Question 6

LQR Controller Design and Evaluation [10]: Repeat the evaluation in (2), (3), and (5) using an LQR-based feedback controller. How does the performance differ in terms of error response characteristics?

Q2 Hover Performance

6.2.1 Below are the figures showing the actual/desired position, as well as the position error
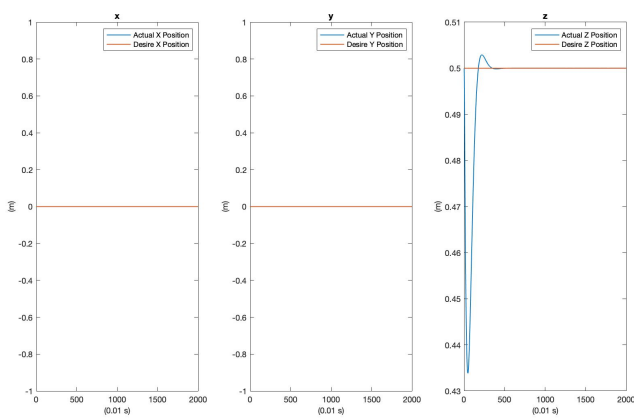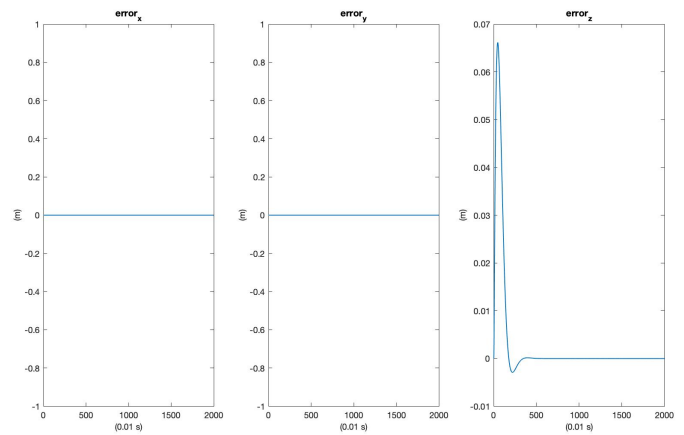

Figure 1. actual position vs desired position

Figure 2. Position Errors

Q2 X Track Performance

6.2.2 Below are the figures showing the actual/desired position, as well as the position error
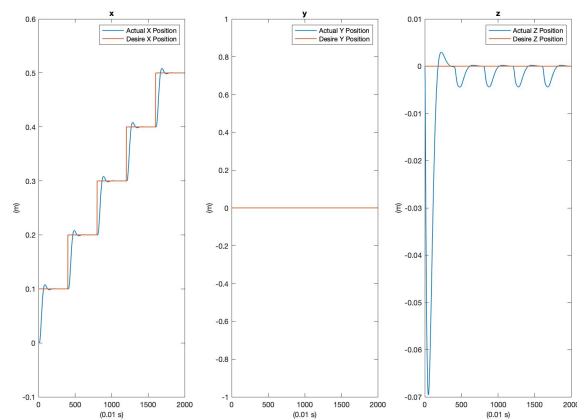

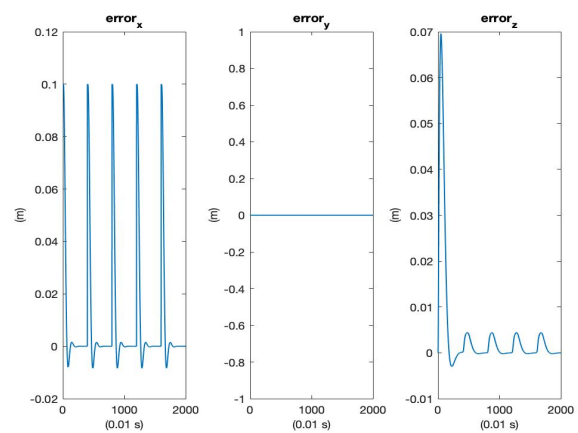Figure 3. actual position vs desired position

Figure 4. Position Errors

Q3 Line-Tracking Performance

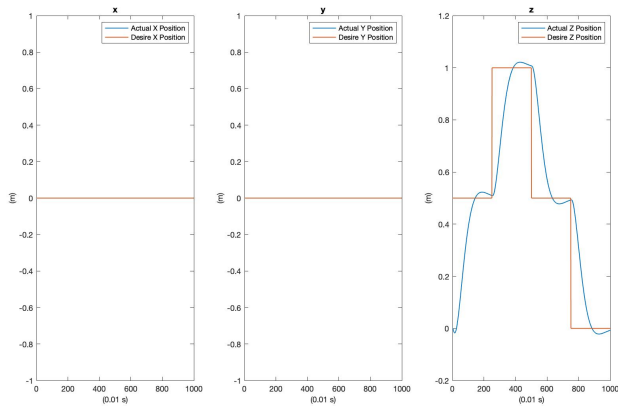6.3 Below are the figures showing the actual/desired position, as well as the position error

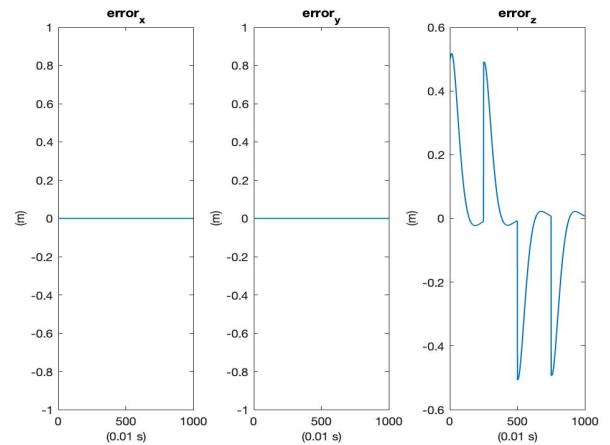Figure 5. actual position vs desired position

Figure 6. Position Errors

Q5 Line-Tracking Performance

6.5.1 Below are the figures showing the actual/desired position, as well as the errors in pose and velocities. (With 0 ending angle)
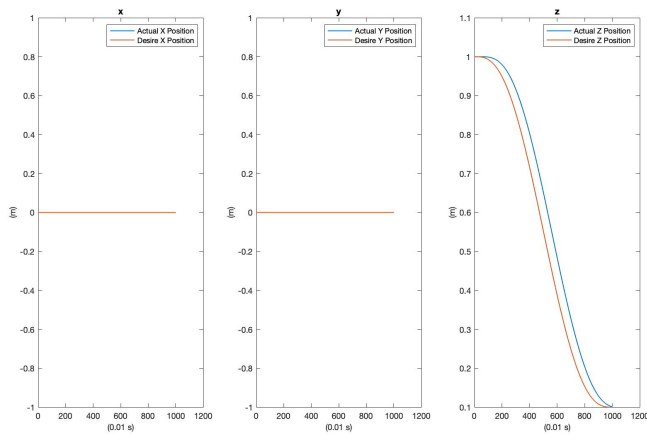

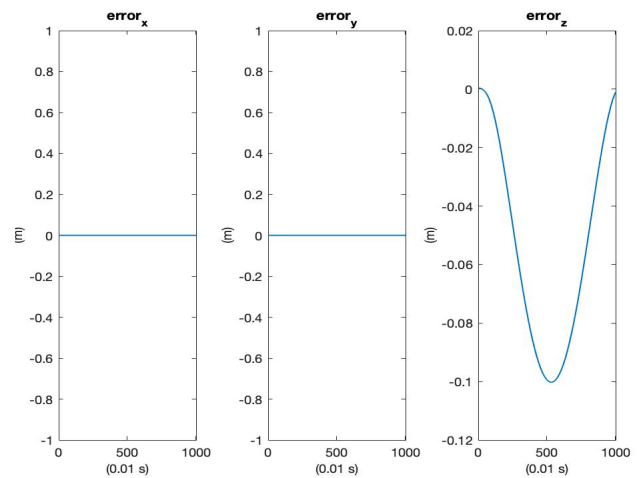Figure 7. actual position vs desired position
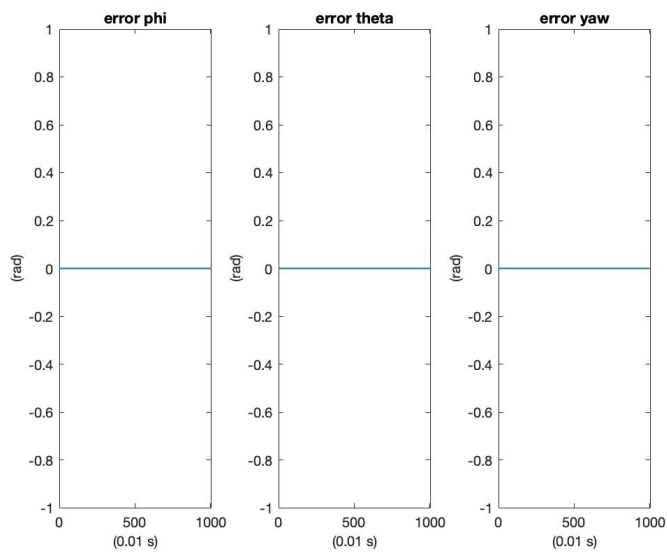

Figure 8. Position Errors
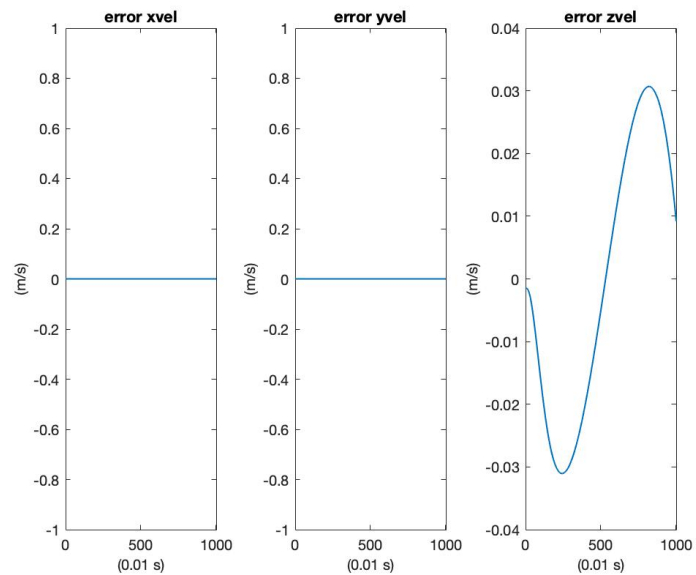
Figure 9. Rotation Errors
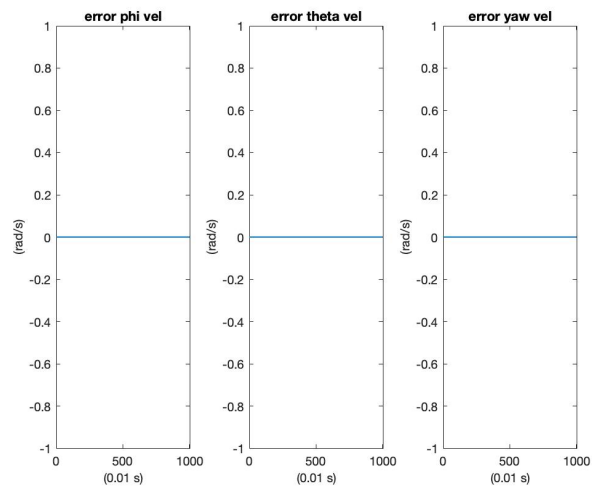
Figure 10. Linear Velocity Errors

Figure 11. Angular Velocity Errors

6.5.2 Below are the figures showing the actual/desired position, as well as the errors in pose and velocities. (With 15 deg ending angle)
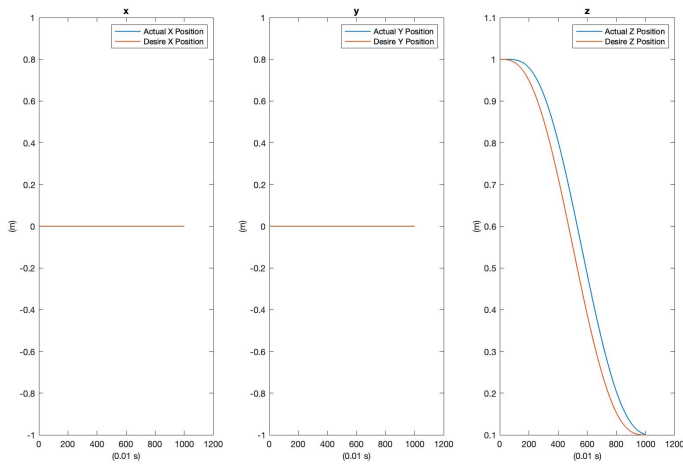

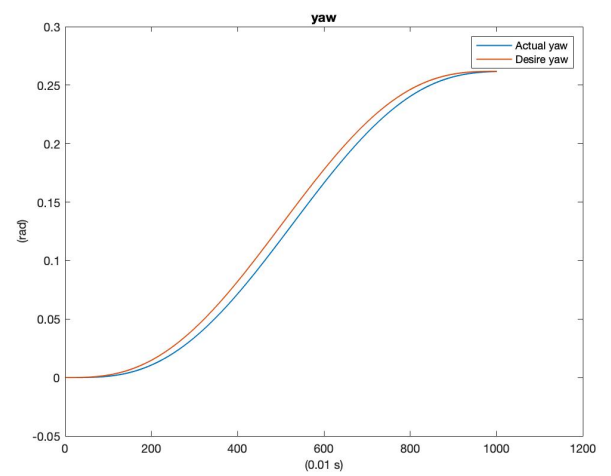Figure 12. actual position vs desired position
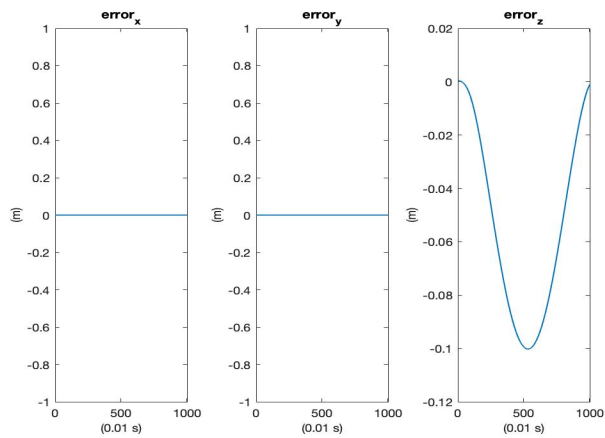

Figure 13. actual yaw vs desired yaw
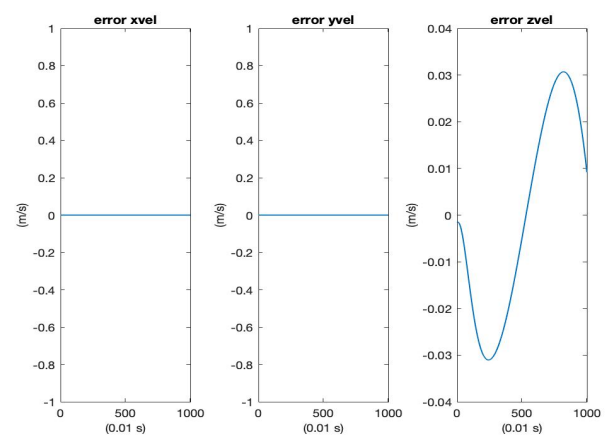

Figure 9. Position Errors
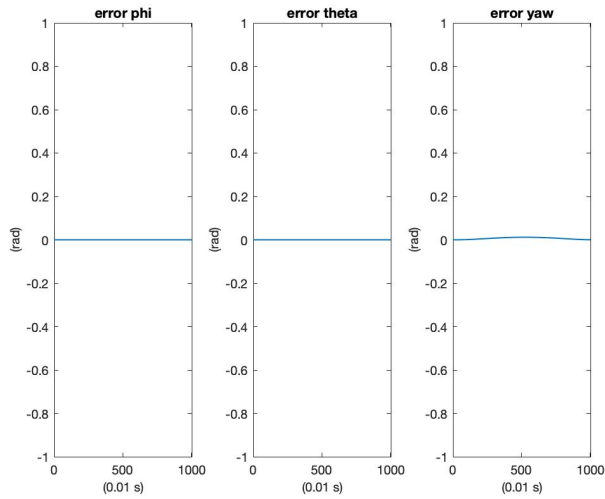

Figure 10. Linear Velocity Errors
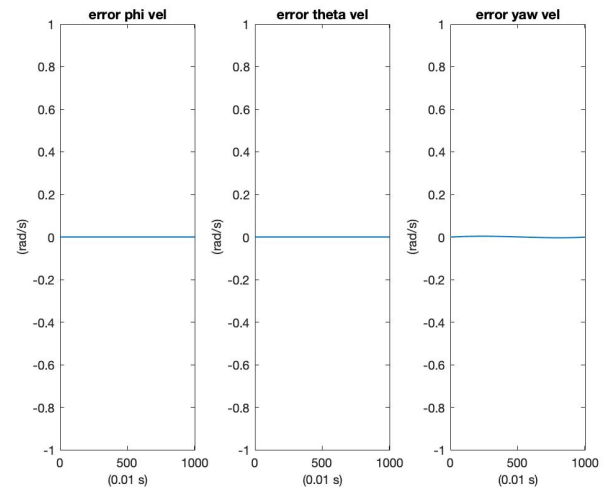
Figure 9. Rotation Errors

Figure 10. Angular Velocity Errors

Comment

We first let the robot to take off at 1m high. Then it hovers for 3 seconds, and transfer into trajectory tracking mode for 10s. The trajectory we want the robot to follow is :[0, 0, 1], [2, 1, 1], [0, 2, 1], [-2, 1, 1]. After returning to the [0, 0, 1] point, robot hovers for 3s, and finally land to the ground.