Appendix

Q1. Point-to-point motion planning

Q1(a) Move a single joint robot from θ = 20 to 60 in 3 secs using the cubic polynomial.

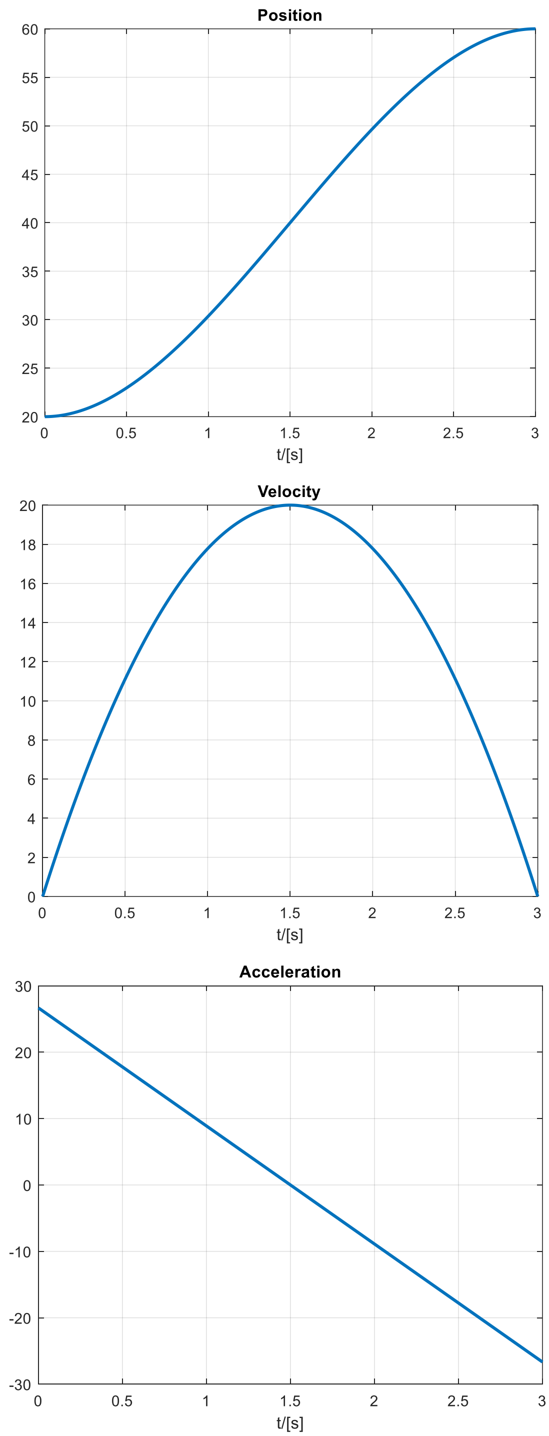

Fig. 1

Q1(b) Move the robot from θ = 5 to 95 in 1 sec and compare with Q1(a) using the cubic polynomial.

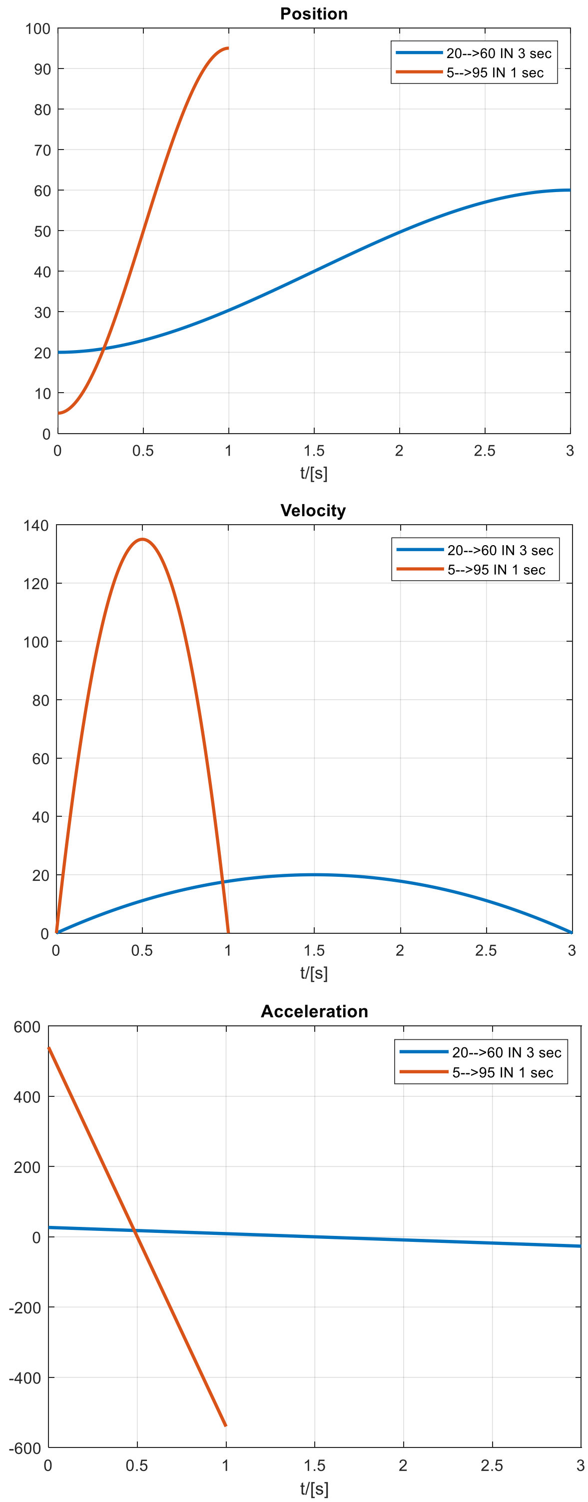

Fig. 2

Q1(c) Using the linear function with parabolic blends approach, 40 deg/s2 and 100 deg/s2 as the two different accelerations to generate the trajectories and compare with (a).

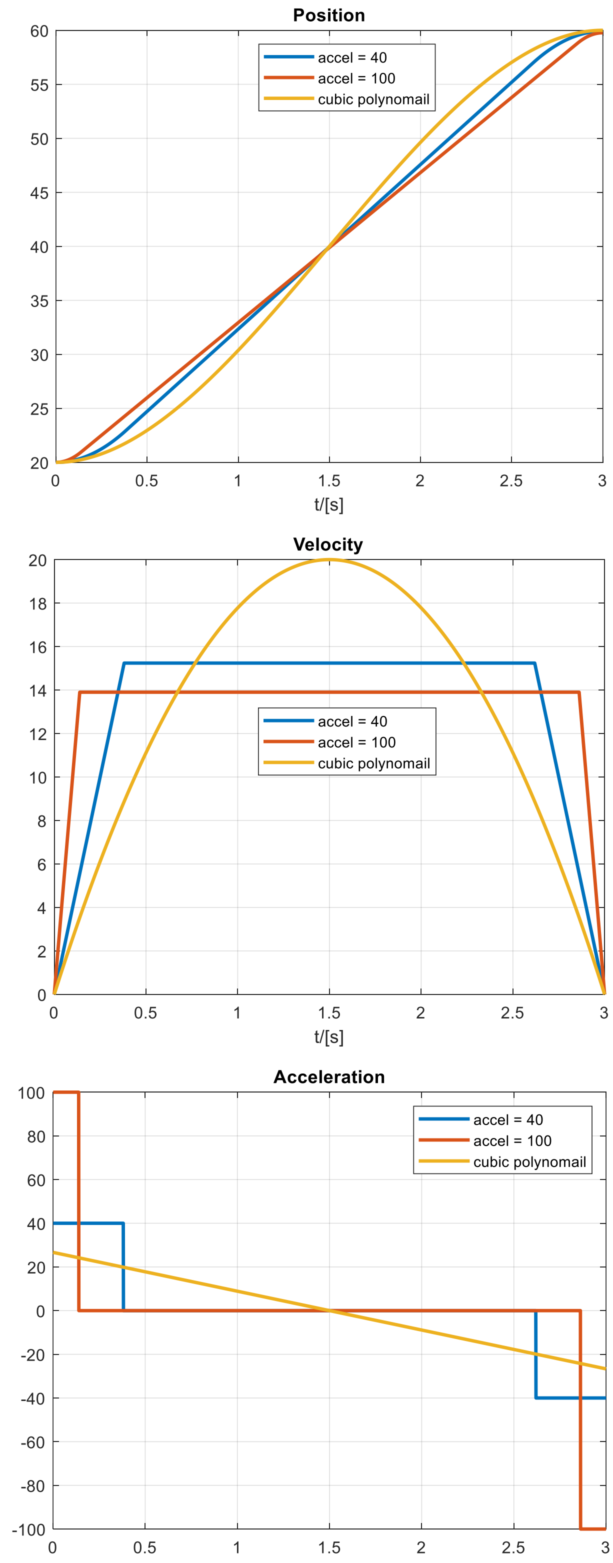

Fig. 3

Q1(d) Repeat (a) with the linear function with parabolic blends approach, choose acceleration as 20 $\mathbf{deg/}s^2$.

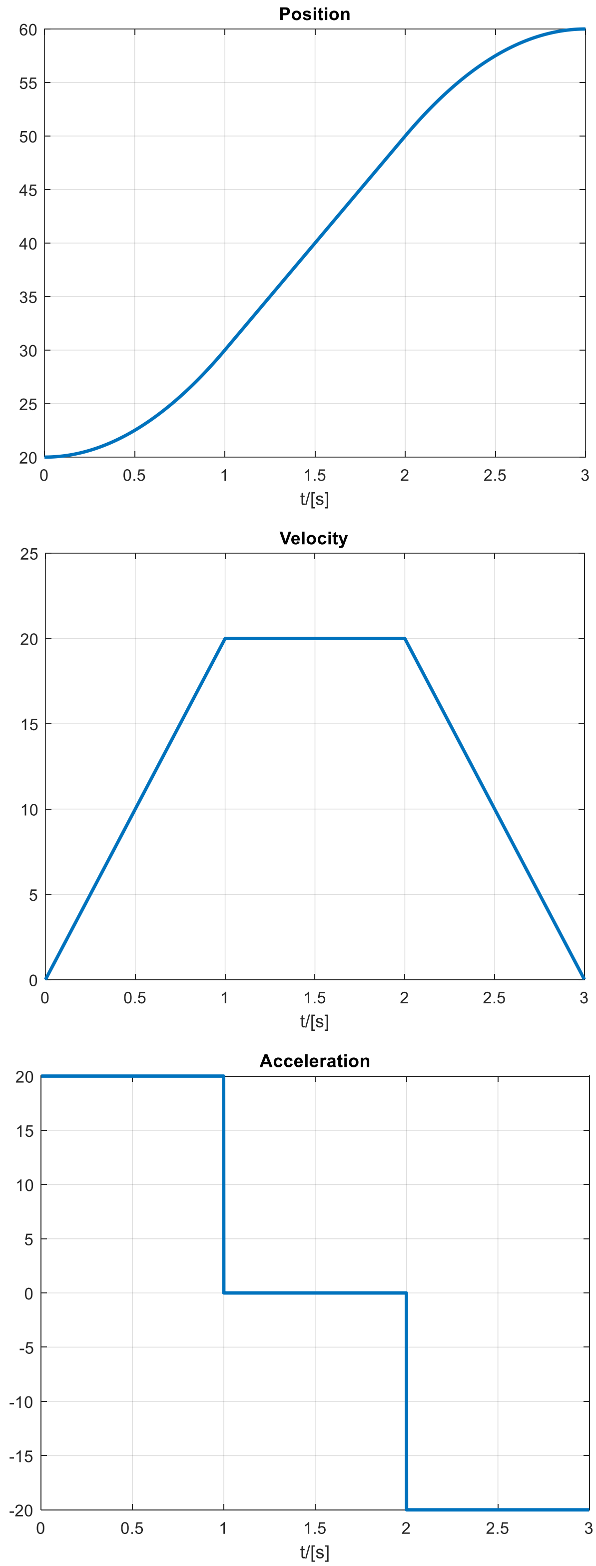

Fig. 4

Q2(c) Plot the normalized transmission ratio r^* against the normalized acceleration a^*.

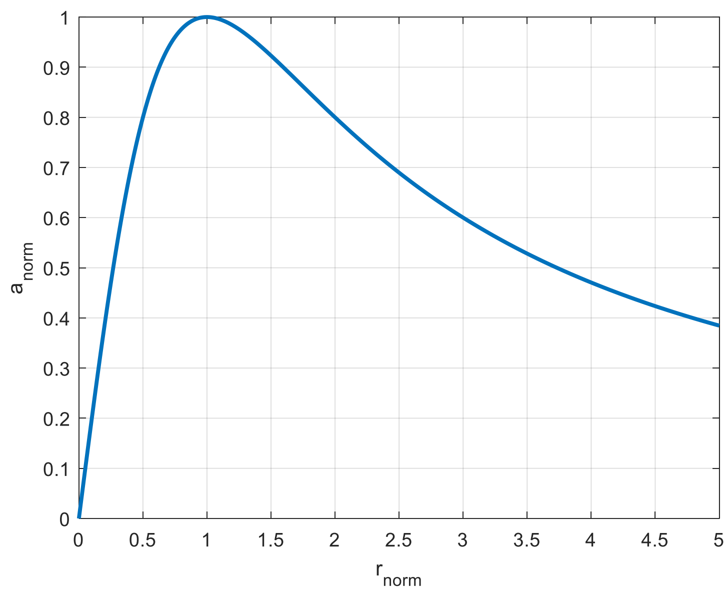

Fig. 5

Q2(c) Plot the normalized transmission ratio r^* against the normalized acceleration a^* with $M_{new} = kM$, where k = 1.25, 1.5, 1.75.

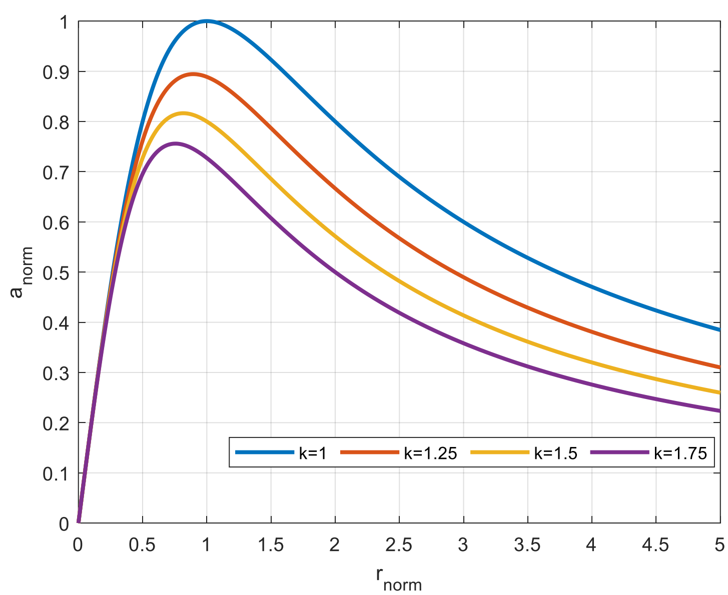

Fig. 6

Q3(b) The step response of the system is critically damped (Without a disturbance input).

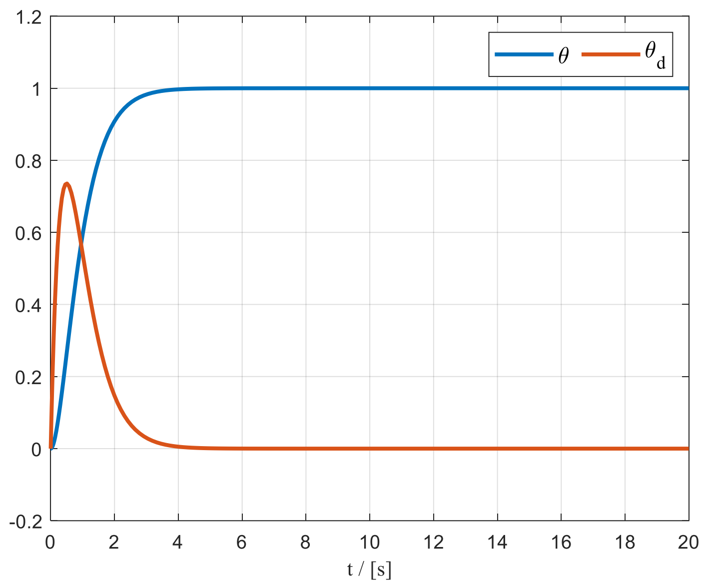

Fig. 7

Q3(c) The step response of the closed loop system with a "step" disturbance $\tau_{dist} = 0.12Nm$.

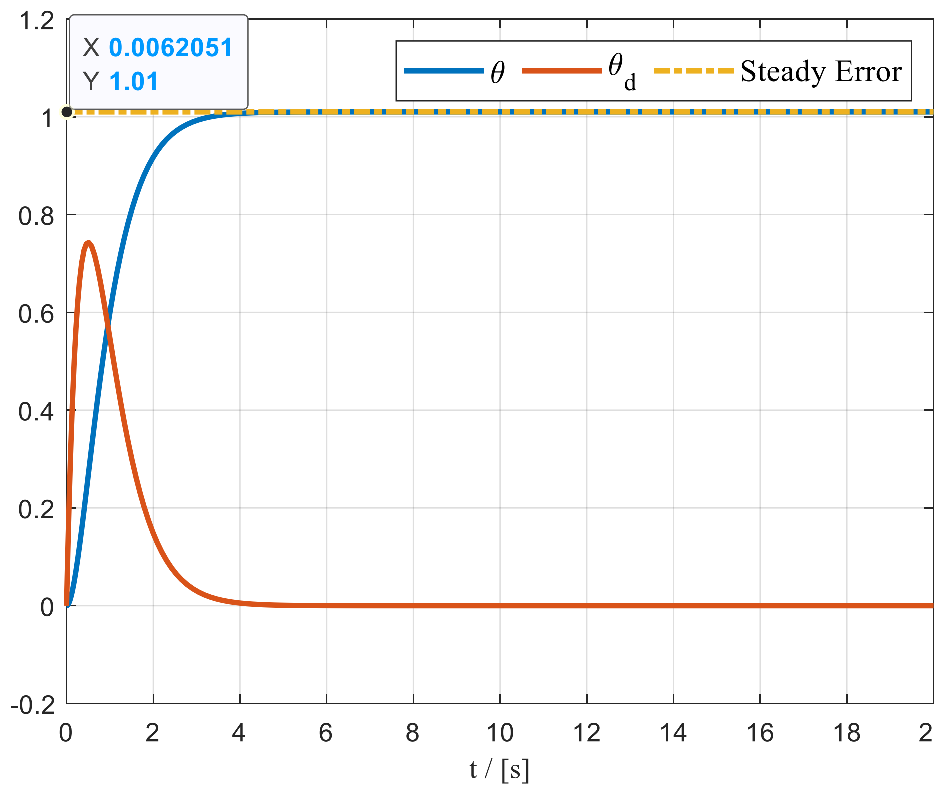

Fig. 8

So we can see that the steady error $e_s = 0.01rad$.