Question 4

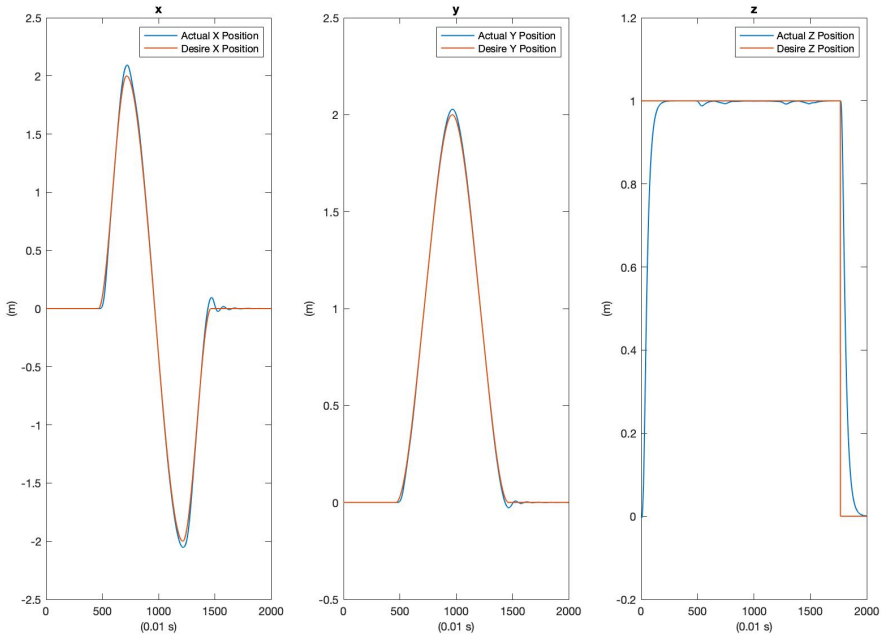
State Machine [5]: Develop and detail a state machine that enables the platform to takeoff to a pre-specified height, hover, track trajectories, and land. Provide a description of this state machine with an associated state machine diagram. One possible strategy is to develop a finite sequence of modes that transition based on the current and desired states as well as the prior mode. Consider the following possible approach:

- The system begins in an **idle** state generating no (or null) control inputs.
- A simulation trial begins by transitioning into a **takeoff** state that consists of a trajectory tracking controller from the current robot state to a desired hover state (fixed pose). When the robot approaches the desired hover state (based on the error between current and desired pose), the robot transitions into a **hover** mode.
- The platform remains in **hover** mode for a small amount of time (e.g., 5 s) before transitioning into a **tracking** mode.
- The platform tracks a specified trajectory and upon completion transitions into the **hover** mode.
- After remaining in **hover** mode for a brief period of time, the robot transitions into **land** mode and begins a descent to the ground.

Remark: The above state machine is a prerequisite for the remainder of the exercises in this project and provides a simple strategy for trial initialization and finalization. The following exercises will leverage this capability and assume that the system is operating in the **tracking** mode. Any requested error plots should apply only to this mode (and not include the takeoff, hover, and landing phases) unless explicitly requested.

Performance

4.1 Below we show an example of complete trajectory



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.