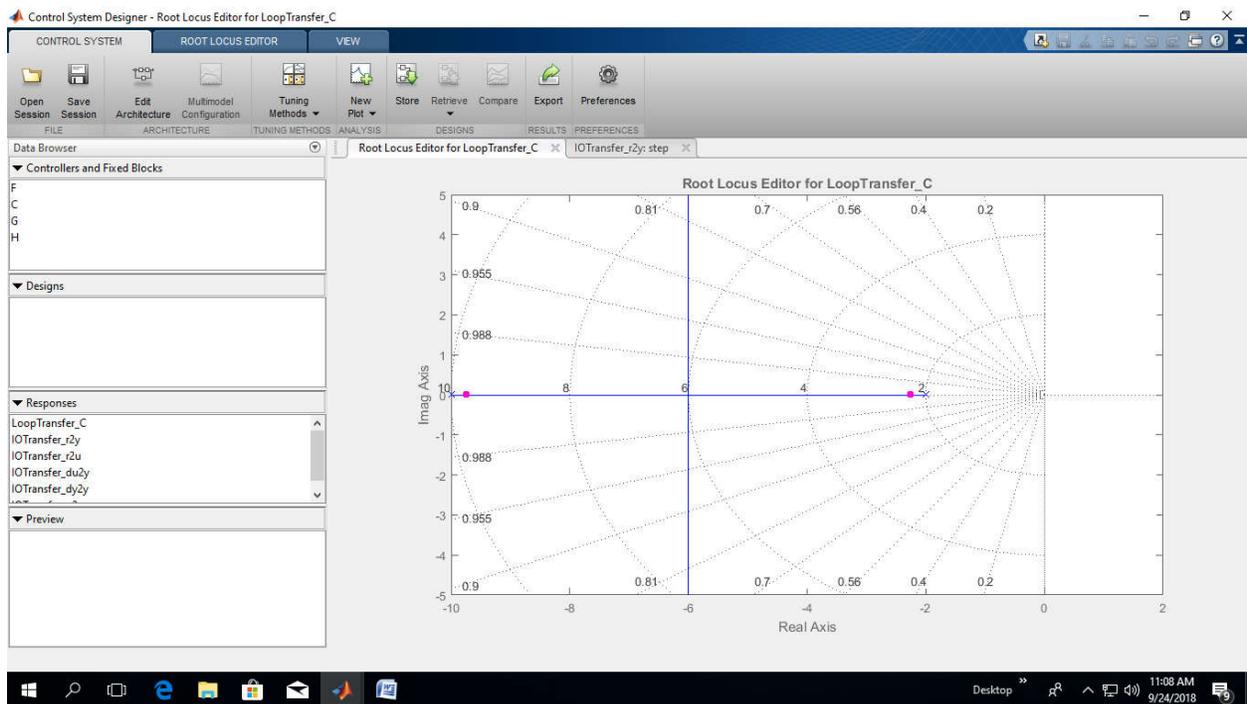


1. Run the following code

```
j=0.01;  
b=0.1;  
K=0.01;  
R=1;  
L=0.5;  
s=tf('s');  
p_motor=K/((j*s+b)*(L*s+R)+K^2);  
sisotool('rlocus',p_motor);
```

2. Right click on Root locus plot > click **Grid**

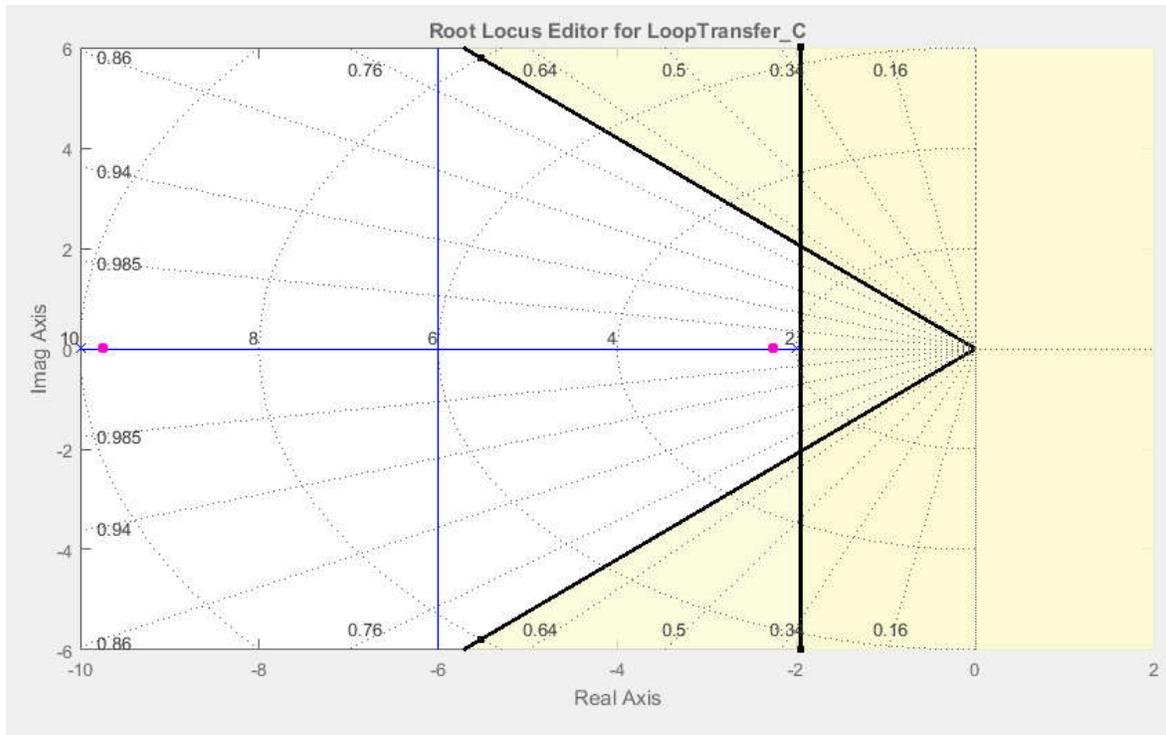


Requirements:

- a) Settling time < 2 sec
- b) Overshoot < 5%
- c) Steady-state error < 1%

3. Right-click on Root locus plot>Design Requirements>New>Settling time>2>ok

4. Right-click on Root locus plot>Design Requirements>New>Percentage overshoot>5>ok



5. Hold any one of the pink dots (closed loop poles) and drag it to the location $-6+j2$. While holding the dot, current location, damping and natural frequency will be shown at the bottom of the figure.
6. Go to **Data Browser** window> Click on **C**> See the value of **C** in **Preview Window**. **C** is the constant gain **K** that is needed to be applied to obtain the required settling time and maximum overshoot.
7. Go to **IOTransfer_r2y:step** window to observe the step response of the closed loop system. It will show that the settling time and overshoot requirements are met well.
8. Now, to reduce the steady state error, we need to add a lag compensator.
9. Click **Preferences** tab> **Options**> Choose zero/pole/gain
10. Right click on the white space of root locus> Click **Edit Compensator**
11. In the **Compensator Editor** window, right click on **Dynamics**> Add pole/zero>lag
12. Choose the line inside the Dynamics

13. Go to **Edit Selected Dynamics** window. Put Real Zero = -1 and Real Zero = -.01
14. Go to IOTransfer_r2y:step and you will see that even though the steady state error requirement is fulfilled, settling time is again increased.
15. To bring the settling time within the range of 2 sec, you will have to increase the gain by moving the dominant poles further.
16. Go to root locus plot> Right click on it> Properties> Limits> change imaginary axis limit from -15 to 15.
17. Pull the closed loop pole (Pink) to increase the gain and hence to reduce the settling time.
18. At about 42 gain, all the requirements will be fulfilled.

