AIN SAHMS UNIVERSITY
FACULTY OF ENGINEERING
Senior2 Mechatronics Engineering program
Spring 2025

MCT445 – Mechatronics in Automotive Application
Lab (2)

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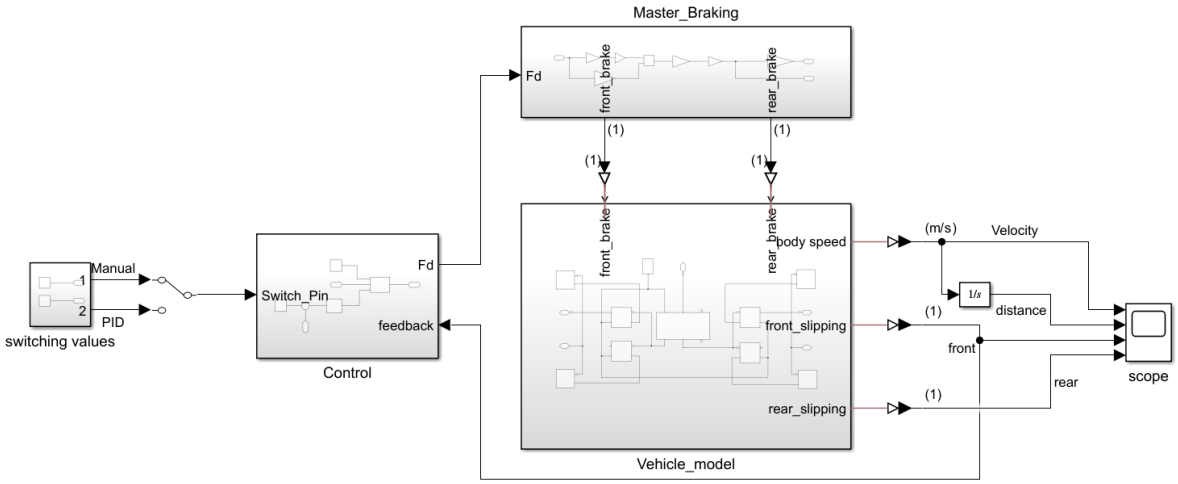
Introduction

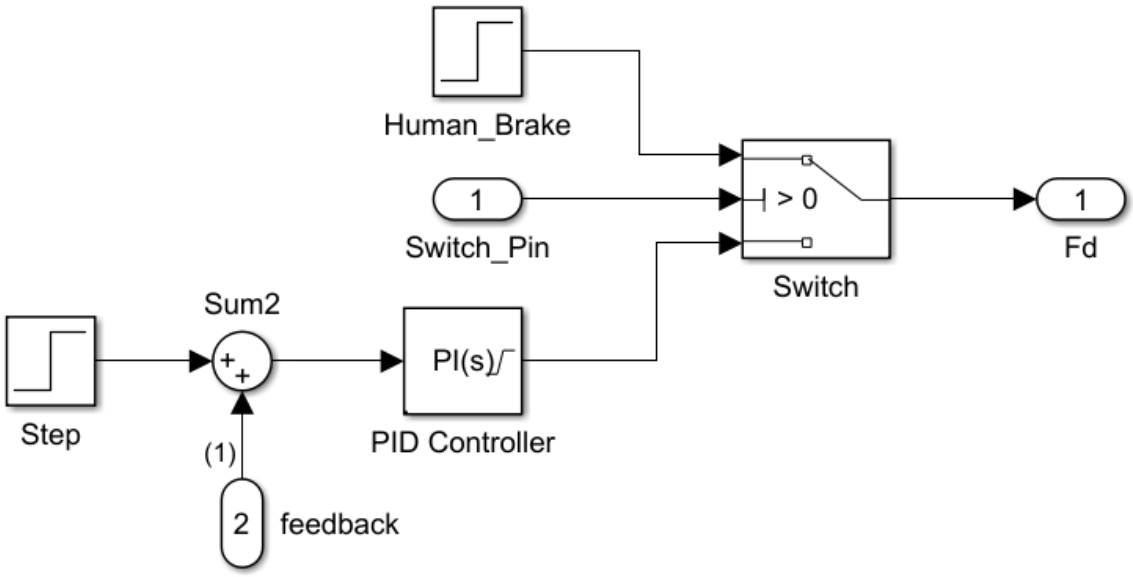
- Braking is a critical function in vehicle dynamics, directly impacting safety, stability, and performance. Traditional **manual braking** relies on the driver's force applied through the pedal, which is amplified by a brake booster before reaching the master cylinder. However, manual braking has limitations, including **inconsistent braking force**, **delayed response time**, and **driver fatigue**. To overcome these challenges, **control systems** such as the **Proportional-Integral (PI) Controller** are implemented to regulate brake pressure more efficiently.

- A **PI controller** is widely used in automotive braking systems due to its ability to **reduce steady-state error** and **improve system stability**. By automatically adjusting the braking force based on feedback from the system, the PI controller provides **smoother and more consistent braking performance** compared to manual braking. This report examines the **effectiveness of a PI controller in controlling brake pressure** compared to conventional manual braking. Through simulation and analysis, we evaluate the **response time, braking efficiency, and pressure stability** in both cases to determine the advantages and potential drawbacks of using a PI-controlled braking system.

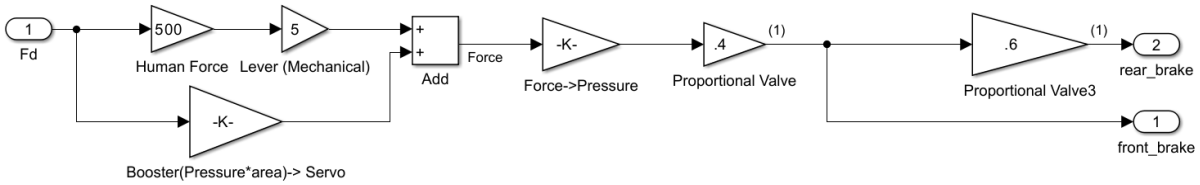
System Model



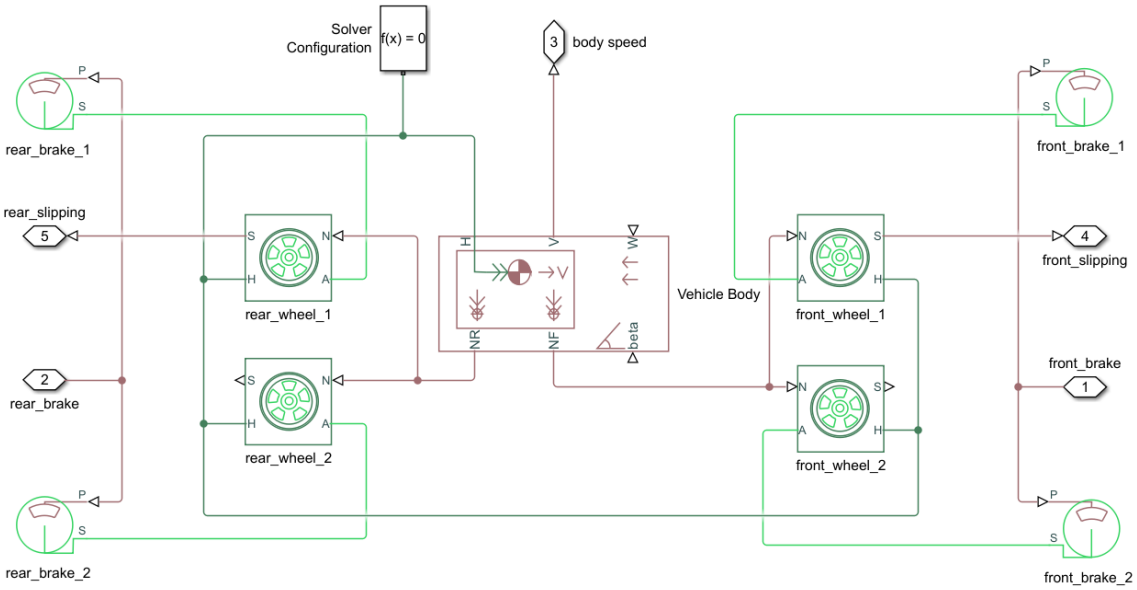
Control



Master Braking

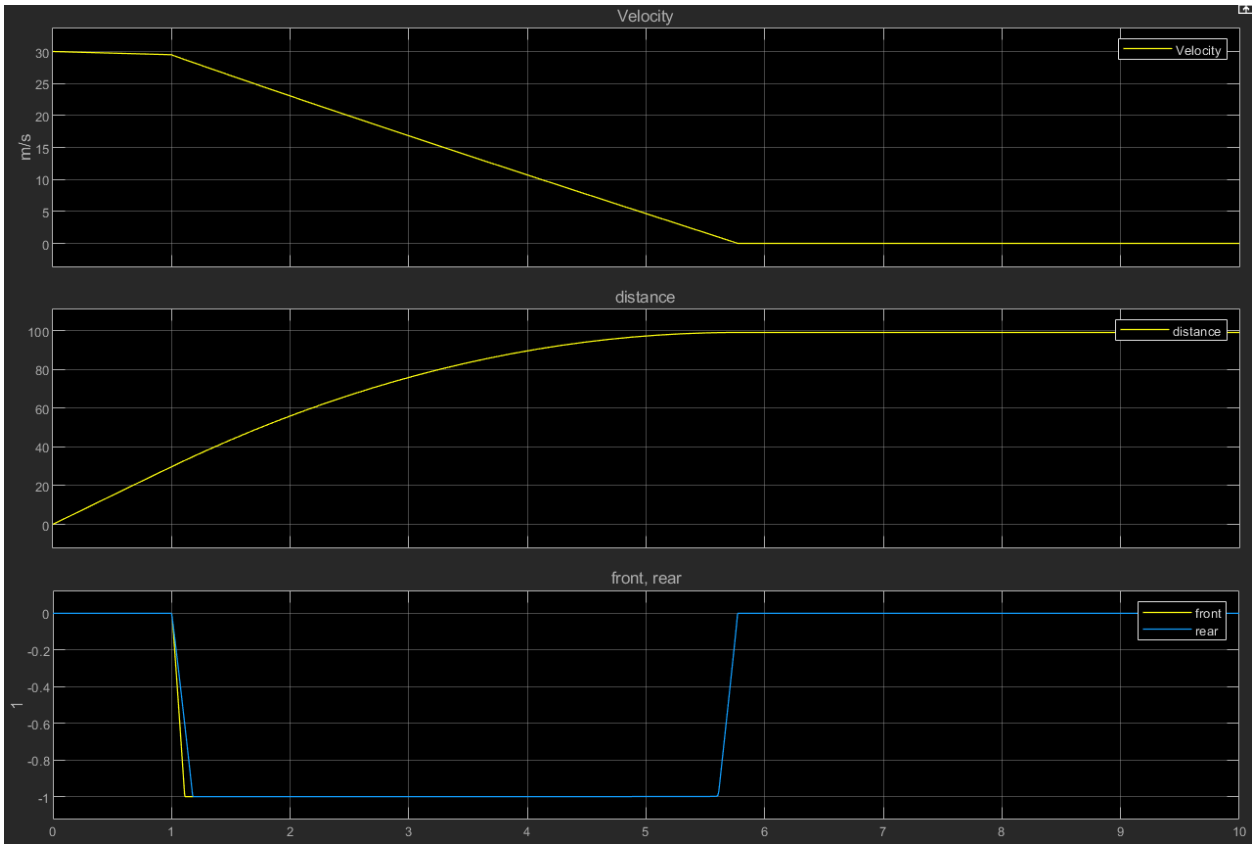


Vehicle Model



Results

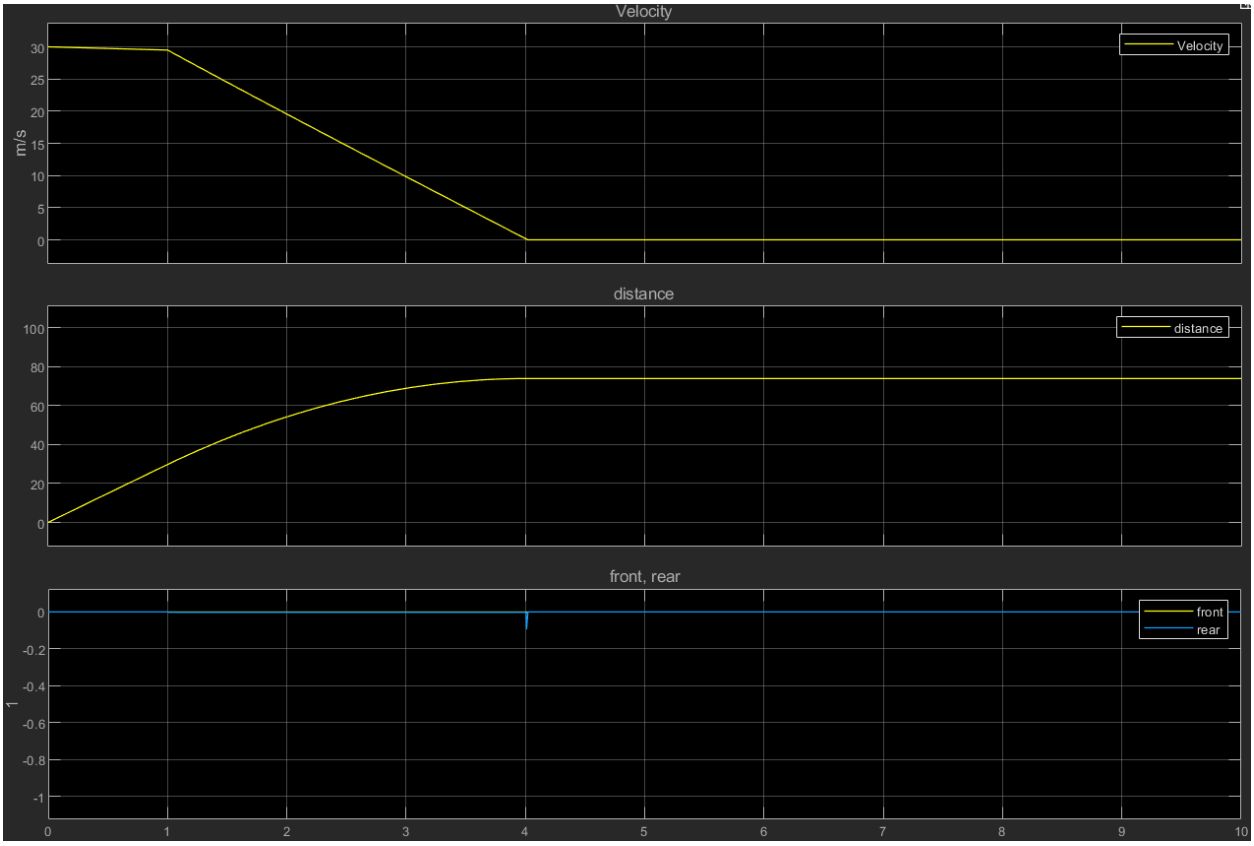
Manual Braking



Distance = 97 m

Stopping time = 5.8 sec

PI Braking



Distance = 73.9 m
Stopping time = 4 sec

Control Parameters

- P = 3.504;
- I = 0.001;

Work link

https://github.com/hossam-selem/Automotive/tree/0c055befbc782d5ccbd695f853d49636cb371367/lab2