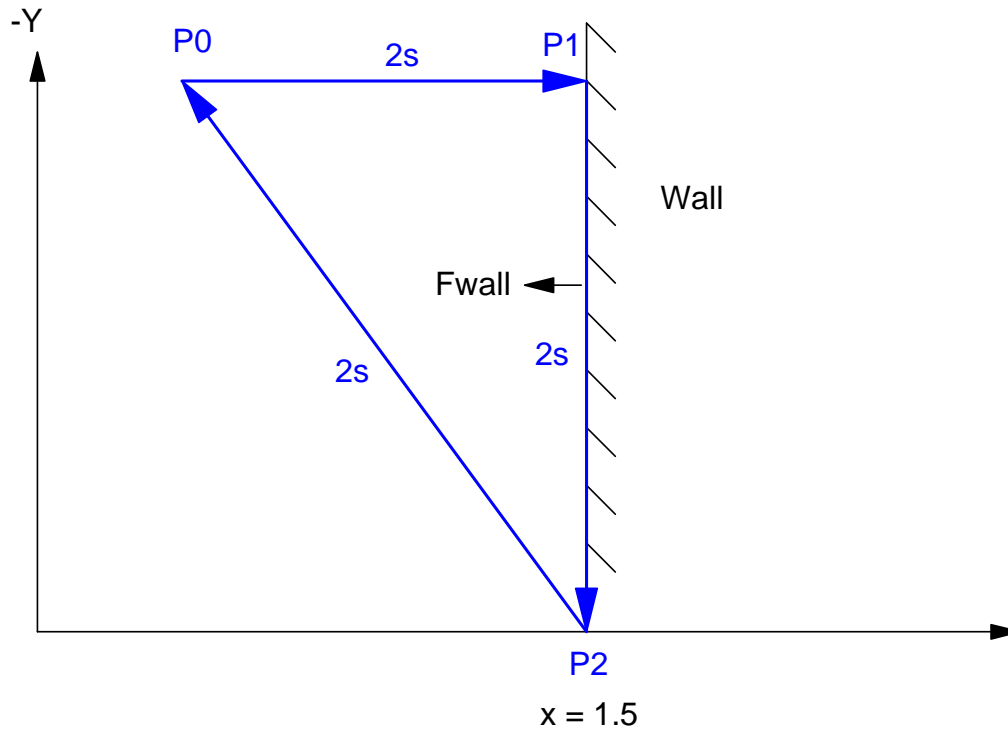


ECE 761: Homework #14: Impact Forces



1) Let $P_0 = (0.5, -1)$, $P_1 = (1.5, -1)$, $P_2 = (1.5, 0)$.

Assume the wall does not exist ($F_{wall} = 0$).

- Specify the path so that the robot travels along the path (P0, P1, P2, P0) in 6.0 seconds
- Simulate the RR robot's motion (including PD control and gravity terms)
- Plot the resulting tip force, F_{wall} vs. time

2) Assume the wall *does* exist at $x = 1.5$. Model the wall as a spring:

$$F_{wall} = \begin{cases} 1000(x_2 - 1.5) & F_{wall} > 0 \\ 0 & F_{wall} < 0 \end{cases}$$

Modify your code so that when the RR robot is in contact with the wall, it pushes against the wall with a force for +10N ($F_{wall} = +10N$)

- Simulate the RR robot's motion (including PD control and gravity terms)
- Plot the resulting tip force (F_{wall}) vs. time

3) Impact Forces: Move the wall to $x = 1.0$ so that the robot hits the wall with more momentum.

$$F_{wall} = \begin{cases} 5000(x_2 - 1.0) & F_{wall} > 0 \\ 0 & F_{wall} < 0 \end{cases}$$

Repeat problem #2 with the force from the wall being arbitrary (set by how far into the wall you move when you hit)

- Simulate the RR robot's motion (including PD control and gravity terms)
- Plot the resulting tip force (F_{wall}) vs. time

4) Repeat problem #3 (wall at $x = 1.0$) with friction added to the wall:

$$F_{wall} = \begin{cases} 5000(x_2 - 1) - 100\dot{x}_2 & F_{wall} > 0 \\ 0 & F_{wall} < 0 \end{cases}$$

- Simulate the RR robot's motion (including PD control and gravity terms)
- Plot the resulting tip force (F_{wall}) vs. time