

## Question 11

*Free Skate [10]:* Generate an aggressive maneuver (of your choosing) and evaluate the performance (following the analysis techniques detailed above). Ensure dynamic feasibility. Aggressive maneuvers invoke extreme roll/ pitch attitudes (e.g., flips). What is the consequence of not modeling drag in this case? What angular velocities are achieved during the maneuver? Many IMUs are designed with a saturation of 300 deg/s. Pursue a maneuver that would approach the capability limits of a robot equipped with an IMU with a 300 deg/s saturation bound.

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### Q11 Performance

10.1 Below are the figures showing the actual/desired trajectory, as well as the errors in positions.

We track the waypoint:  $[0, 0, 1, 0]$ ,  $[2, 1, 1, \pi/2]$ ,  $[0, 2, 1, \pi]$ ,  $[-2, 1, 1, 3\pi/2]$ ,  $[0, 0, 1, 2\pi]$  within 1 second, which forces the angular velocity to be larger than 300 deg/s.

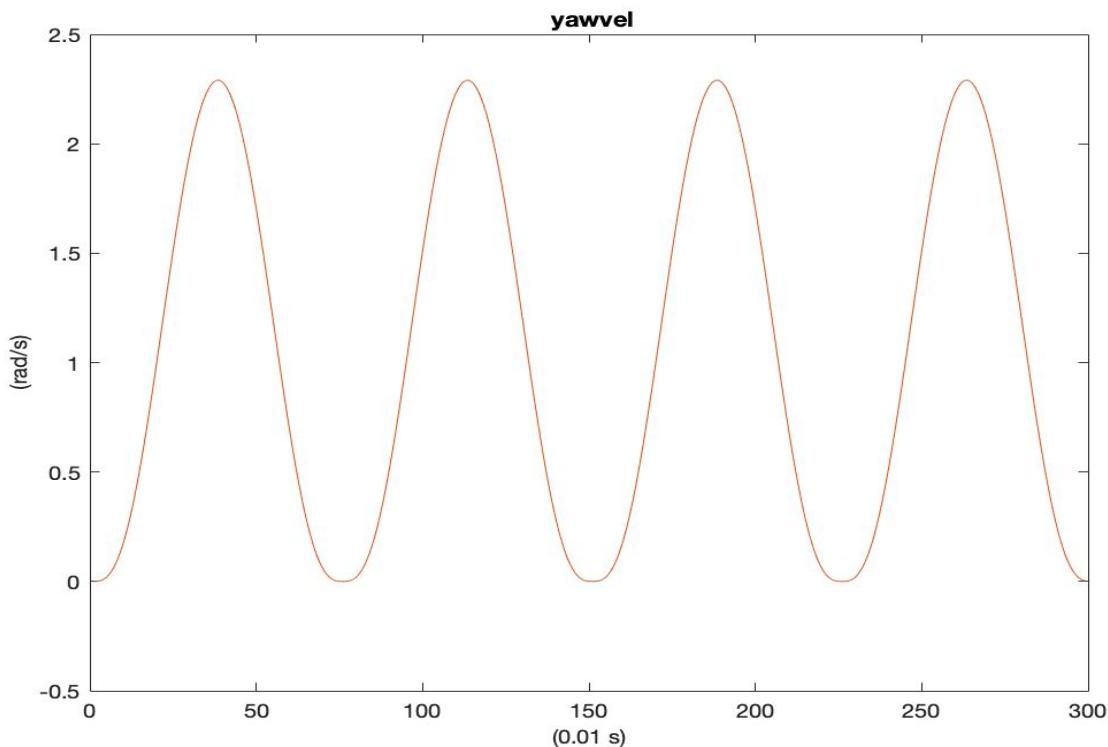


Figure 1. Yaw angular velocity

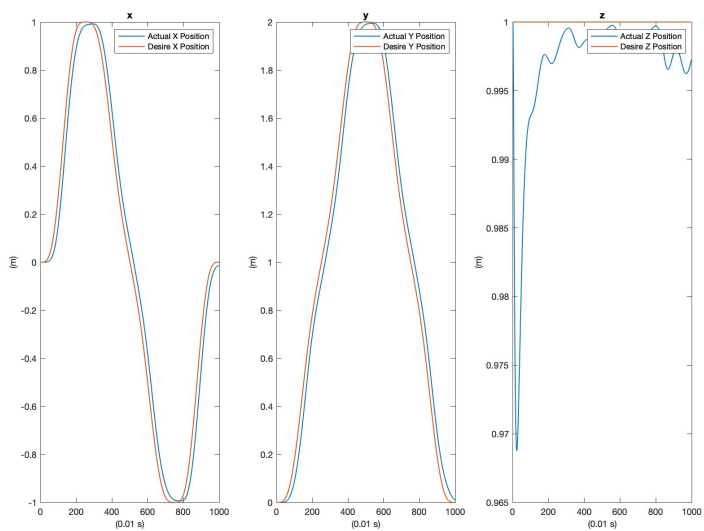


Figure 2. Actual Position vs Desired Position

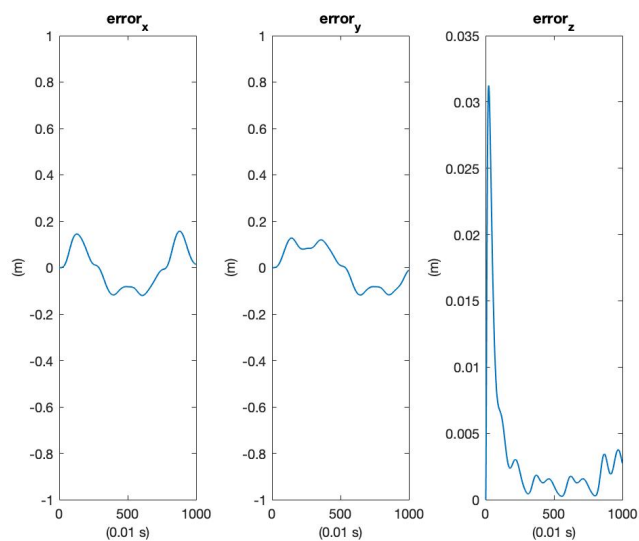


Figure 3. Position Error

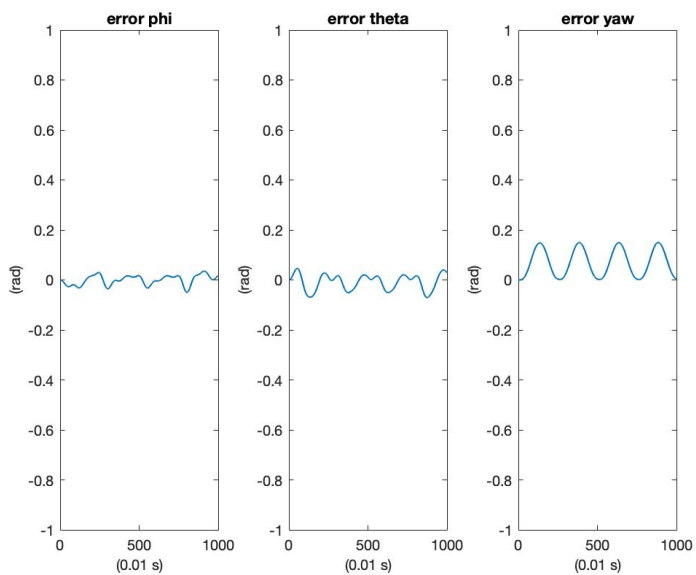


Figure 4. Rotation Error

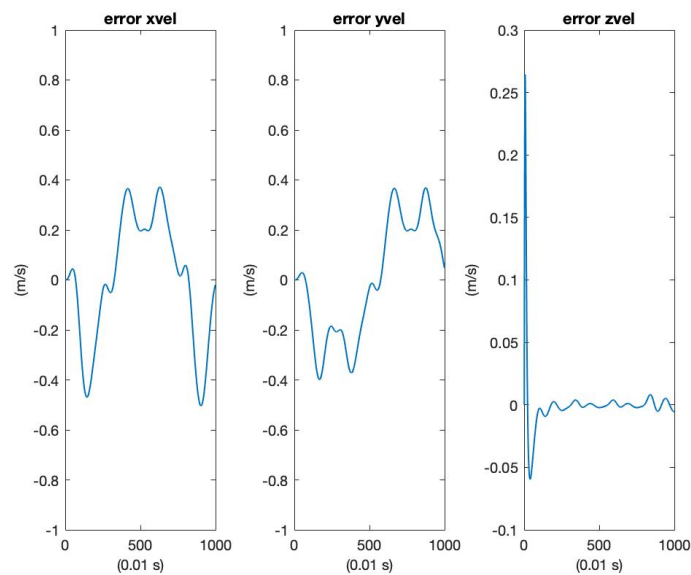


Figure 5. Linear Velocity Error