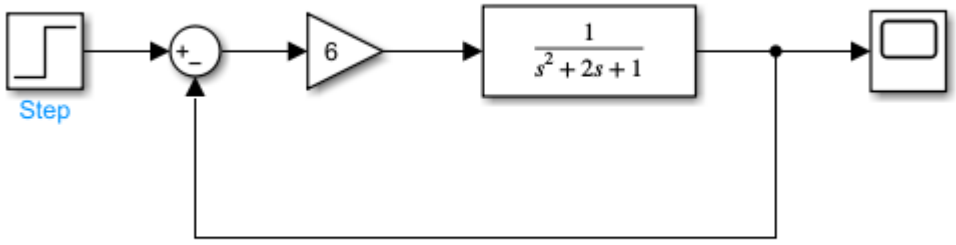
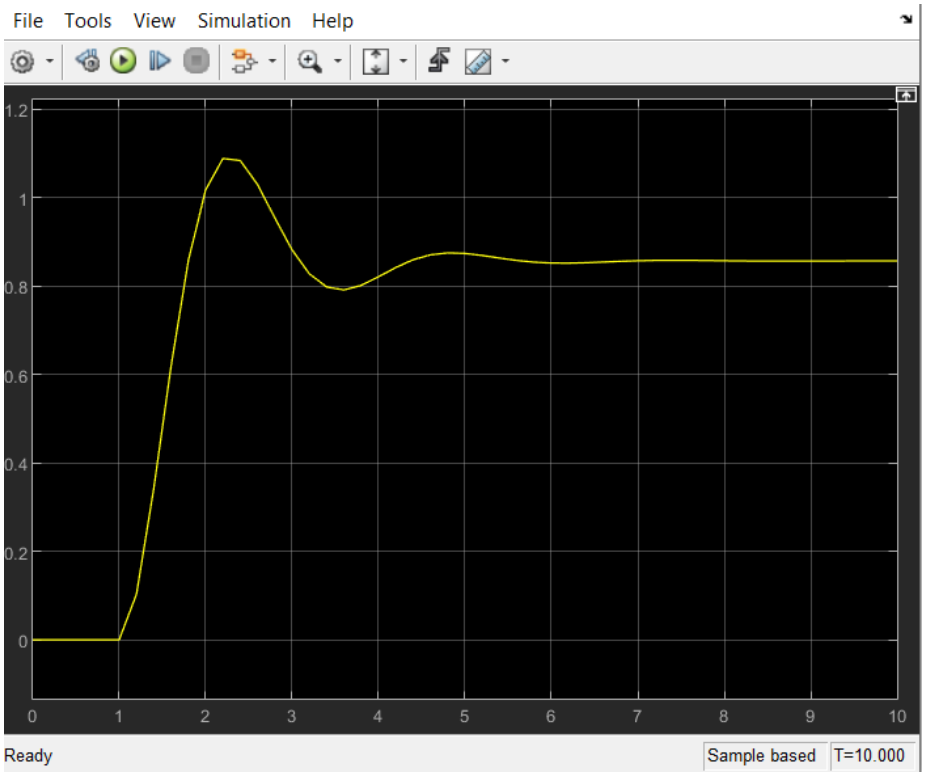
Lab 4: Practical Demonstration of P, I, and PI Controllers

Part 1: P-Controller

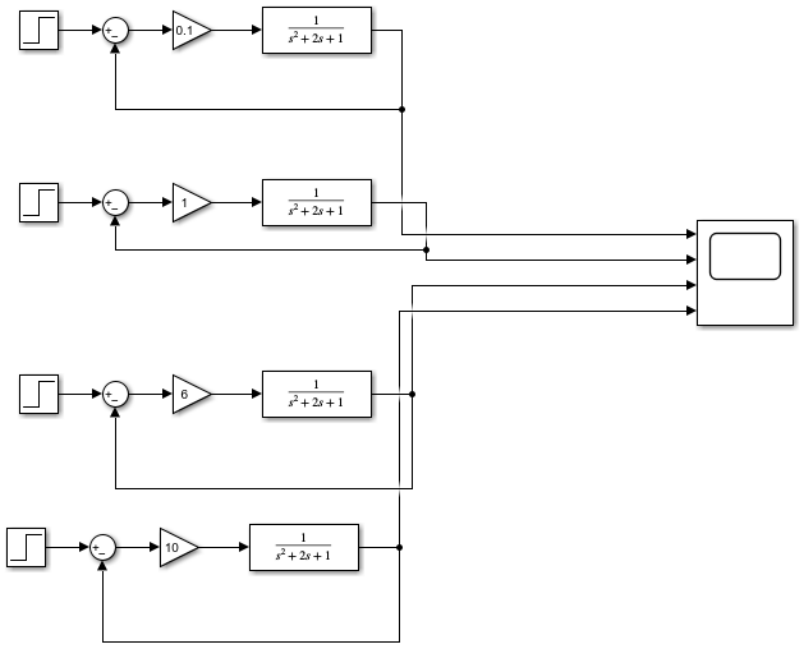
Simulink model:



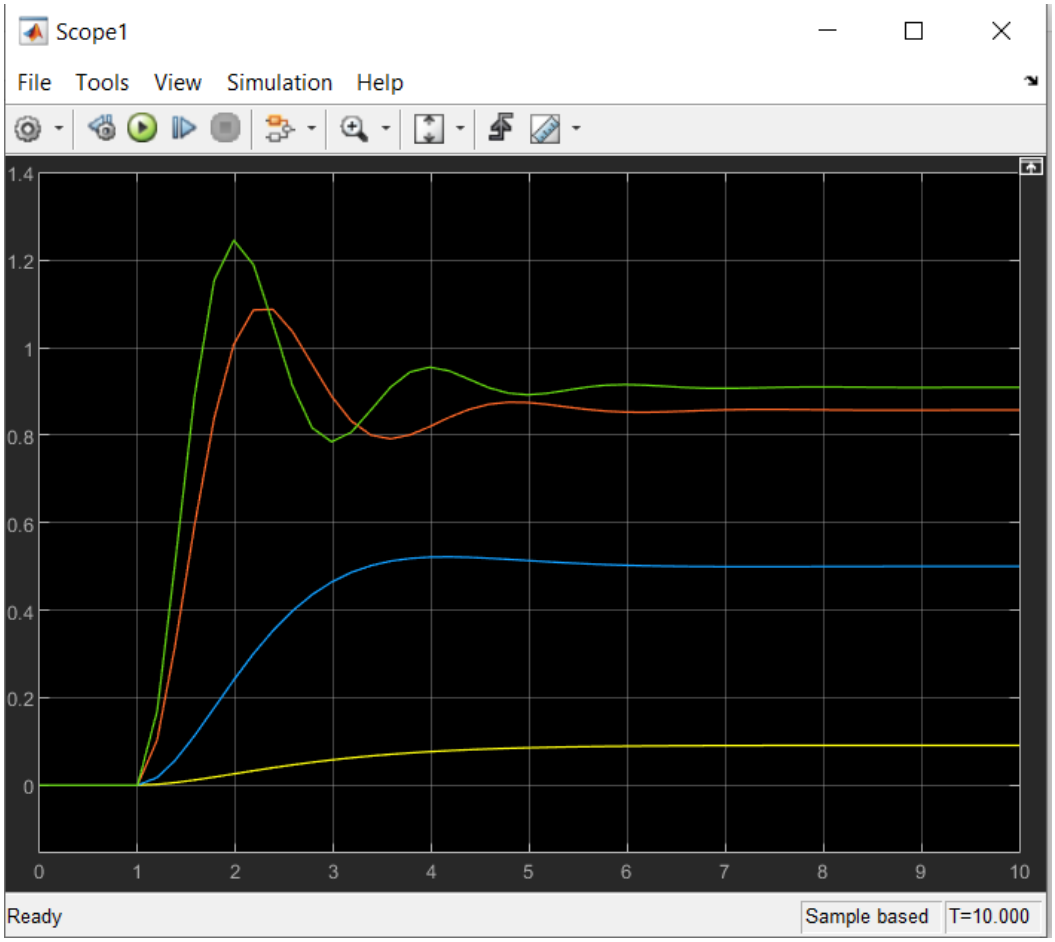
After adjusting the proportional gain (Kp) in the P-Controller:



Running simulations with different Kp values:

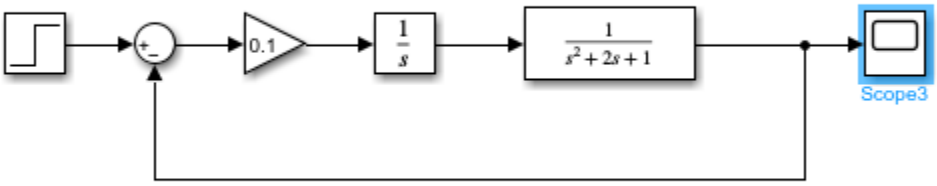


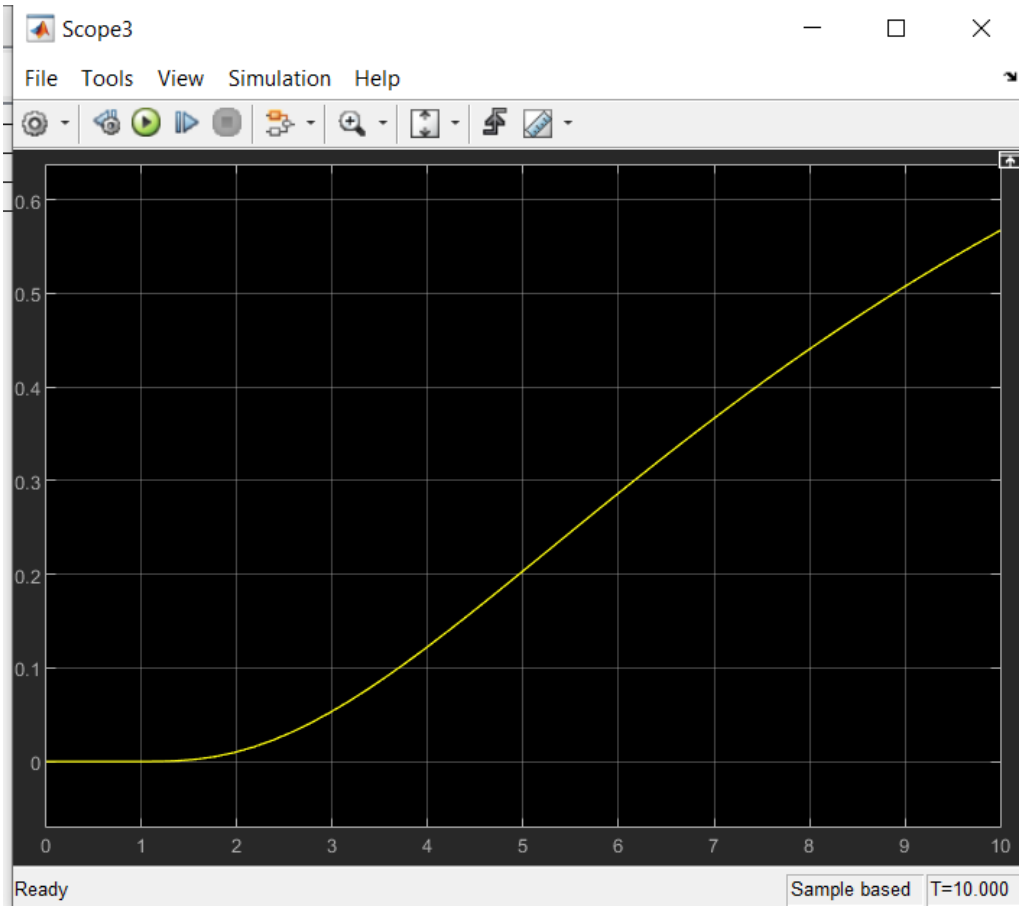
As the proportional gain increases, the system response becomes faster; however, beyond a certain value of Kp , the system begins to exhibit overshoot.



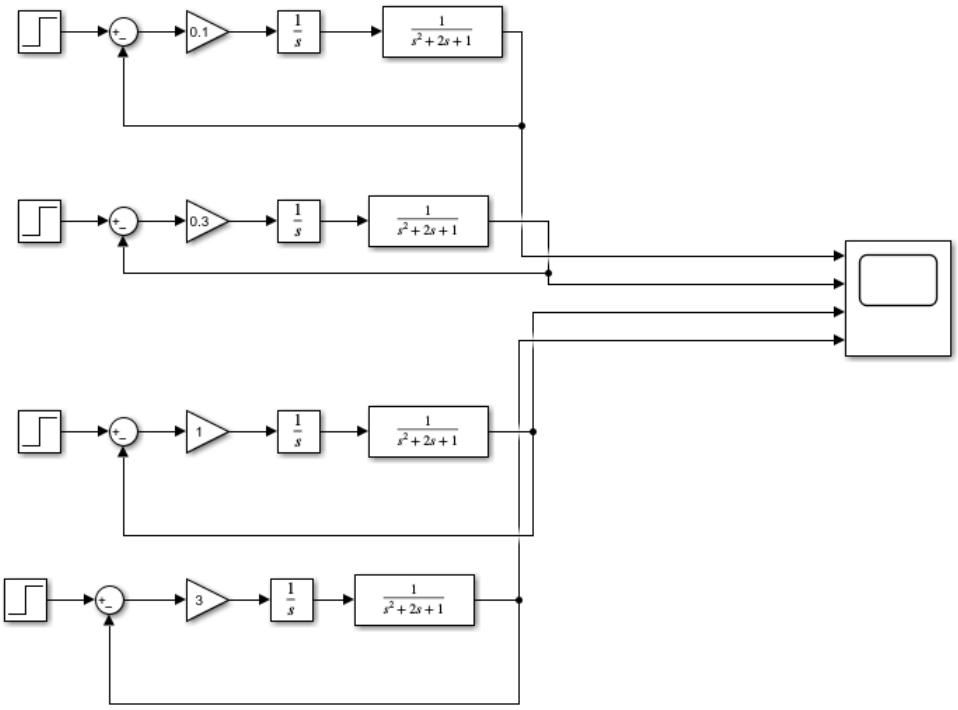
Part 2: I controller

Simulink model:

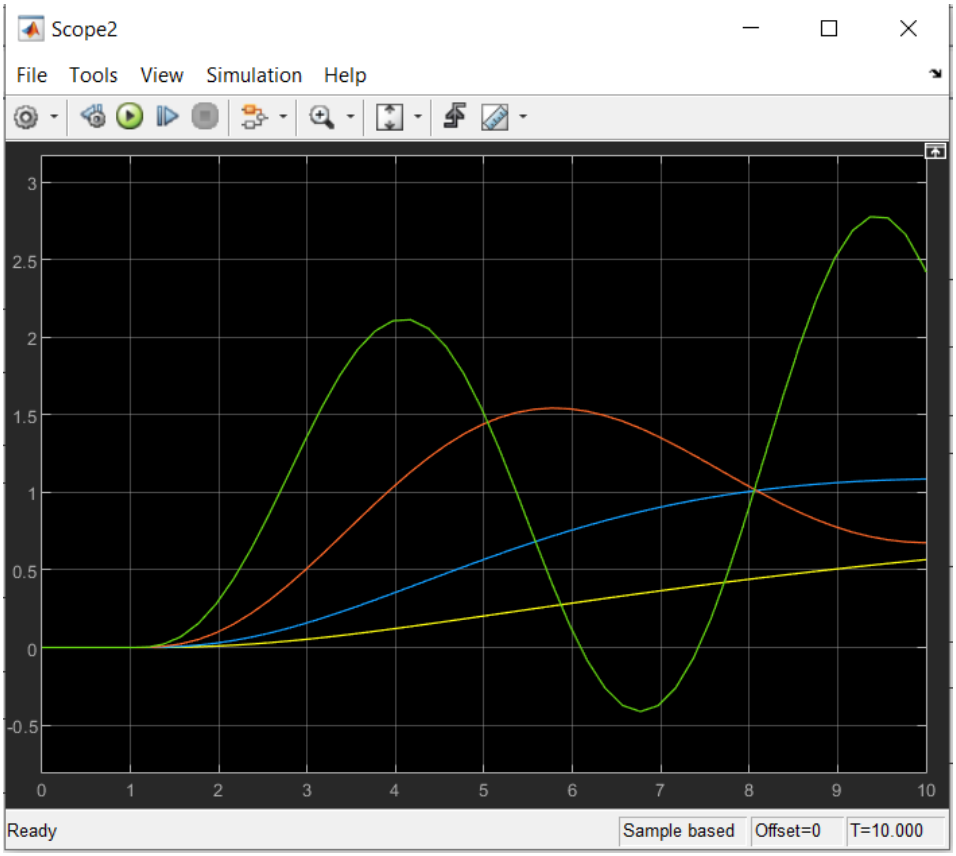




Running simulations with different Ki values:

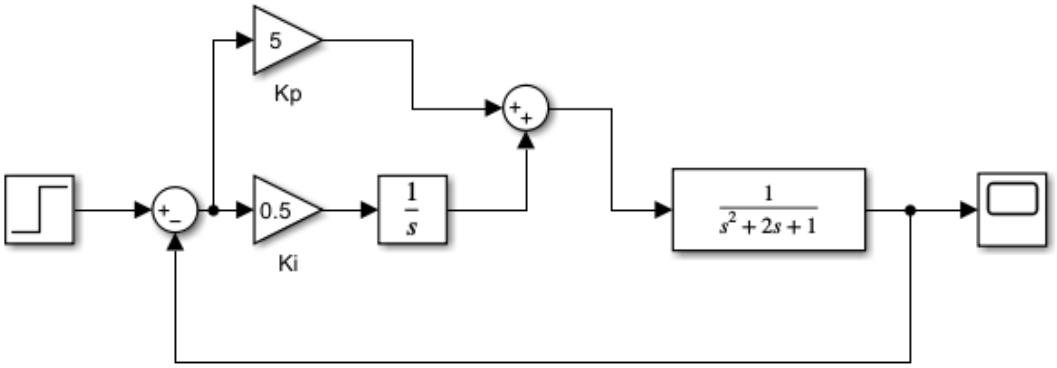


As the Ki increases, the oscillations and overshoot increase.

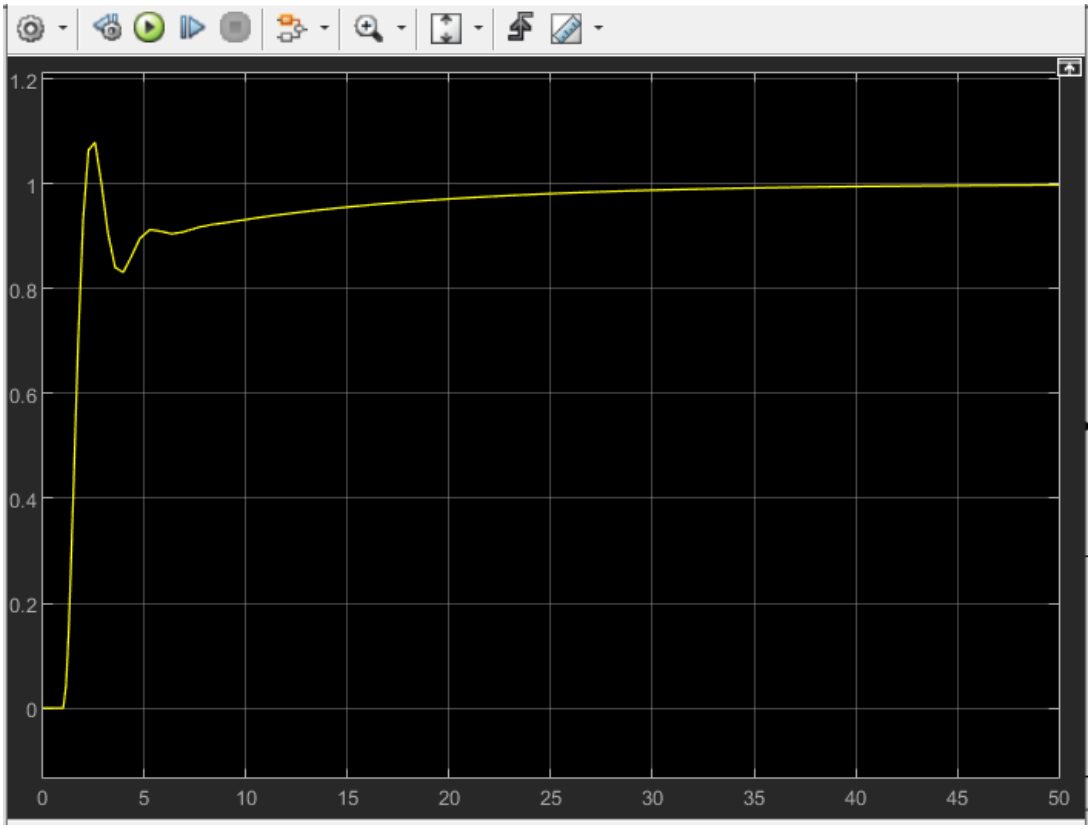


Part 3: PI-Controller

Simulink model:

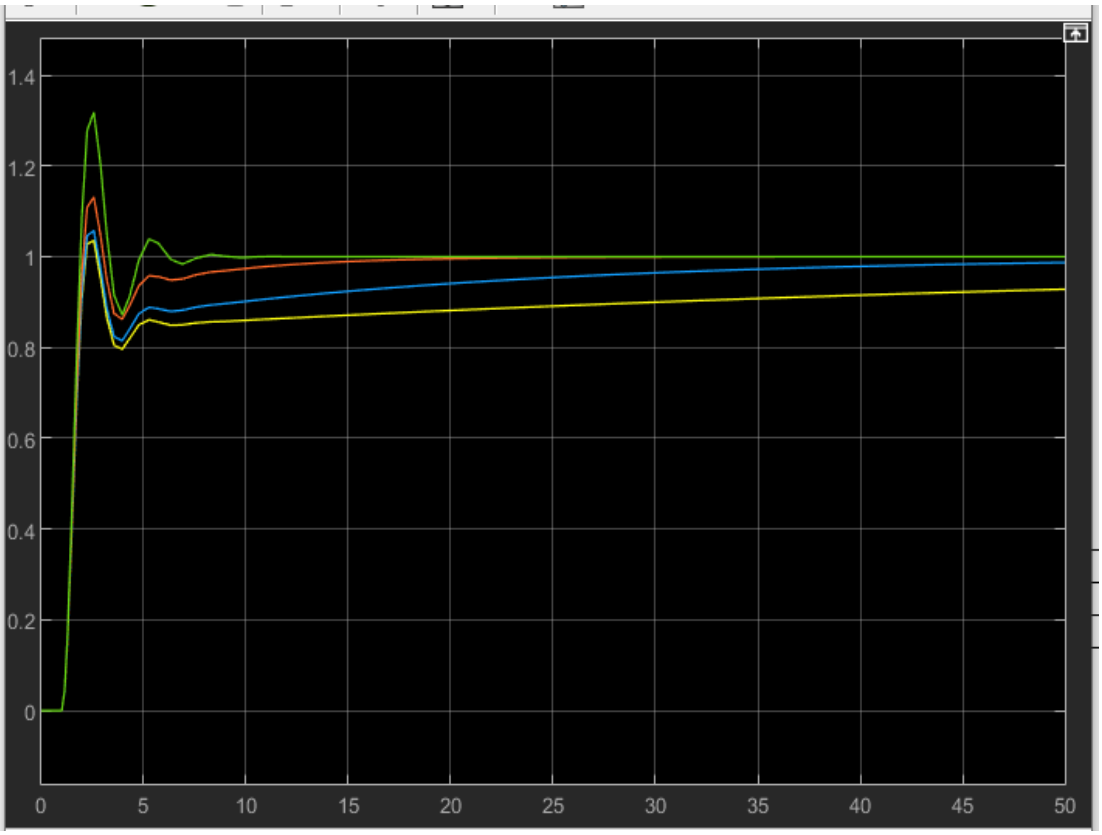


The system Response:

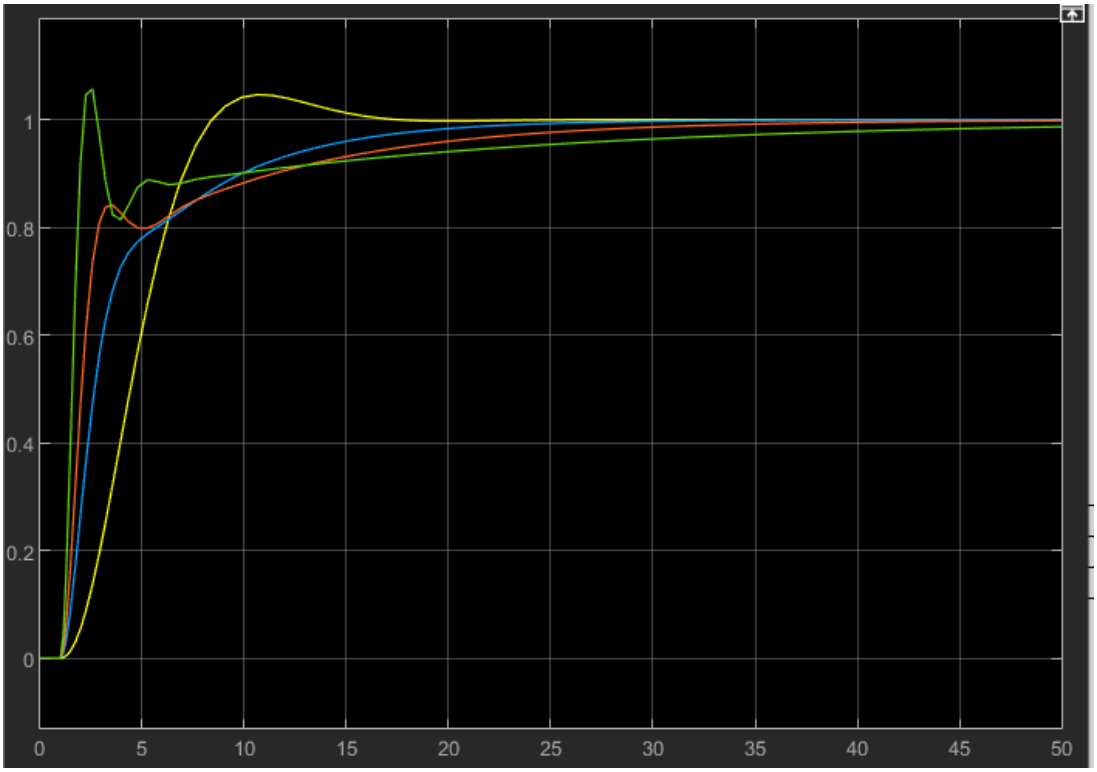


Running simulations with different Ki and Kp values:

With different Ki Values:



With different Kp Values:



Conclusion:

The P-Controller makes the system faster but leaves some steady-state error. The I-Controller removes steady-state error but causes more oscillations. The PI-Controller combines both actions, giving a faster response while also eliminating steady-state error, making it more balanced overall.