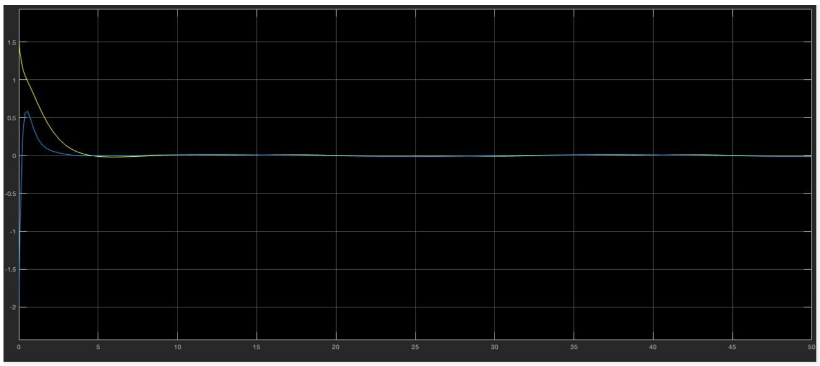
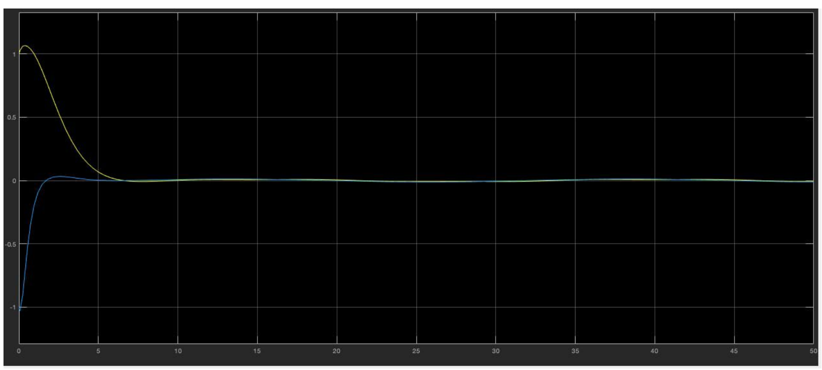
Question 1)

i) k = 1, alpha = 1

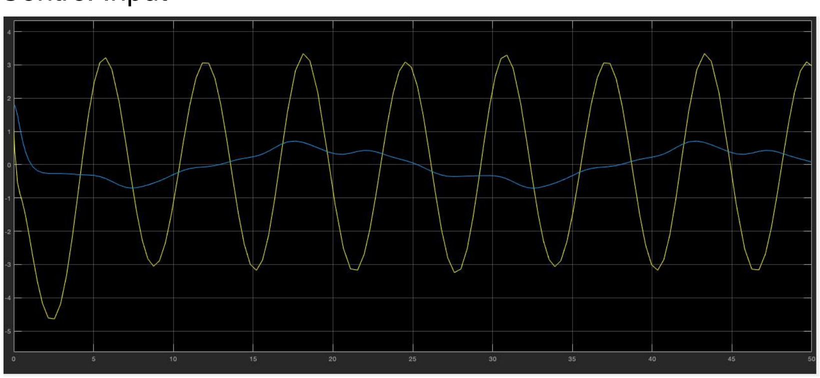
Tracking Error



Filter Tracking Error

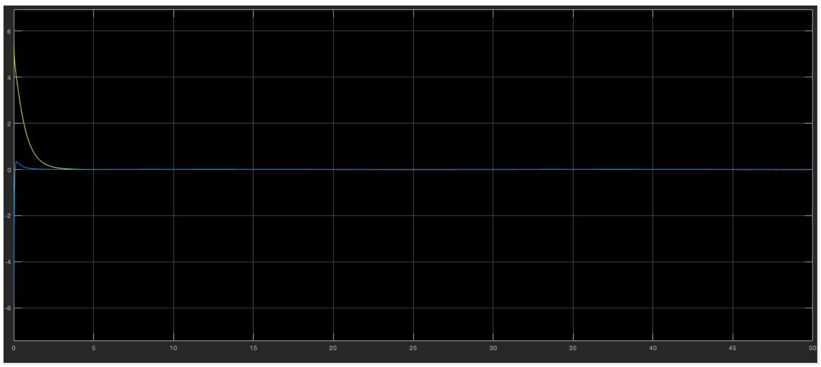


Control Input

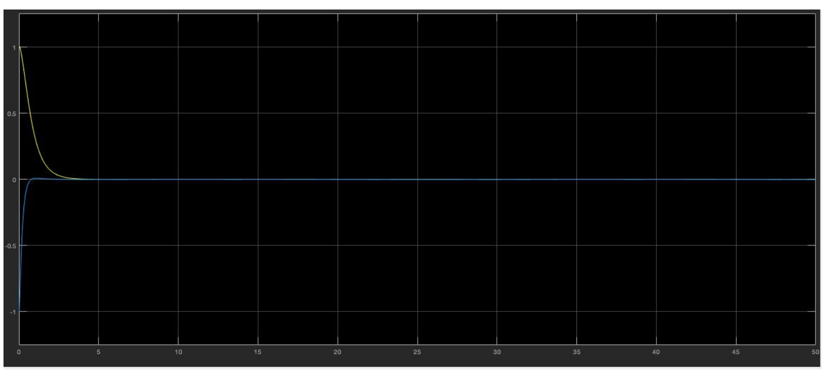


ii) k = 5, alpha = 5

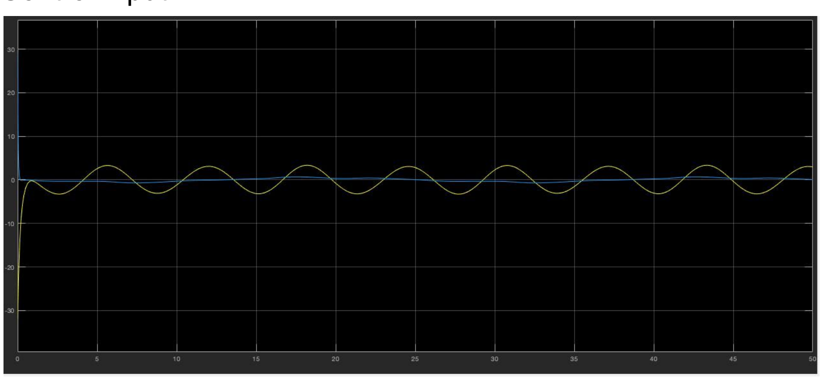
Tracking Error



Filter Tracking Error

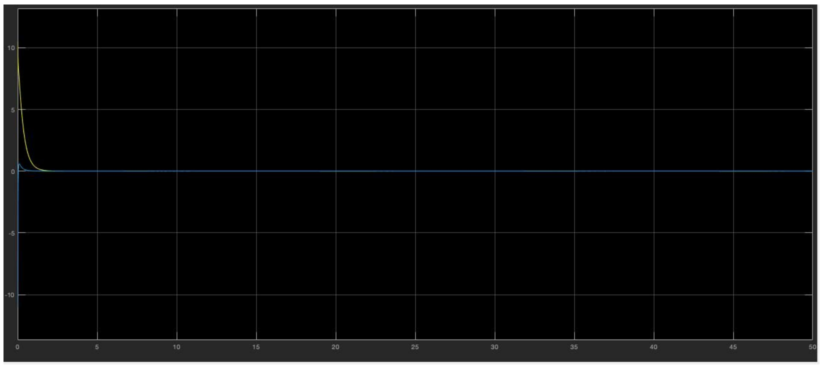


Control Input

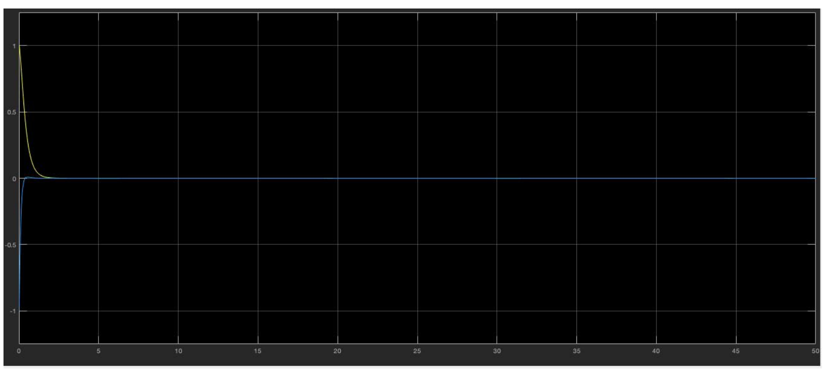


iii) k = 10, alpha = 10

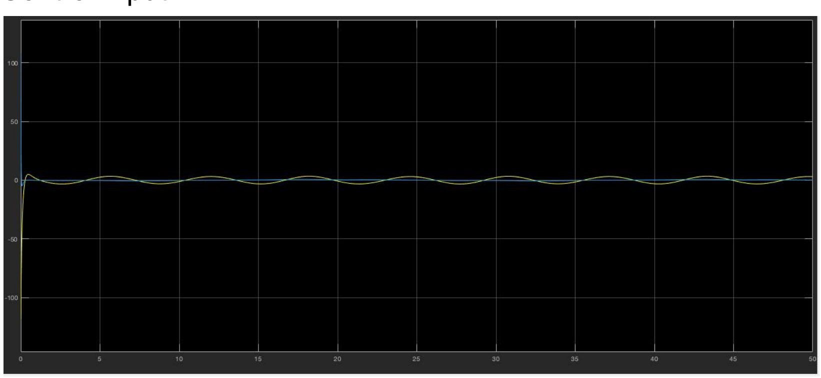
Tracking Error



Filter Tracking Error



Control Input

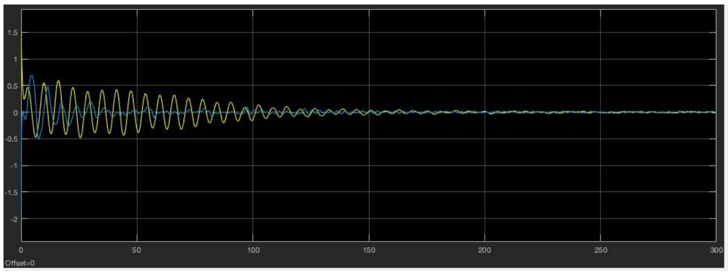


As the value of k and alpha increases, the time of convergence decreases (tracking and filter tracking error converges to zero) and the control input required also decreases. Hence, with increase in k and alpha, the performance improves.

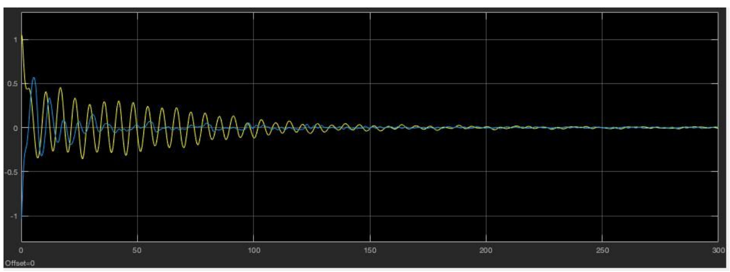
Question 2)

i) k = 1, alpha = 1, gamma = I5

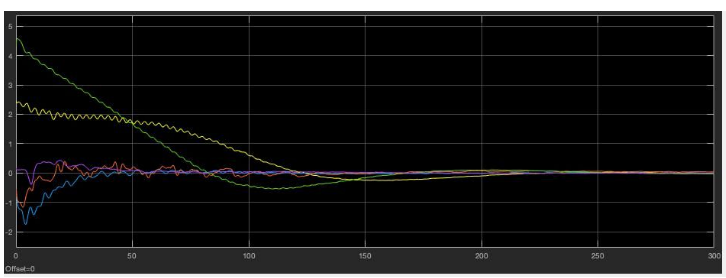
Tracking Error



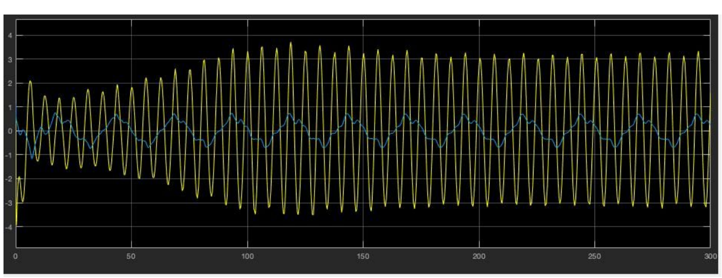
Filter Tracking Error



Parameter Estimation Error

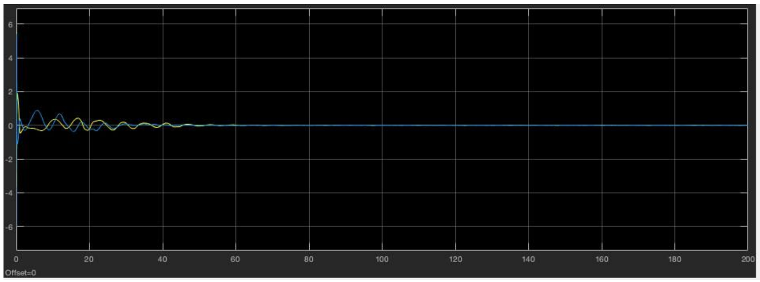


Tau

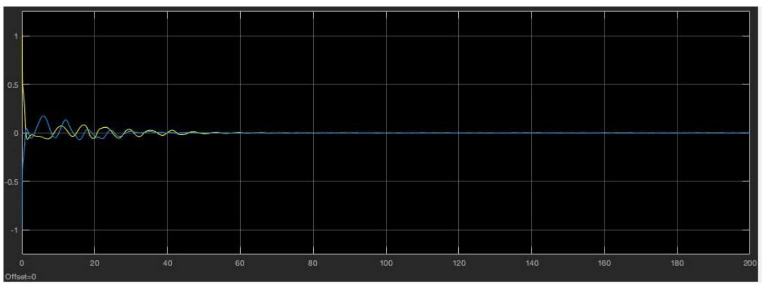


ii) k = 5, alpha = 5, gamma = 5xI5

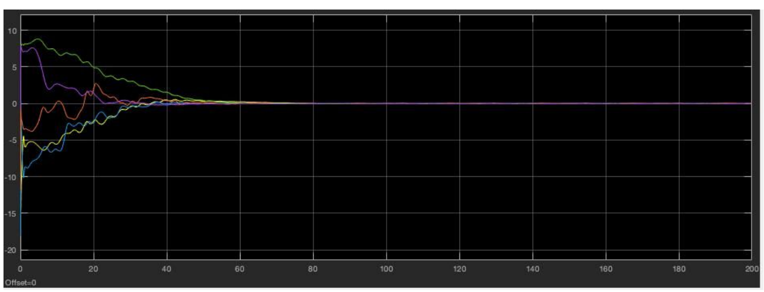
Tracking Error



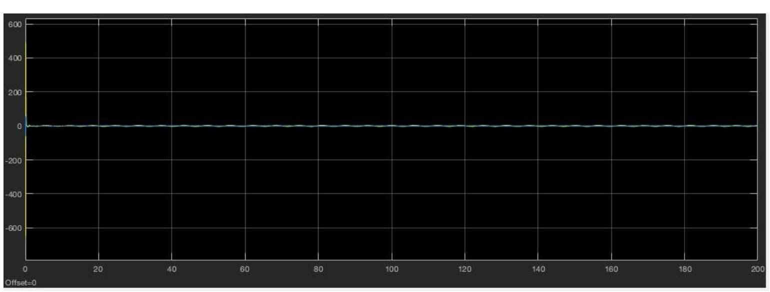
Filter Tracking Error



Parameter Estimation Error

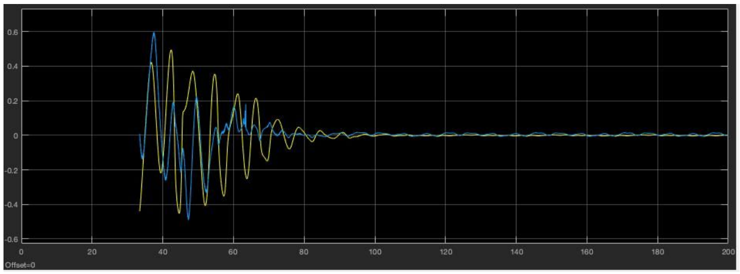


Tau

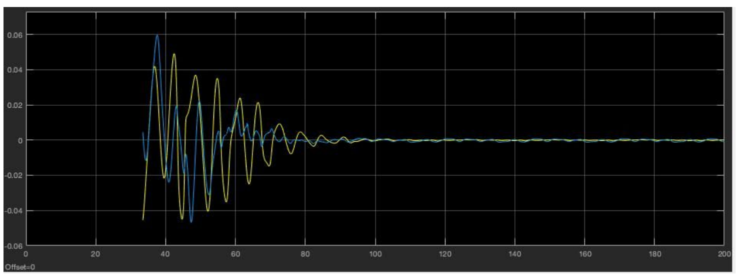


iii) k = 10, alpha = 10, gamma = 10xI5

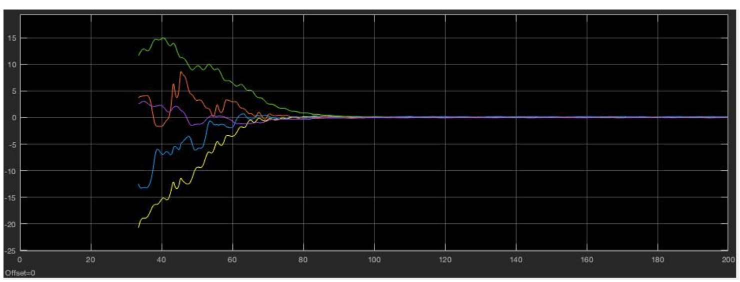
Tracking Error



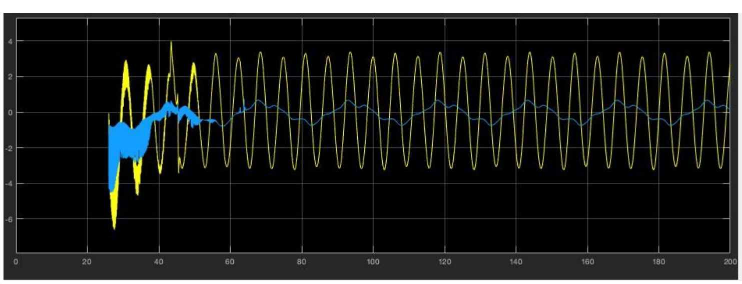
Filter Tracking Error



Parameter Estimation Error



Tau



Speed of convergence of error is fastest in case where k=5, alpha=5 and gamma = 5xI5, and control effort requirement is also minimum in that case (can be seen by plotting Tau using another scope). It is not always true that increasing k, alpha and gamma will result in improvement in performance as we can see in this case in part iii, the required control input (Tau) is very high a some moments (due to jittering) while it is very low throughout part ii. The speed of convergence is slowest in part i.
Hence, the performance is best in part ii.