Assignment 1

Ivan Efremov

September 2022

1 Task 1

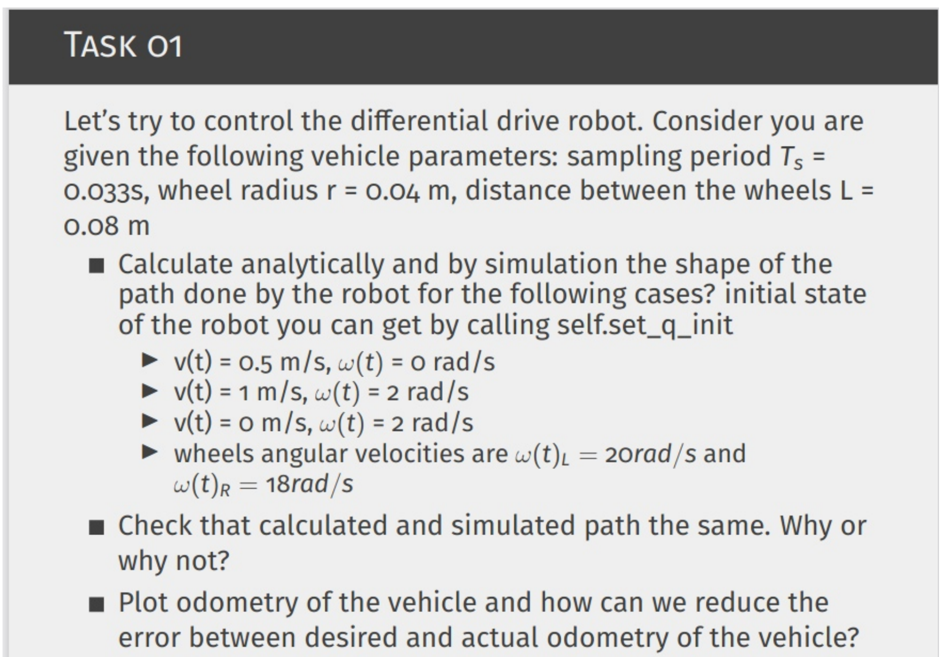

Figure 1: Task description

This task was tested on Hagen's robot in Gazebo simulation. The installation folder is here.

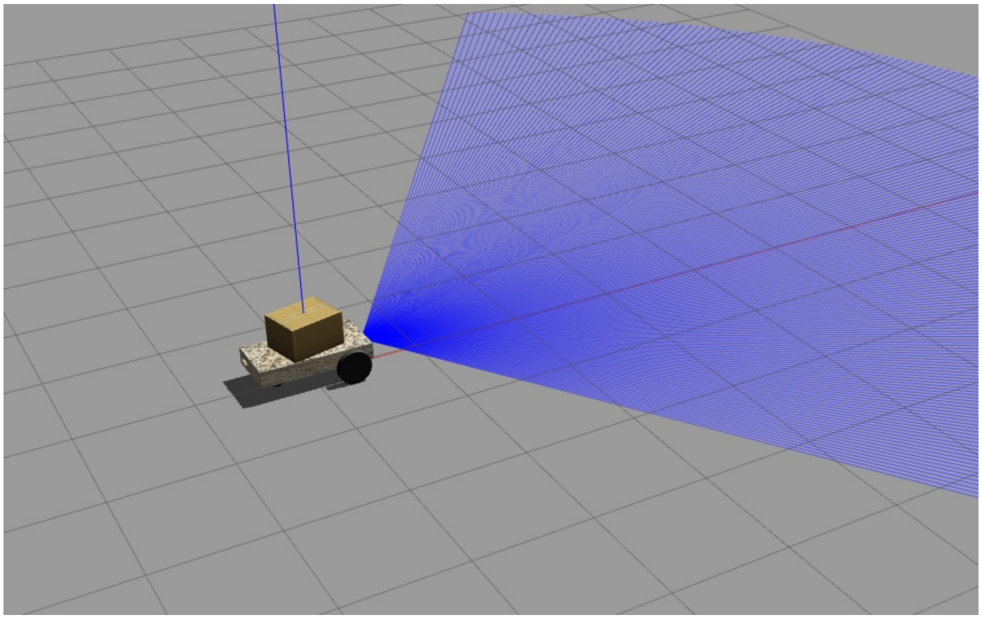

Figure 2: Example of Gazebo simulation

1.1 Case 1

Launch simulation during 5 seconds, where v=0.5 m/s and w=0 rad/s.

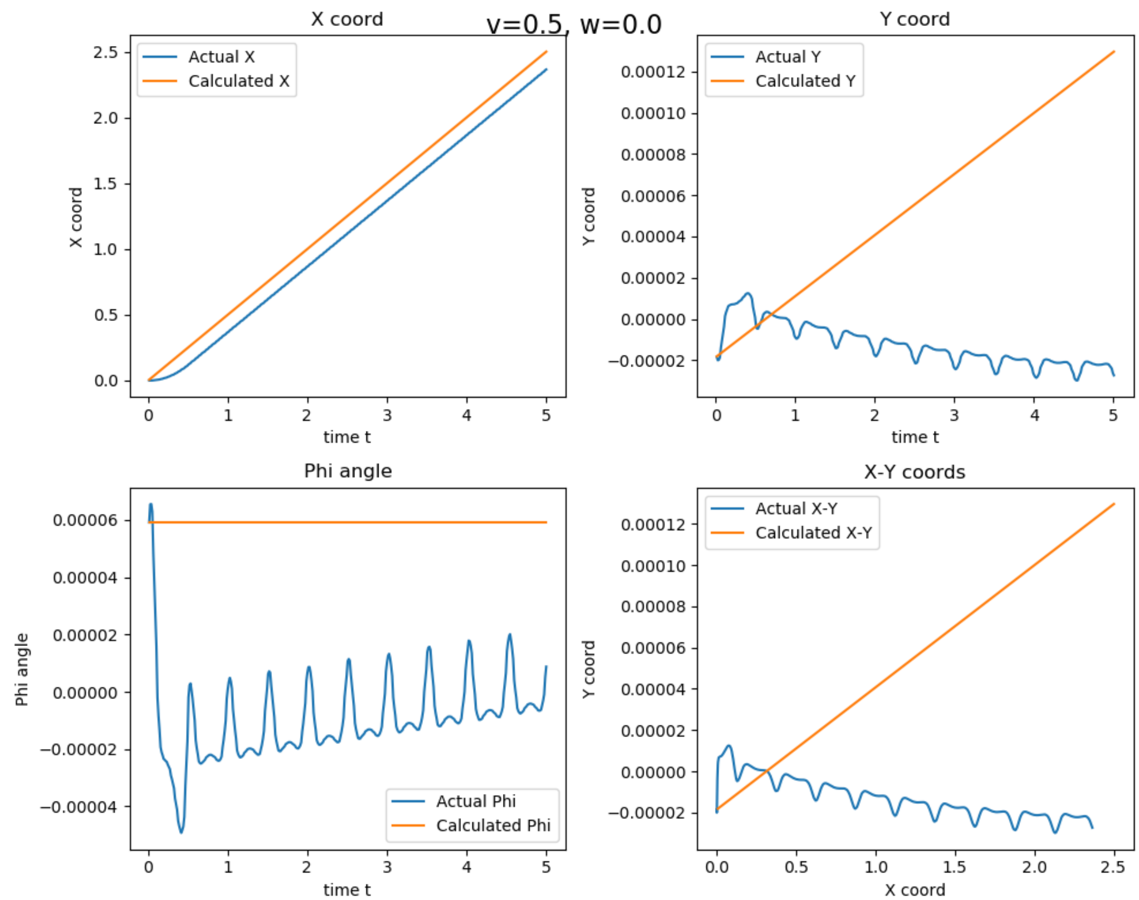

Figure 3: v=0.5 m/s and w=0 rad/s

As we can see, there is little bias in Y coordinate. Also it takes time to reach desired velocity, so there is some shift in X coordinate.

1.2 Case 2

Launch simulation during 5 seconds, where v=1 m/s and w=2 rad/s.

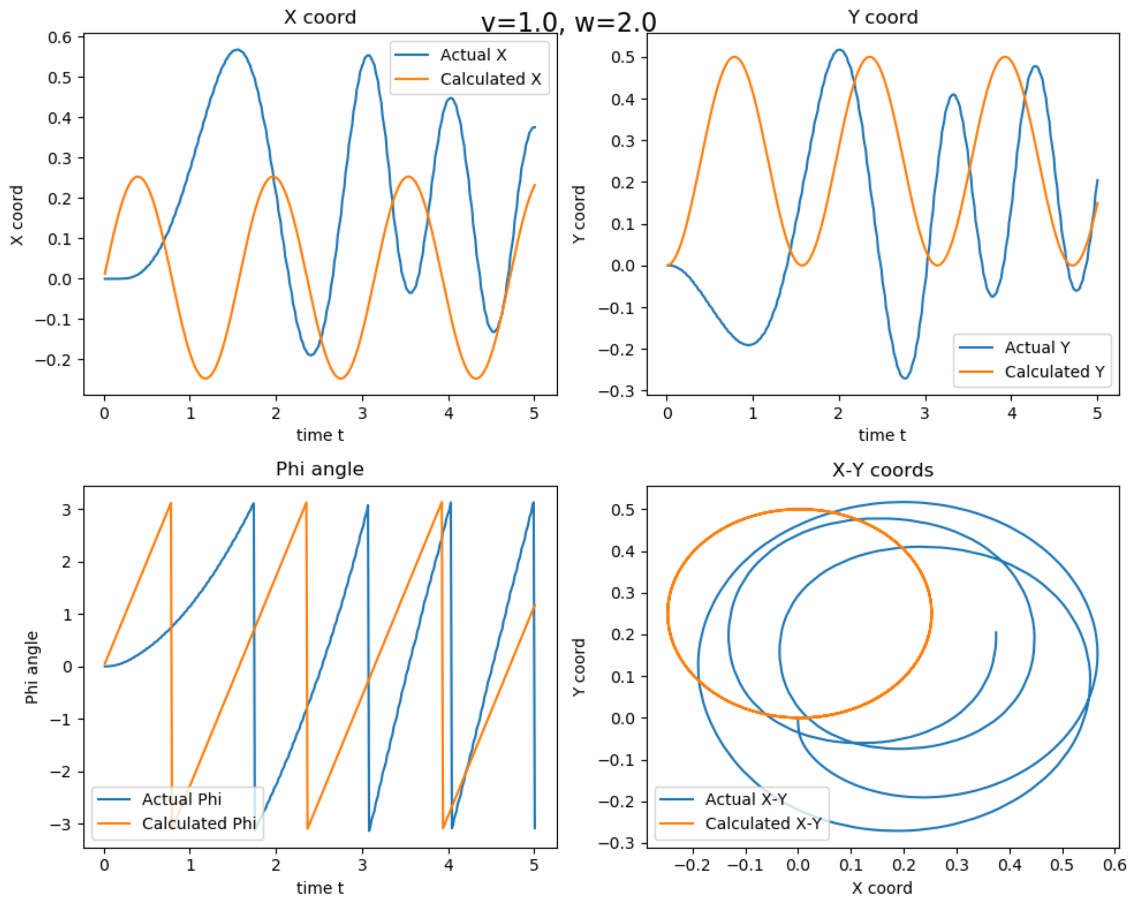

Figure 4: v=1 m/s and w=2 rad/s

There is quite big error for this case. Desired trajectory is a circle, but because of inertia it can't be reach.

1.3 Case 3

Launch simulation during 5 seconds, where v=0 m/s and w=2 rad/s.

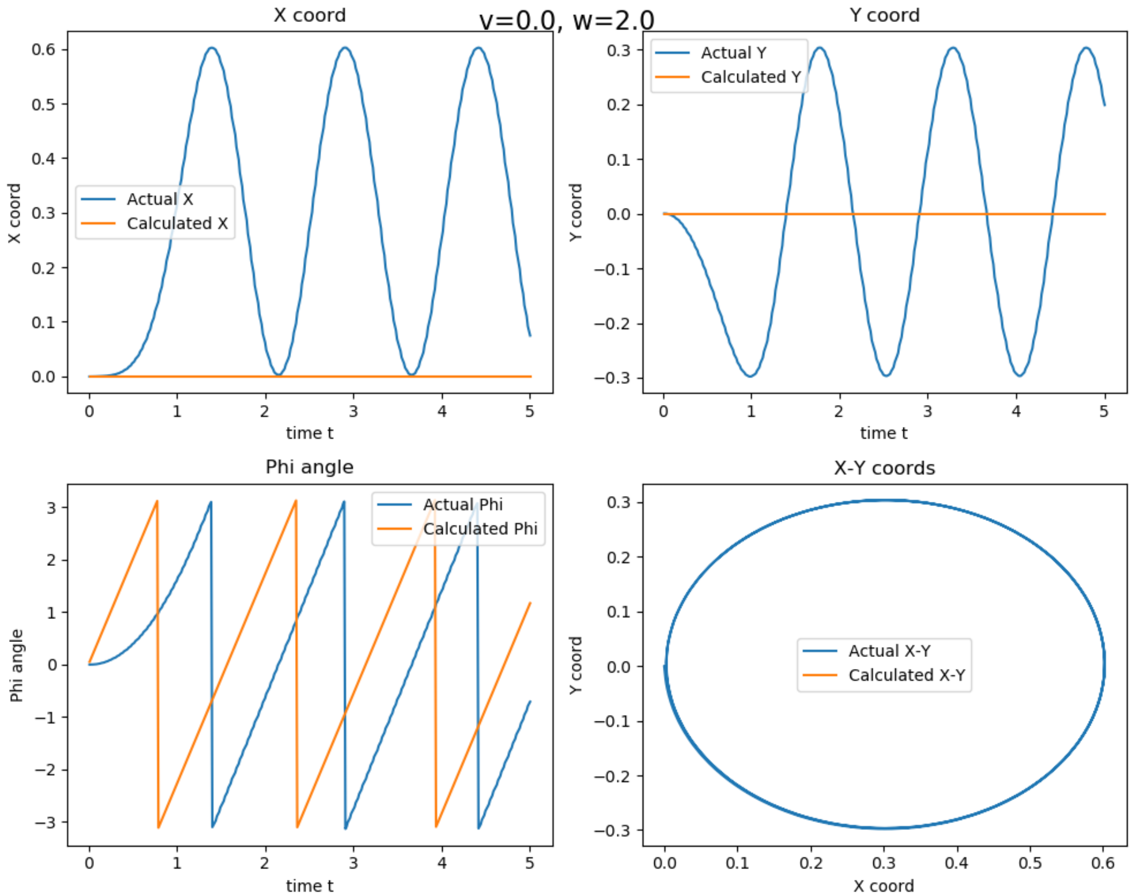

Figure 5: v=0 m/s and w=2 rad/s

Almost the same situation as for case 1. It takes time to reach desired angular speed. Also there is a bias for X and Y coordinates, because center of robot rotation is not in (0,0) point.

1.4 Case 4

Launch simulation during 5 seconds, where w_L=20 rad/s and w_R=18 rad/s.

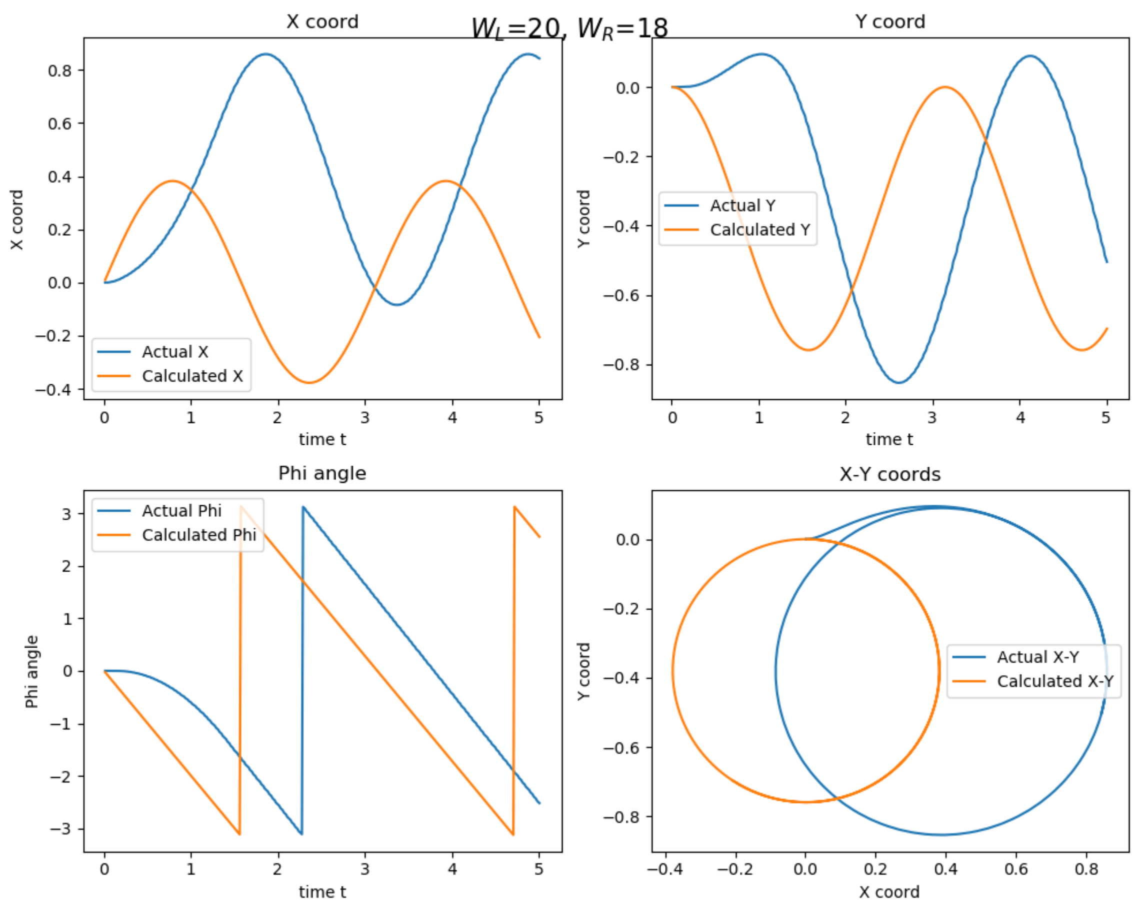

Figure 6: w_L=20 rad/s and w_R=18 rad/s

Almost the same case as case 2. There is no drift as in case 2, because tangential acceleration is less. But there is also big error because of inertia.

2 Conclusion

There can be quite a big error between the calculated and actual odometry. We can reduce this error by taking into account the physical parameters of the robot. It is also possible to reduce the error by using a smaller sampling period and perform integration with higher precision (using trapezoidal numerical integration for example).