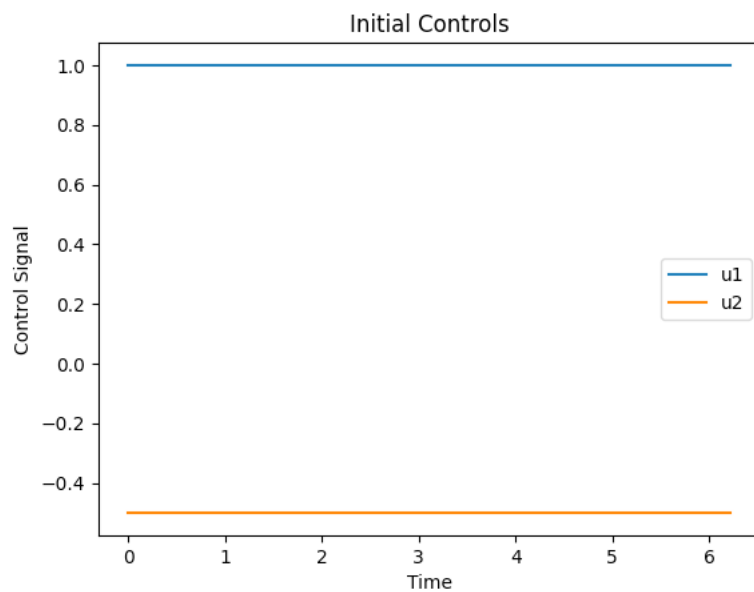
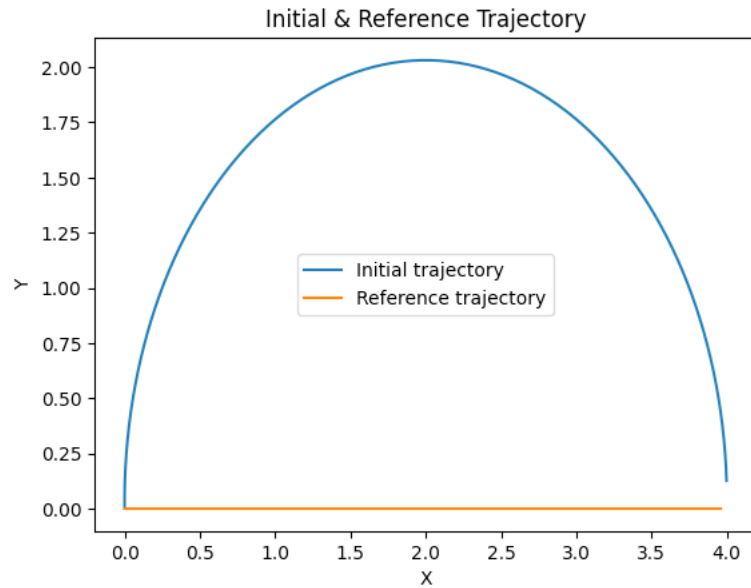


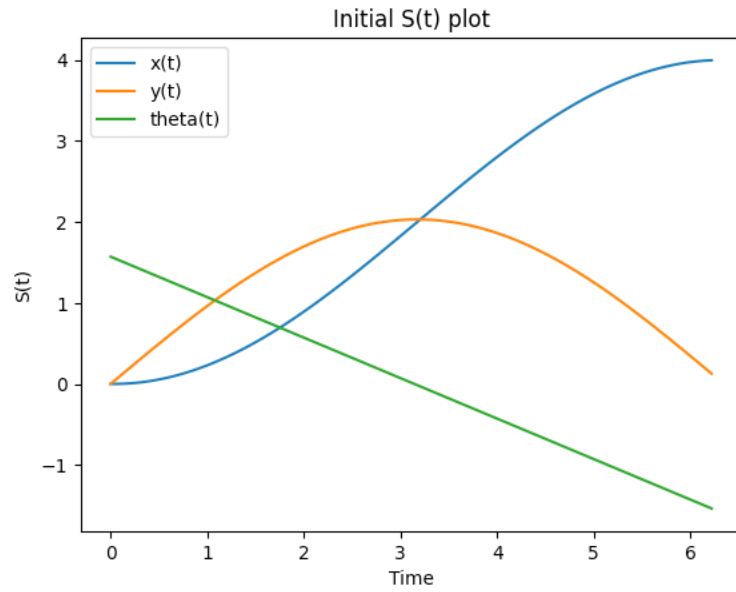
ME 455 Homework 1

Ian Shi

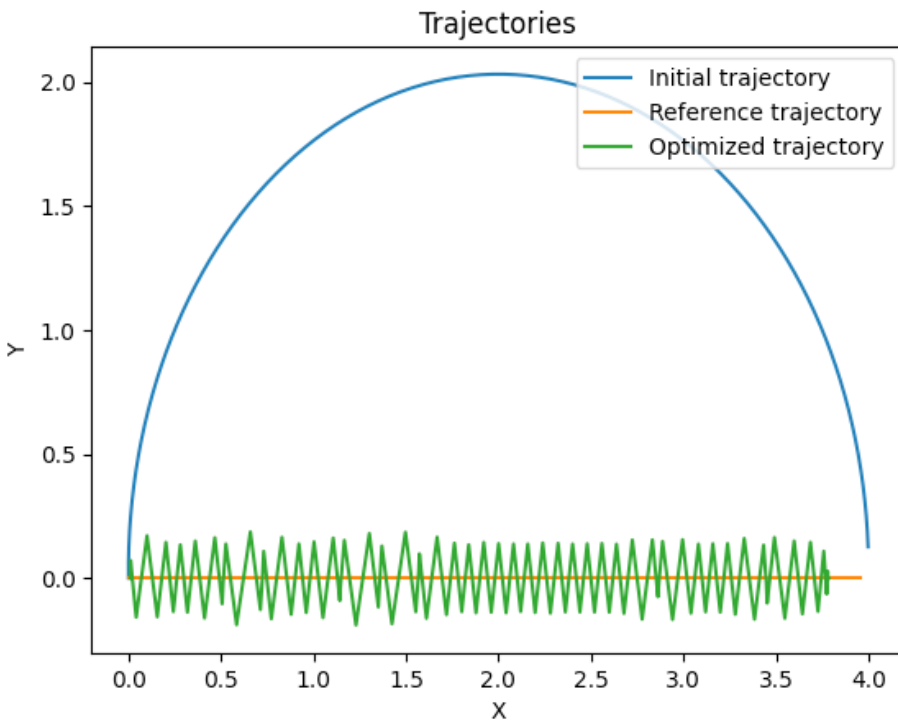
1.

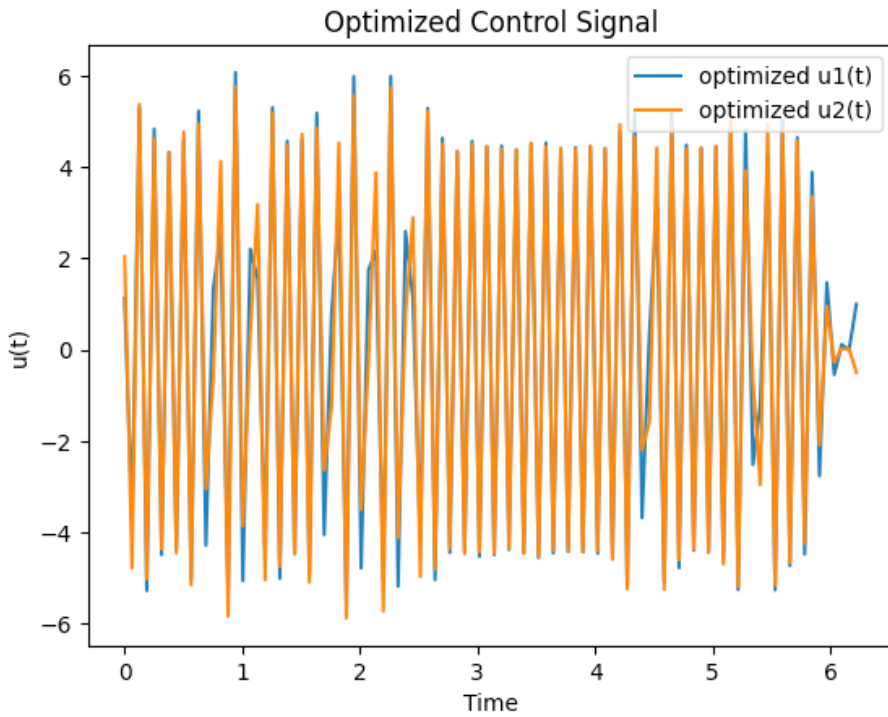
Plots of the initial and reference trajectories, controls, and $S(t) = \{x, y, \theta\}$ are shown below:





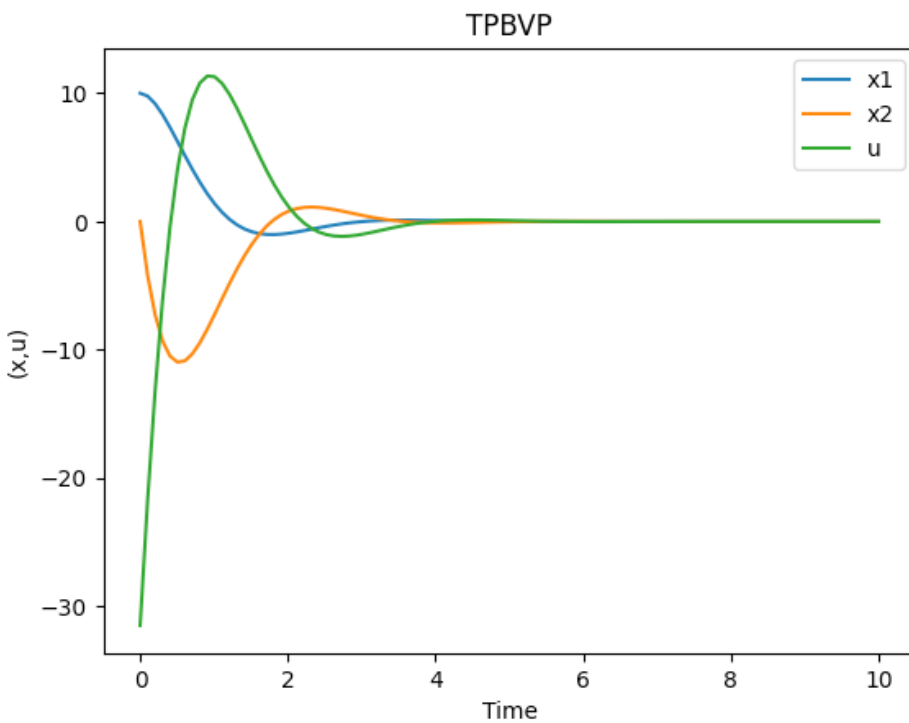
Plot of the overlaid trajectories, and optimized controls are shown below. In my `scipy.optimize.minimize` function, I set `{“maxiter”:10000}` so that it could run on my computer in a reasonable time, which explains the slight gap between the optimized trajectory and the final X value of 4.





2.

Plot of the resulting $x(t)$ and $u(t)$ of the two point boundary value problem is shown below:



A table of randomly generated perturbances $v(t)$ and the resulting directional derivative is shown:

$v(t)$	Directional derivative
$0.41\sin(0.95t + 0.76) + 0.98$	-0.058
$0.5\sin(0.36t + 0.34) + 0.39$	-0.025
$0.48\sin(0.33t + 0.89) + 0.89$	-0.056
$0.31\sin(0.39t + 0.88) + 0.69$	-0.041
$0.65\sin(0.29t + 0.77) + 0.63$	-0.048
$0.46\sin(t + 0.15) + 0.98$	-0.049
$0.06\sin(0.18t + 0.98) + 0.59$	-0.028
$0.17\sin(0.19t + 0.64) + 0.36$	-0.020
$0.6\sin(0.57t + 0.65) + 0.25$	-0.028
$0.87\sin(0.39t + 0.27) + 0.4$	-0.028

3.

Plot of the difference between the Riccati solution and the TPBVP solution is shown below:

