Adaptive Control – Final Project

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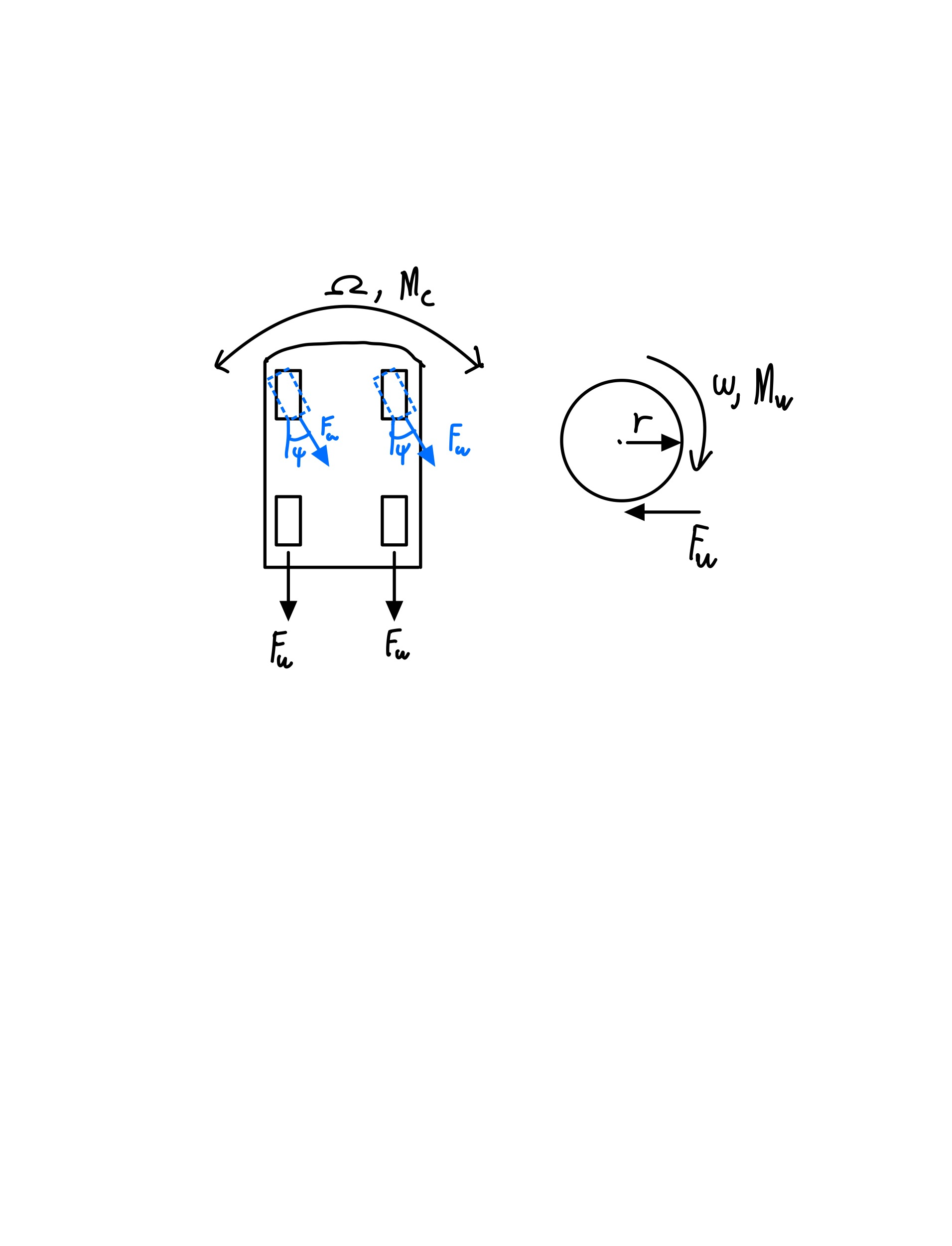
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# Introduction:

When designing a car, one of the most important components is nailing down how good it drives. Handling qualities in cars can be a make-or-break factor for customers on the look for a new vehicle. This project involves designing an adaptive controller that yields desired handling qualities given any car model and some extra specifications. In order to accomplish this, a simple car model is used with second order system approximations for both throttle and steering engine and actuator models respectively. A robust controller is to be designed for sportier cars where the performance will be determined based on responsiveness throughout different input frequencies and amplitudes.

# System Modeling:

A car’s steering characteristics is determined by wheelbase and speed, therefore a throttle and steering mechanism needs to be modeled in order to asses performance for the goal in mind (car handling qualities). We will assume a AWD car model where equal force is exerted by all four wheels. The front wheels rotate and induce a moment in the car that causes the car to turn due. The force of the wheels is calculated via the wheel speed and the moment it would induce per wheel. The diagram below shows the general diagrams from which the equations of motion are going to be derived.



The symbols are described below:

The equations of motion are then organized by forces and moments in X and Y as shown below.

These can be organized into state space format as follows:

Where road friction was modeled by the damping terms and for forward acceleration and angular acceleration respectively.

# Control Law Design and Simulation:

# Results & Discussion: