EBS 221 HW 1

Benoit Rouchy, Kevin Oghalai

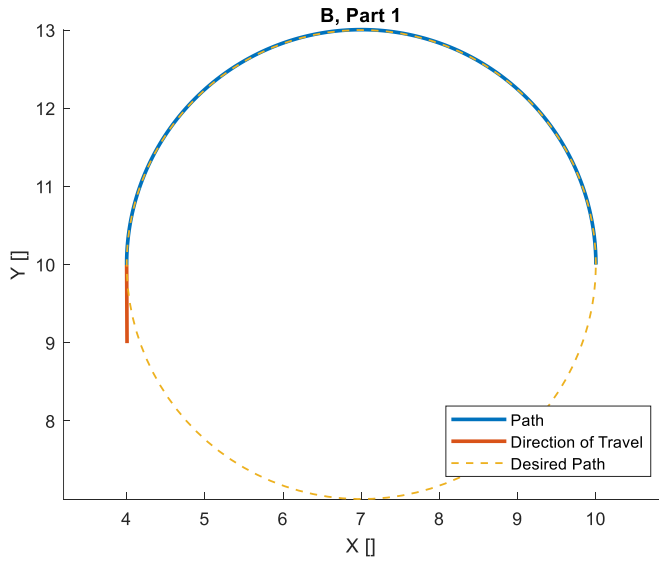
A) The code was implemented following the dynamics set in class:

$$\dot{X} = \begin{pmatrix} \dot{x} \\ \dot{y} \\ \dot{\theta} \\ \dot{v} \\ \dot{\gamma} \end{pmatrix} = \begin{pmatrix} v\,cos(\theta) \\ v\sin(\theta) \\ v\tan(\gamma)/L \\ (-v + v_d)/\tau_v \\ (-\gamma + \gamma_d)/\,\tau\_\gamma \end{pmatrix}$$

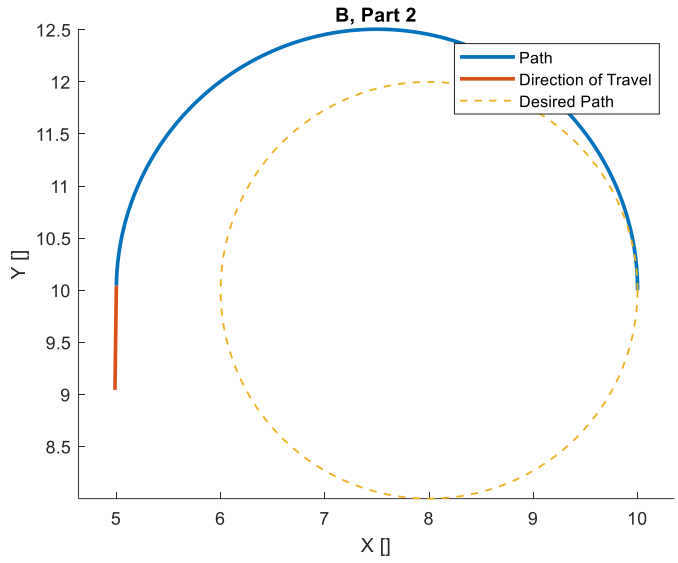
$$X_{\{k+1\}} = \dot{X}_{\{K\}}\,dt + X_{\{k\}}$$

It was then used to create the following plots:

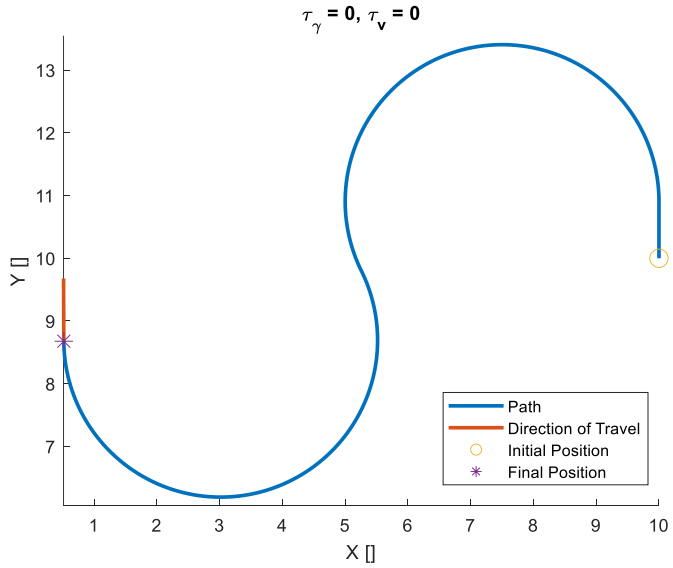
B) A circle of radius 3 meters was desired, so a steering angle of 0.69 radians was calculated to achieve this. Shown below is a plot of the desired path and actual path. Shown in red is the orientation of the vehicle at the end of the traveling time.



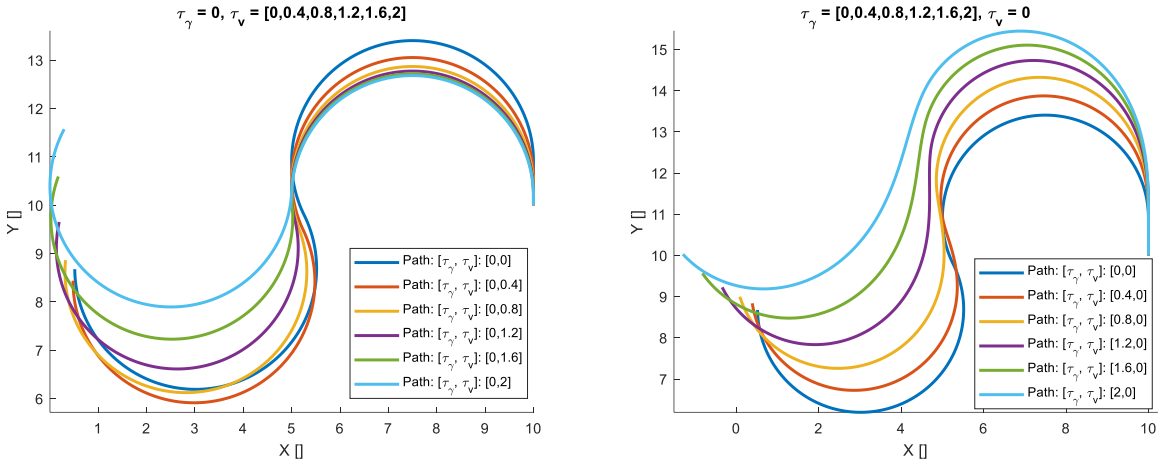
For the next part, a circle of radius 2 meters was desired, but in this case the steering angle required to achieve this was above that allowed for the vehicle, thus it got capped, leading it to be unable to follow this smaller radius of circle. Once again, the actual path, desired path, and ending orientation of the vehicle is shown.



C) The next part asks for the steering angle to be changed depending on the time, starting at 0 radians for 1 second, then going to the maximum and minimum respectively for 10 seconds each. Shown below is a plot of what this looks like with $\tau_\gamma, \tau_v = 0$.



The next part asks for $\tau_v, \tau_\gamma = [0, 0.4, 0.8, 1.2, 1.6, 2]$. Each τ is varied individually, with the other kept at 0 for a specific plot. Shown below are the paths. The plot on the left shows τ_v being varied, while the other shows τ_γ being varied.



Both plots show that when the time constants of the steering angle and velocity are changed, this does affect the vehicle's ability to move. The plot with varied τ_v shows less travel while the vehicle speed is ramping up, leading to different orientations later in the path after the steering angle has been changed. This leads to different results, not just in ending position, but also the ending orientation and path taken. The plot on the right varies τ_γ, which shows the obvious decreases in turning speed with higher values of the time constant. Once again, this leads to varied paths and ending positions and orientations.