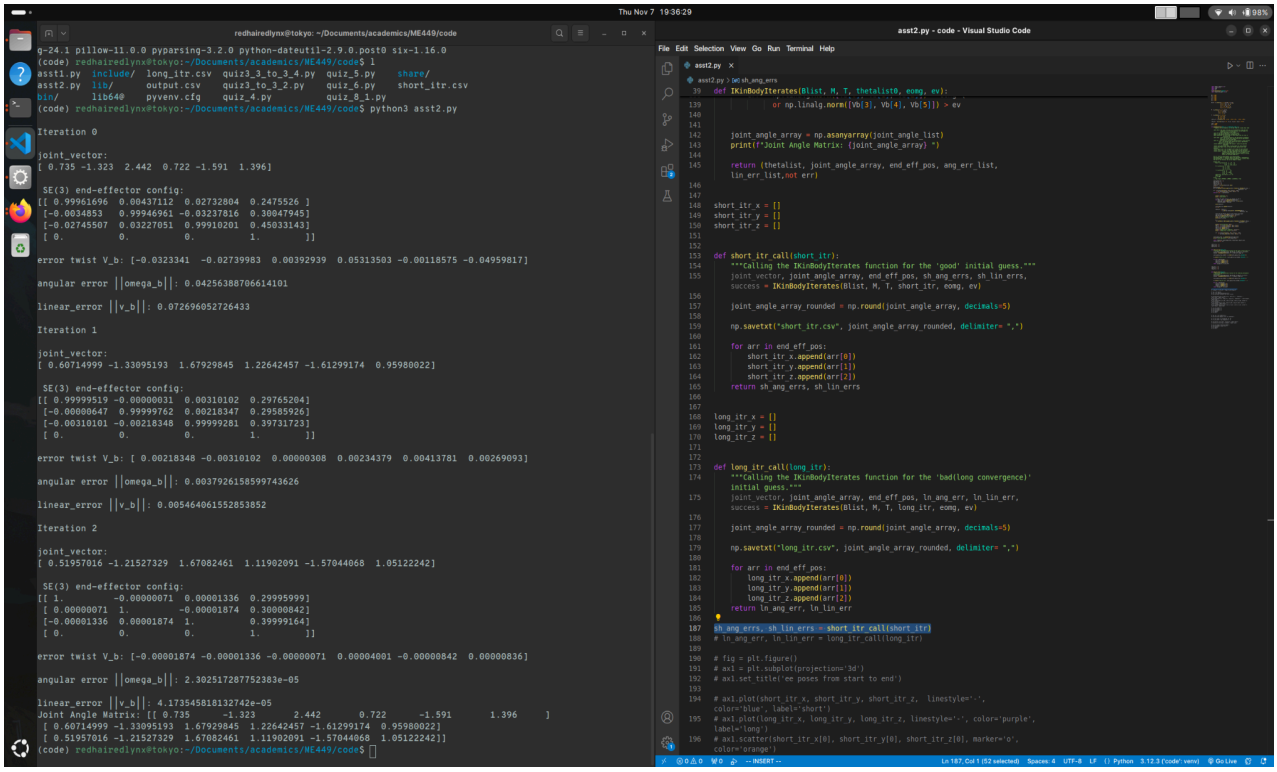
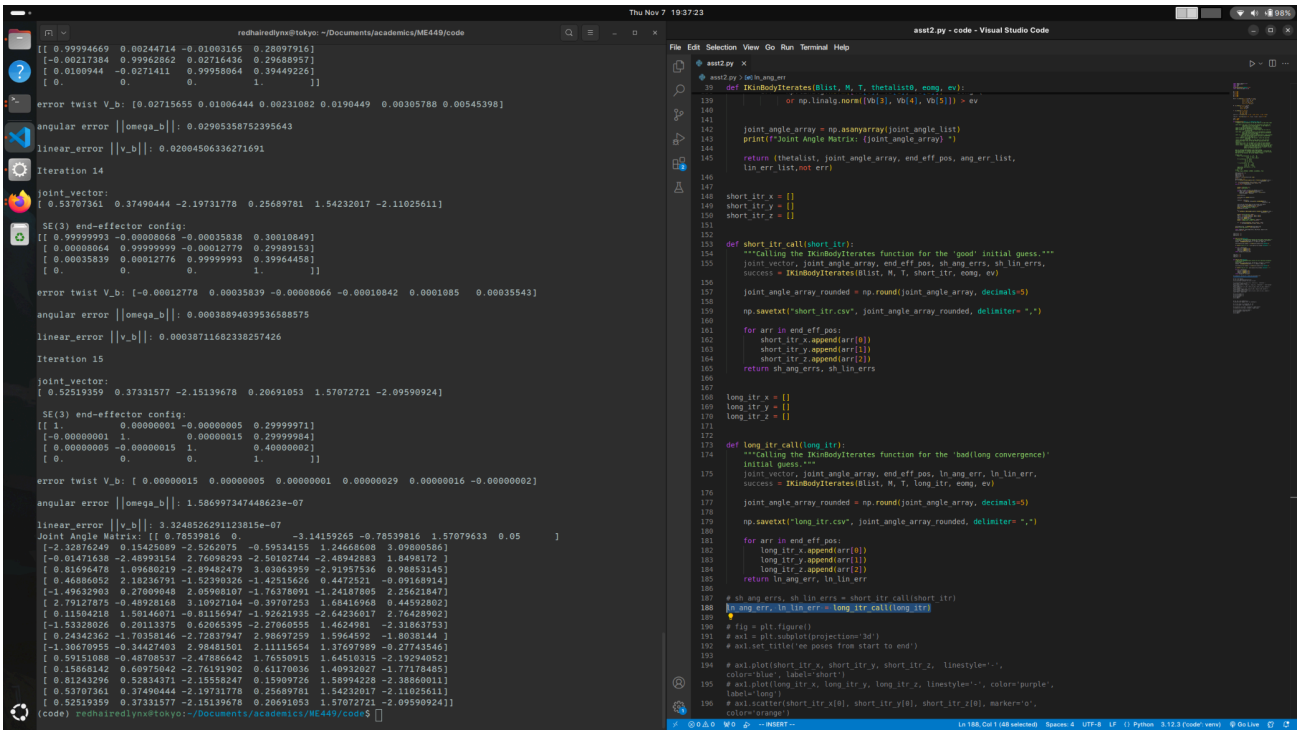
ME 449 Assignment 2

Part 1

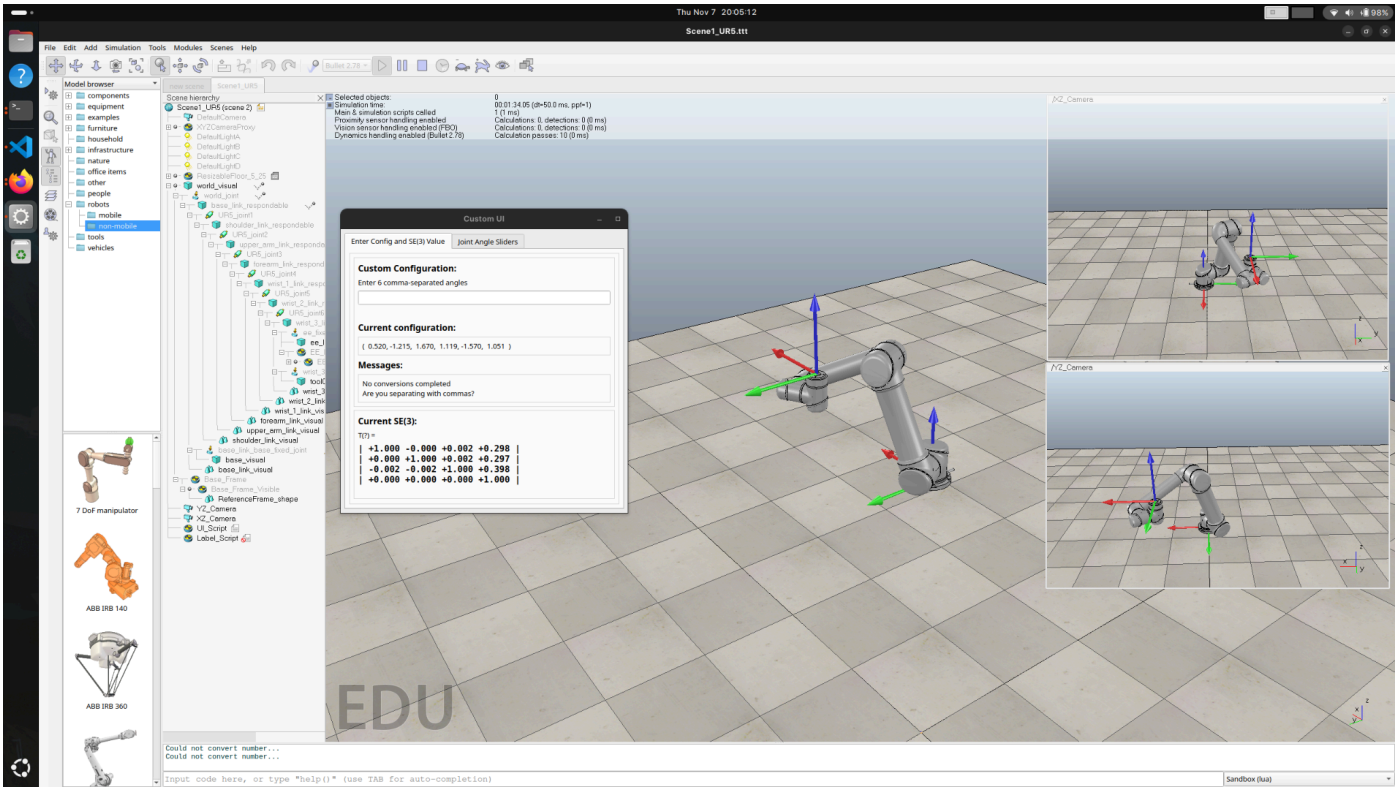
Log of Output for ‘good’ guess (short iterations)



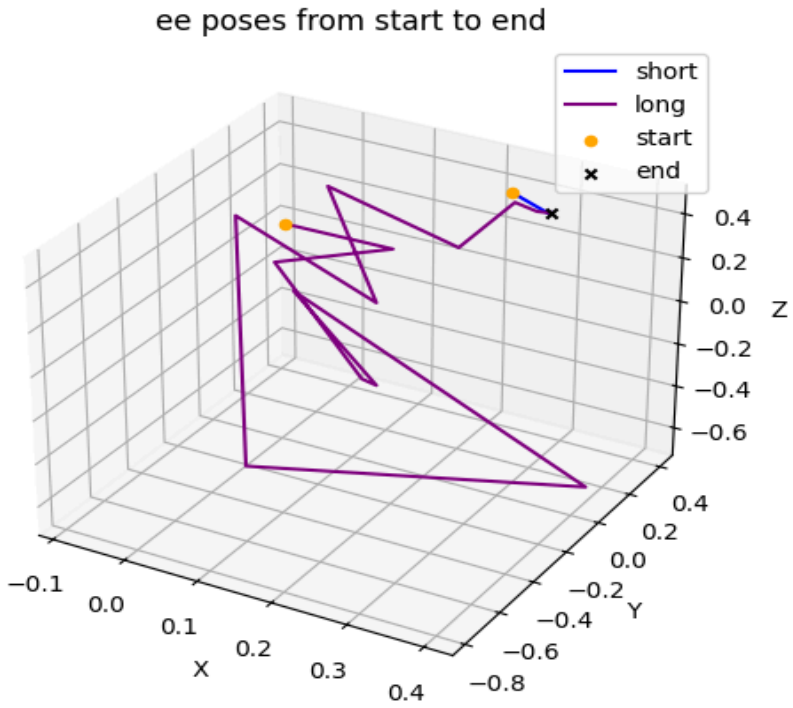
Log of output for ‘bad’ guess (long iterations)



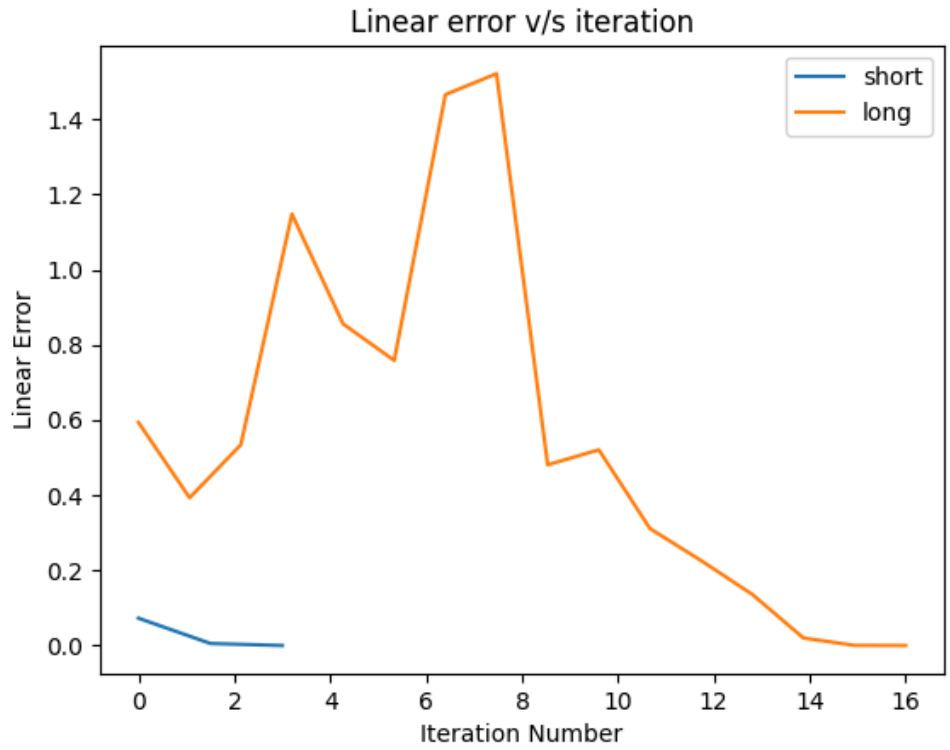
Final configuration and joint angles of the UR5 Robot after the short iterations



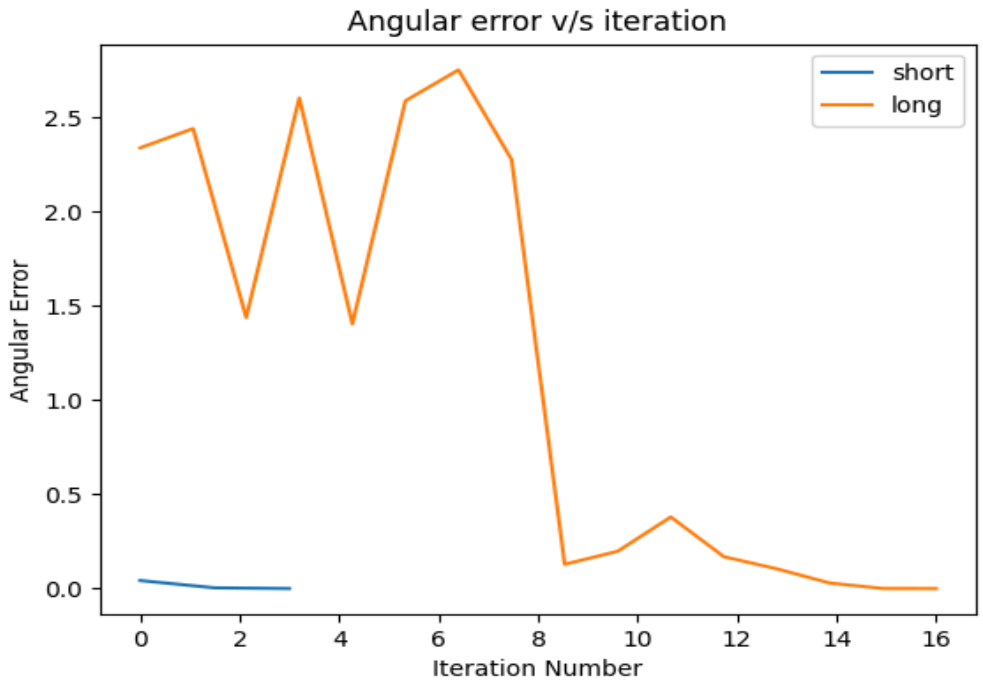
End effector pose variation over each iteration



Linear error variation with each iteration



Angular error variation over each iteration



Why is convergence difficult from the long_iterates initial guess?
Ans: The Newton Raphson iterative method involves using the first order terms of the Taylor Expansion to compute the next configuration from the current configuration. During this process, if the initial guess is too far off from the desired configuration, i.e. it does not lie in the **basin of attraction** of the solution, the consequent iteration values also do not lie in the basin of the solution and so the process does not converge. Therefore, in our case convergence from the long_iterates initial guess is difficult.

Part 2

(a) The constant joint speed at which we command the joints is given by:

$$\dot{\theta} = (\theta^* - \theta^0)/t_f$$

(b) The commanded join speed vector at time 0 and at time tf/2 is given by:

$$\dot{\theta}(0) = J_b(\theta(0))^{-1} vec([V])$$

$$\dot{\theta}(t_f/2) = J_b(\theta(t_f/2))^{-1} vec([V])$$

(c) The advantage of (a) over (b) is that the joint speeds are constant and the body Jacobian is not needed to be computed at each instant making it simpler and more straightforward.