Question 10

Enforcing Smooth State Machine Transitions [10]: The naive state machine proposed in (4) does not enforce the requirement that feedback control references can exhibit non-smooth (and non-trivial) jumps in the desired pose, velocities, and higher-order terms. As an example, consider the transition from the trajectory mode to the hover mode based on an error term that only considers the desired and current pose (ignoring the non-zero velocity and acceleration). Propose, implement, and evaluate two strategies to address and mitigate rapid changes in modes by saturation or gain selection. Possible strategies may include bounding changes in the input reference via a saturation function or choosing softer gains.

Q10 Performance

10.1 Below are the figures showing the actual/desired trajectory, as well as the errors in positions. (Because here we don't have desired variation in rotation, so we don't plot the error change in rotation.)

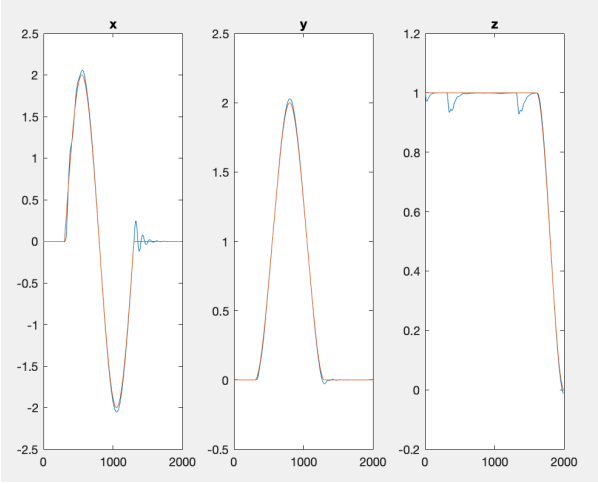

Figure 1. Actual Position vs Desired Position

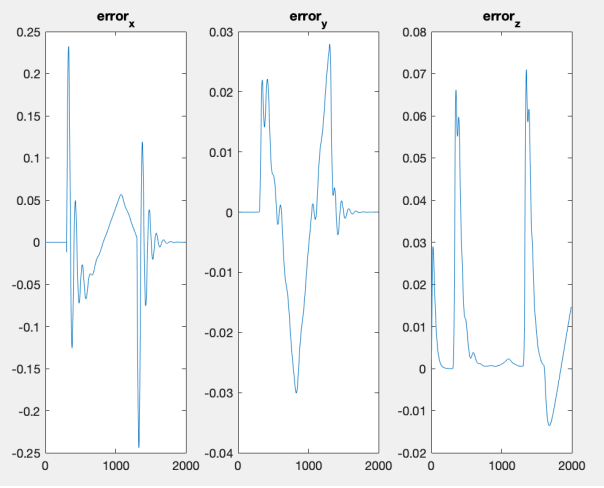

Figure 2. Position Error

Q10 Performance with saturation function

10.2 Below are the figures showing the actual/desired trajectory, as well as the errors in positions. (Because here we don't have desired variation in rotation, so we don't plot the error change in rotation.)

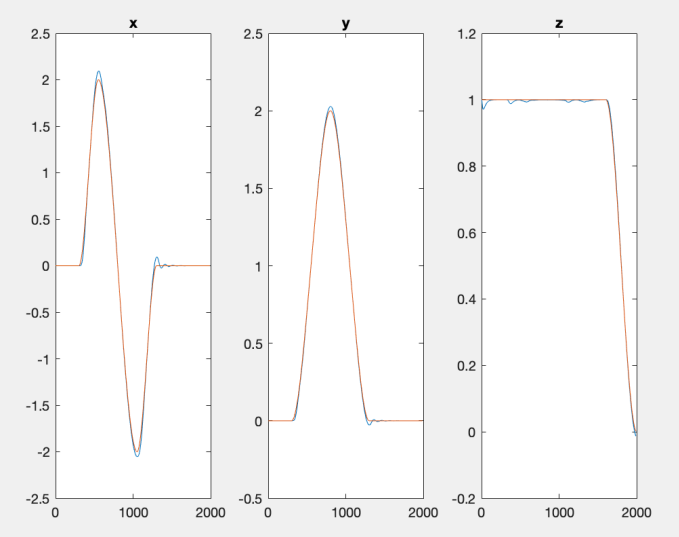

Figure 1. Actual Position vs Desired Position

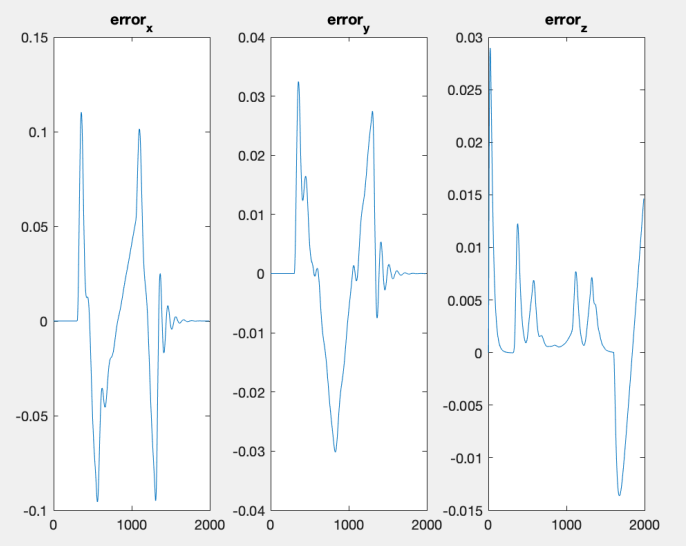

Figure 2. Position Error

Q10 Performance with softer gain

10.3 Below are the figures showing the actual/desired trajectory, as well as the errors in positions. (Because here we don't have desired variation in rotation, so we don't plot the error change in rotation.)

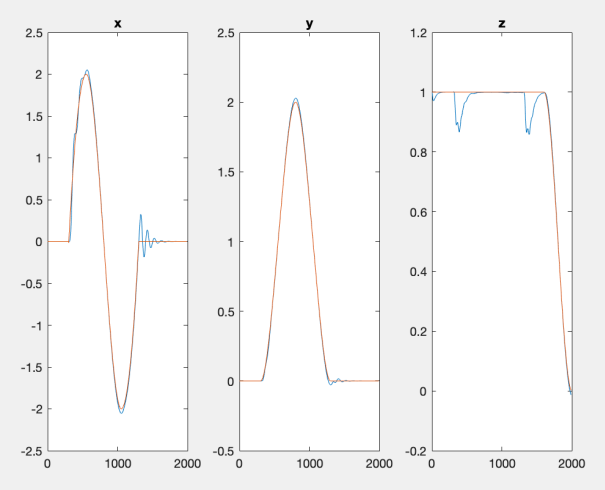

Figure 1. Actual Position vs Desired Position

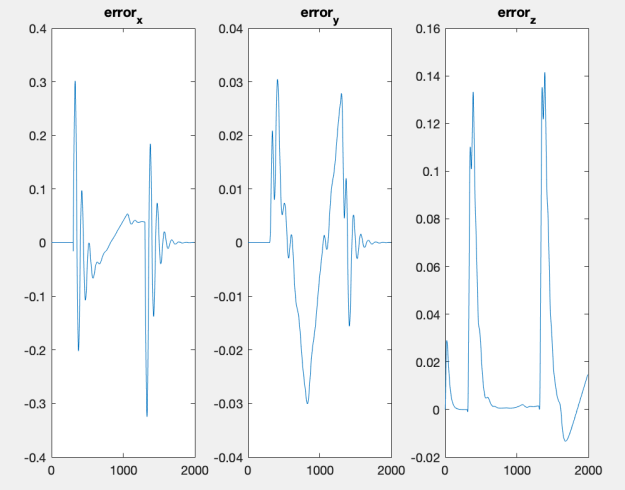

Figure 2. Position Error