

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



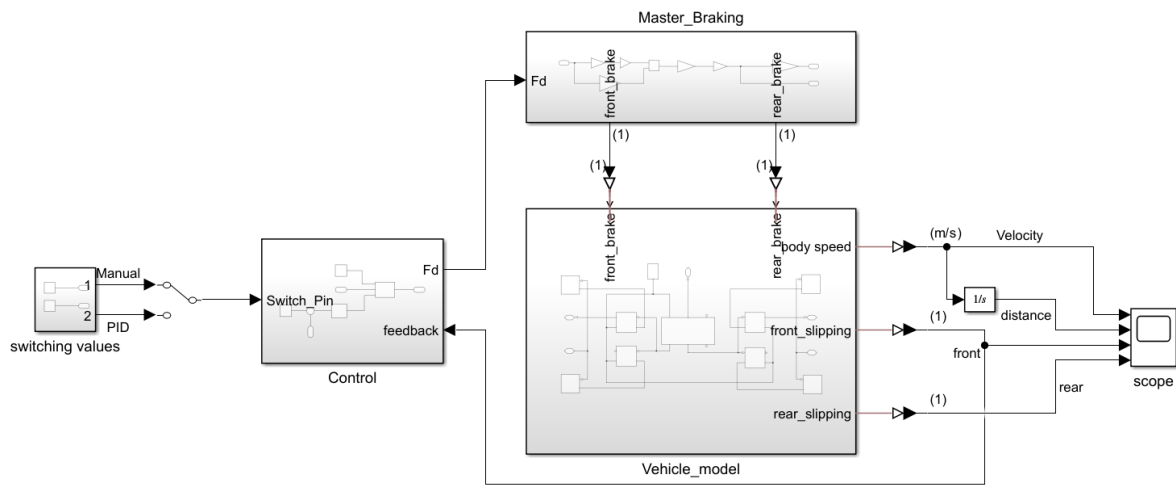
MCT445 – Mechatronics in Automotive Application
Lab (2)

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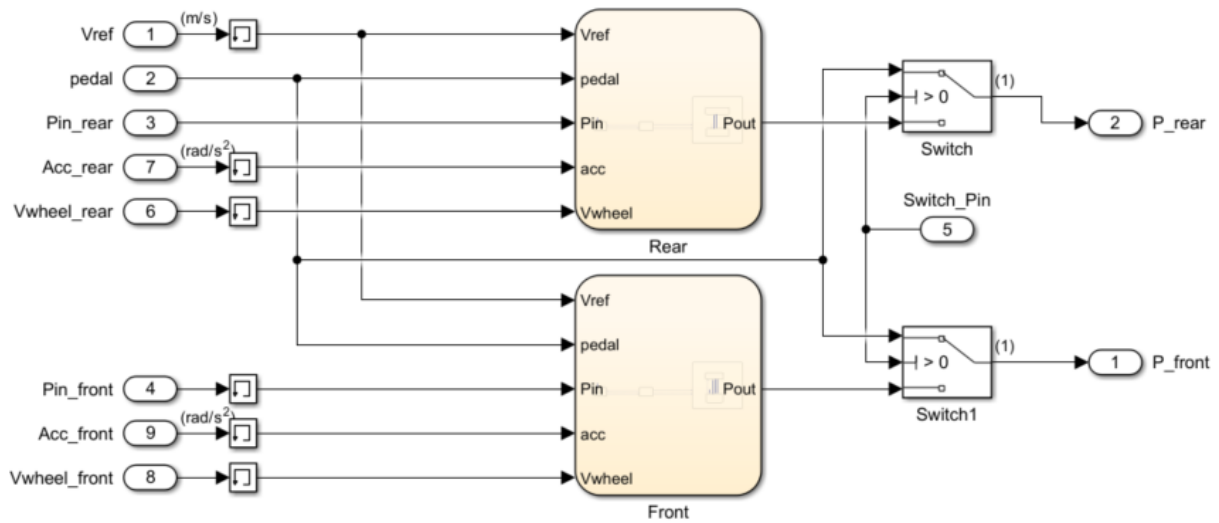
Introduction

- Anti-lock Braking System (ABS) is a crucial advancement in vehicle braking technology, designed to enhance safety, stability, and control during emergency braking situations. Traditional braking systems can cause wheel lockup under hard braking, leading to loss of steering control and increased stopping distances. ABS prevents wheel lockup by modulating brake pressure dynamically, ensuring optimal traction between the tires and the road surface.
- The ABS operates through a three-stage cycle: Hold, Increase, and Drop. In the Hold phase, the system maintains the current brake pressure when it detects an impending wheel lockup. If additional braking force is required, the Increase phase momentarily raises brake pressure to maximize stopping power. When excessive braking force is detected, the Drop phase reduces pressure to prevent wheel lockup and restore traction. This continuous cycle occurs multiple times per second, enabling controlled and effective braking performance.
- This report explores the effectiveness of ABS in preventing wheel lockup and maintaining vehicle stability. Through simulation and analysis, we assess braking efficiency, stopping distance, and stability under various road conditions. By comparing ABS to conventional braking, we highlight its advantages and discuss potential limitations in real-world applications.

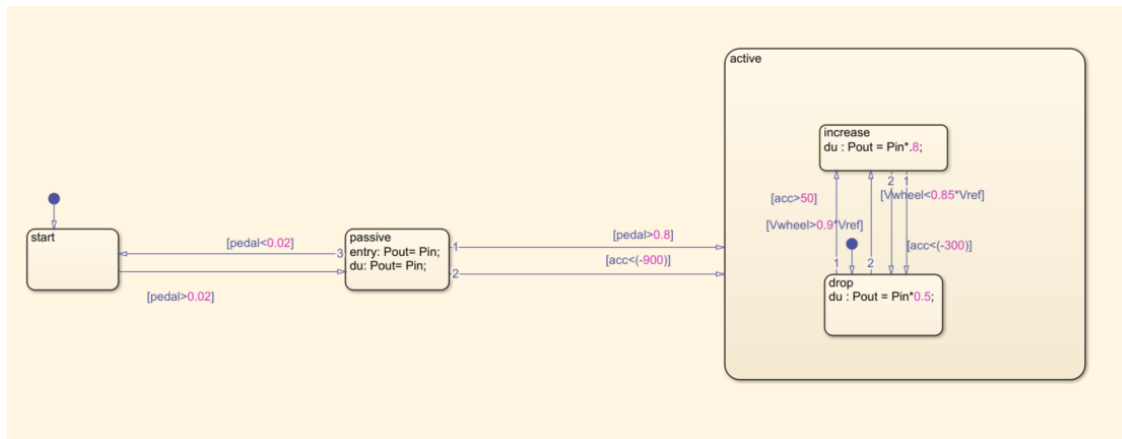
System Model



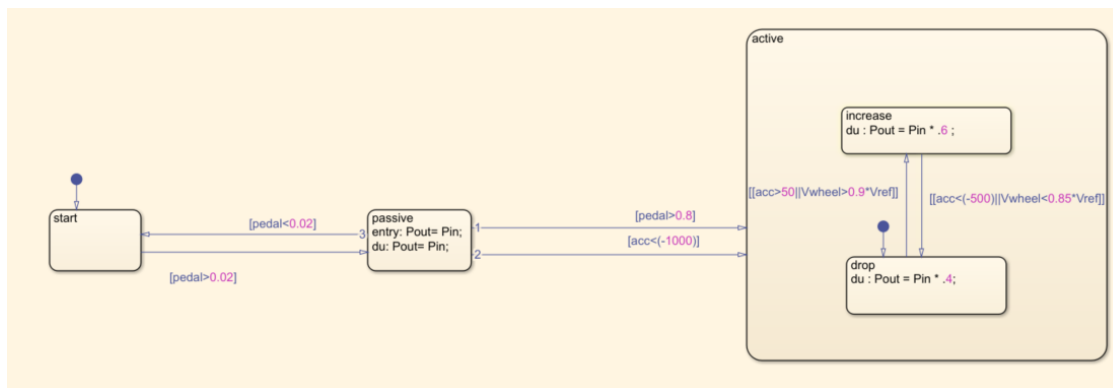
Control



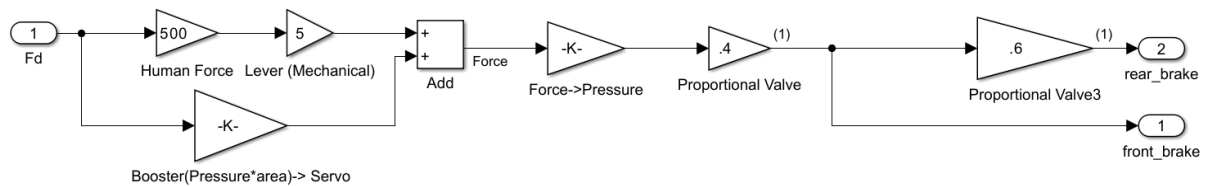
- Front



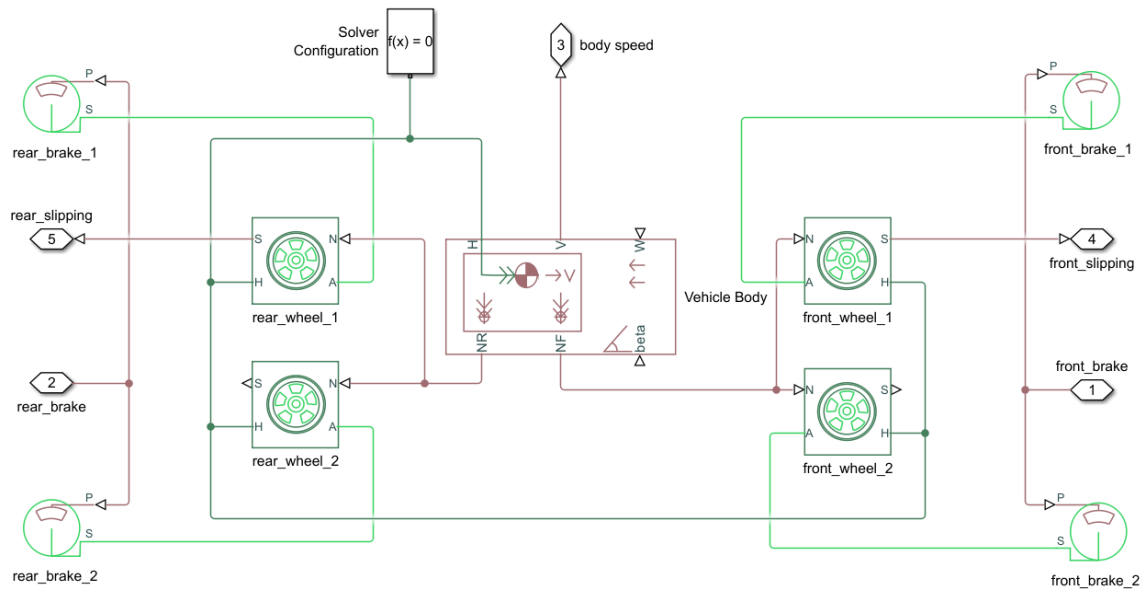
- Rear



Master Braking

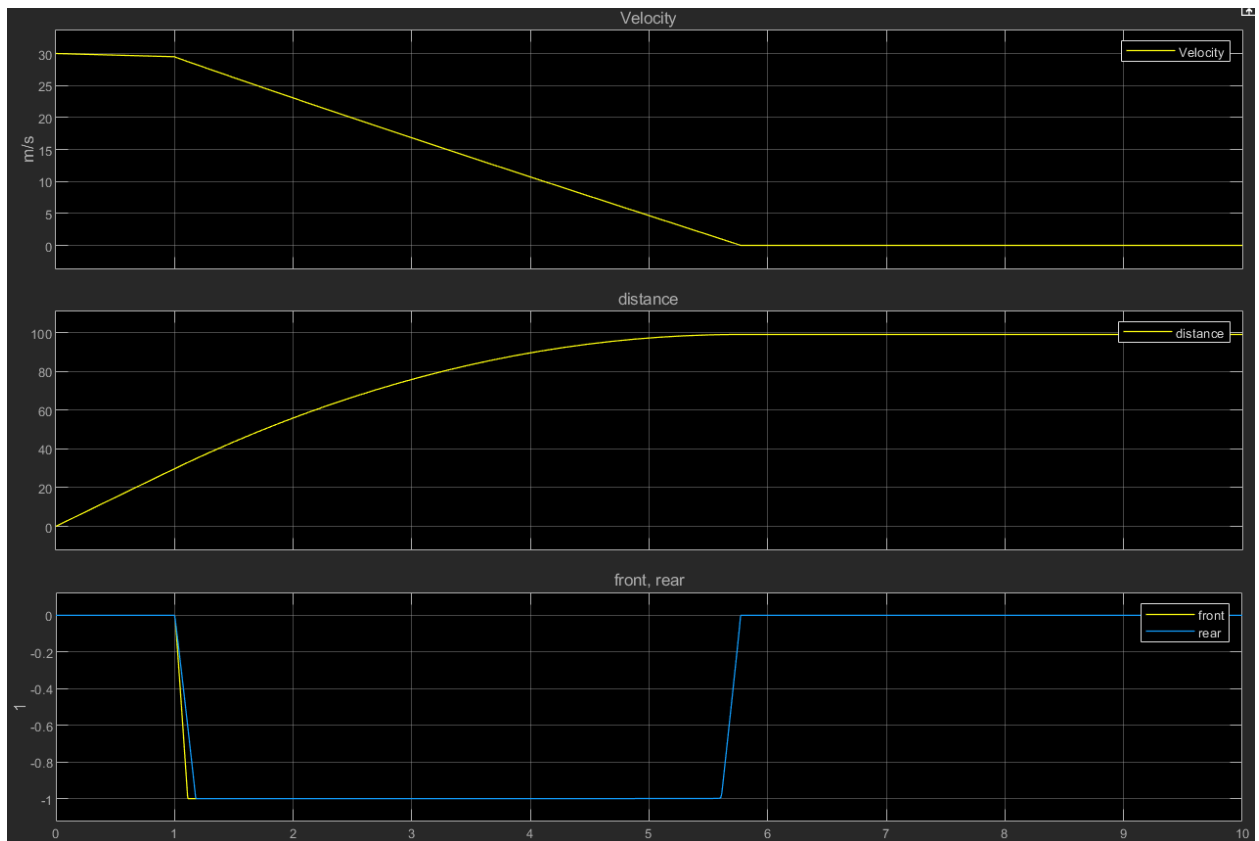


Vehicle Model



Results

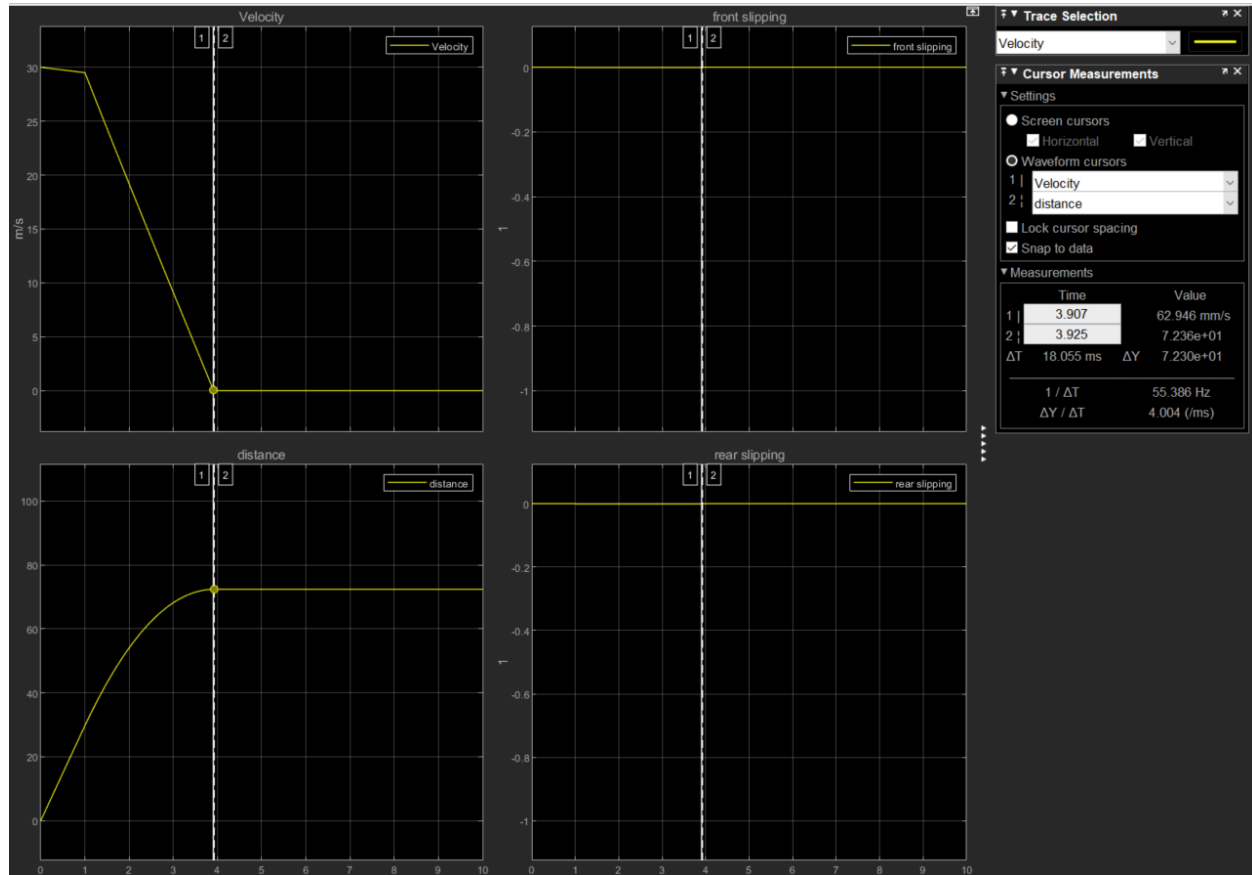
Manual Braking



Distance = 97 m

Stopping time = 5.8 sec

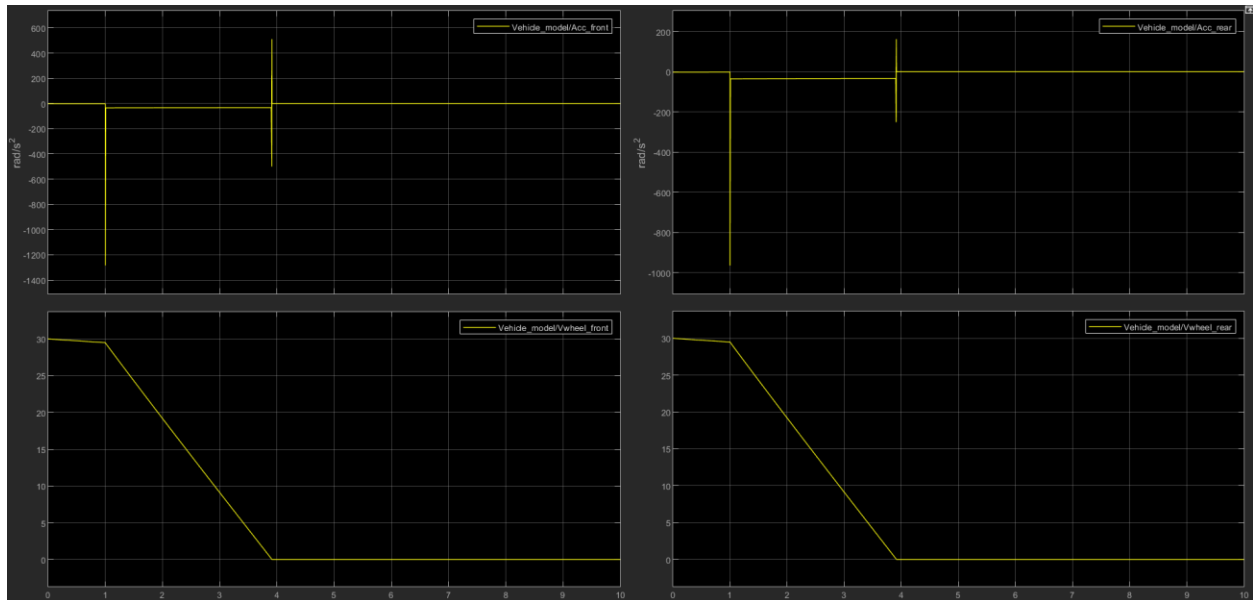
ABS Braking



Distance = 72.3 m

Stopping time = 3.9 sec

Wheels' acceleration



Work link

https://drive.google.com/drive/folders/1RtEPQgRpflnOFIL6jwip4HNHhp_ZJ0sZ?usp=sharing