



# Cruise Control System of a Vehicle Using PID Controller

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# Abstract for Cruise Control System of a Vehicle

This presentation provides an in-depth overview of the cruise control system in modern vehicles. It explores the key components, working principles, and benefits of this advanced technology that enhances driving comfort and efficiency.



# Block diagram of Cruise Control System



1.Speed Sensor

Measures vehicle speed and sends data to the control unit.



2.Control Unit

Processes speed data and adjusts throttle.



3.Actuator

Adjusts throttle based on control unit commands.



4.User Interface

Allows driver to set, adjust, and disengage cruise control.

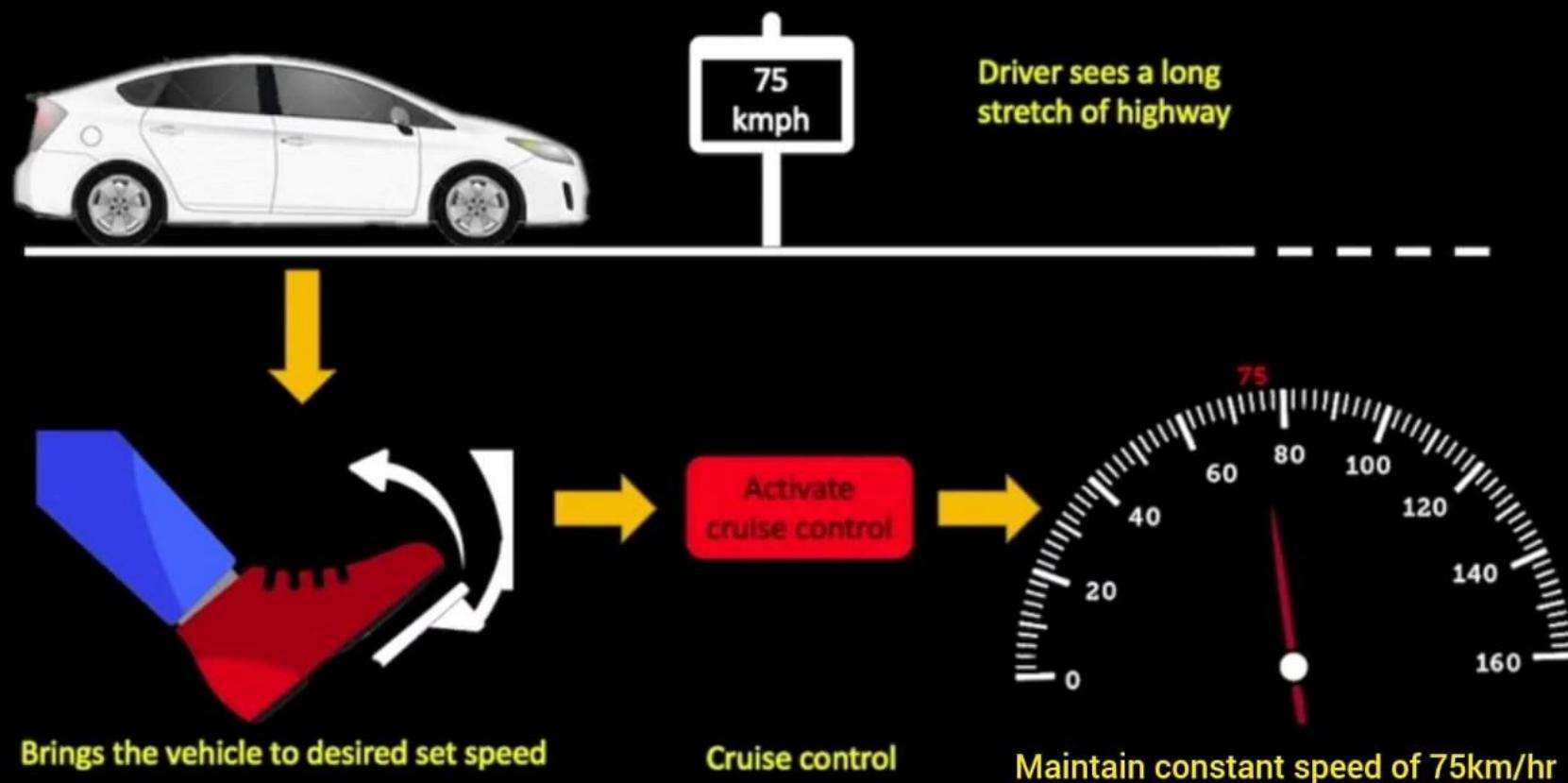


# What is Cruise control?



1. Definition: Cruise control is an automated system that maintains a constant speed set by the driver.
2. The cruise control system is a valuable feature in modern vehicles, allowing drivers to maintain a constant speed without the need to continuously press the accelerator pedal.
3. The system takes over the throttle of the car to maintain a steady speed as set by the driver.
4. It is a system that allows you to set your car to a specific speed, letting you take your foot off the accelerator pedal.
5. Cruise control - automatically controls the speed of a motor vehicle.
6. purpose: Enhances driver comfort during long-distance driving and improves fuel efficiency.

# CRUISE CONTROL OF A VEHICLE



# Adaptive Cruise Control



Radar, cameras, and sensors

Monitor the surrounding traffic



Automatic acceleration and braking

Adapt to changing road conditions



Safe following distance

Maintain a constant speed and following distance



Reduced driver fatigue

Enhanced safety and convenience

Adaptive cruise control (ACC) is an advanced cruise control system that automatically adjusts the vehicle's speed to maintain a safe following distance from the car ahead. This intelligent technology helps reduce driver fatigue and improves fuel efficiency by automatically maintaining a constant speed and following distance, even in stop-and-go traffic. It represents a significant step towards autonomous driving, enhancing safety and convenience for modern vehicles.

# Application of Cruise Control System

## Maintaining Constant Speed

Cruise control allows drivers to maintain a consistent speed on highways, reducing the need for constant acceleration and braking.

## Improved Fuel Economy

By keeping the vehicle at a steady speed, cruise control can help improve fuel efficiency and reduce fuel consumption.

## Reduced Fatigue

Cruise control can help alleviate driver fatigue on long drives by automatically adjusting the vehicle's speed, allowing the driver to focus on the road ahead.

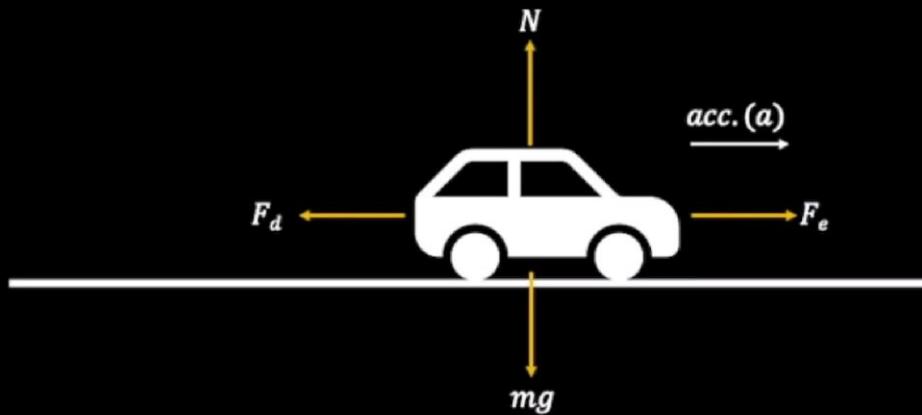
## Enhanced Safety

Cruise control can help drivers maintain legal speed limits, reducing the risk of speeding and associated safety hazards.

## Adaptive Capabilities

Advanced cruise control systems, such as Adaptive Cruise Control (ACC), can automatically adjust the vehicle's speed to maintain a safe following distance from the car in front.

# Free body diagram



## Mathematical modelling

$$N = mg$$

$$F_e - F_d = ma$$

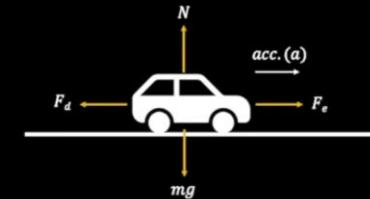
$F_e \propto$  throttle position  $\propto$  input

$$F_e = k_1 \cdot (\text{input to throttle})$$

$$F_d = k_2 v$$

$$k_1 \cdot (\text{input}) - k_2 v = ma$$

$$m \frac{dv}{dt} = -k_2 v + k_1 \cdot (\text{input}) \rightarrow$$

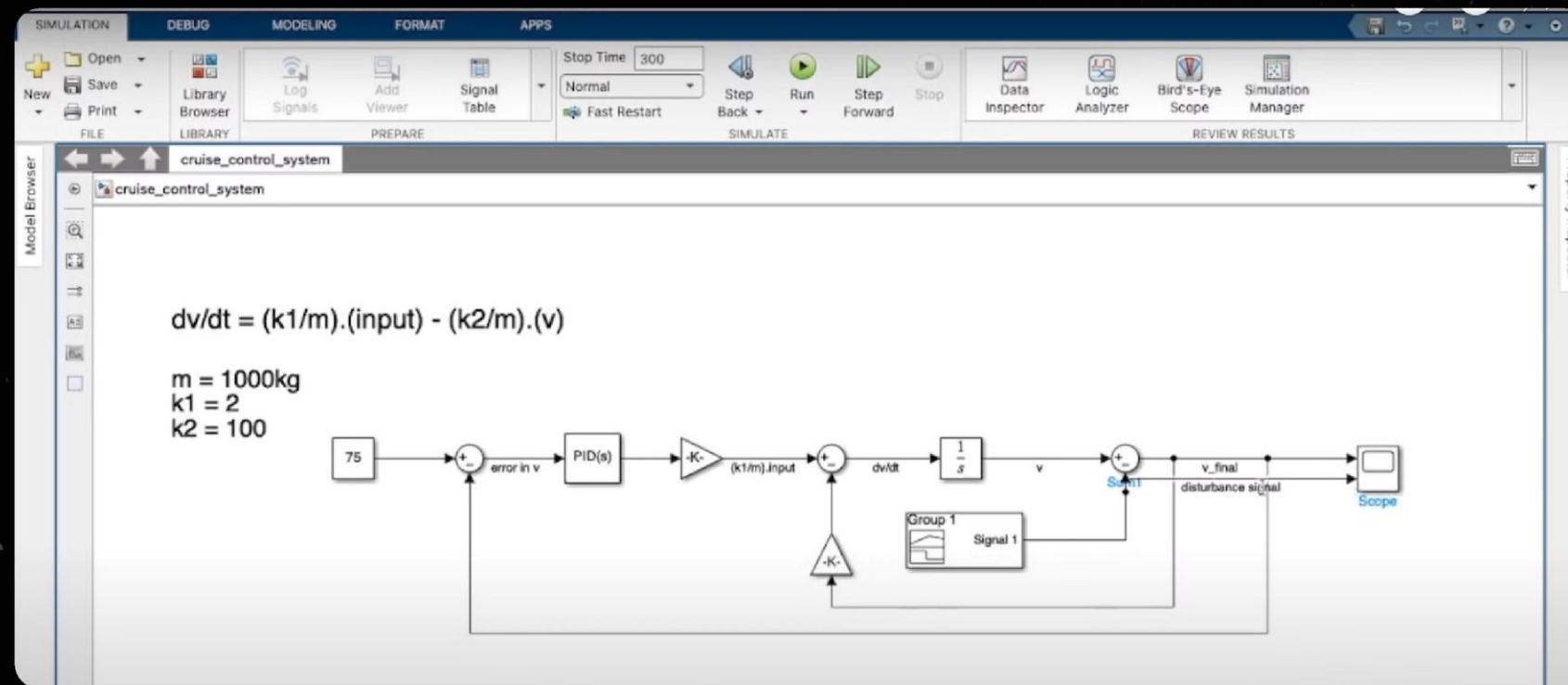


$$\boxed{\frac{dv}{dt} = -\frac{k_2}{m} v + \frac{k_1}{m} \cdot (\text{input})}$$

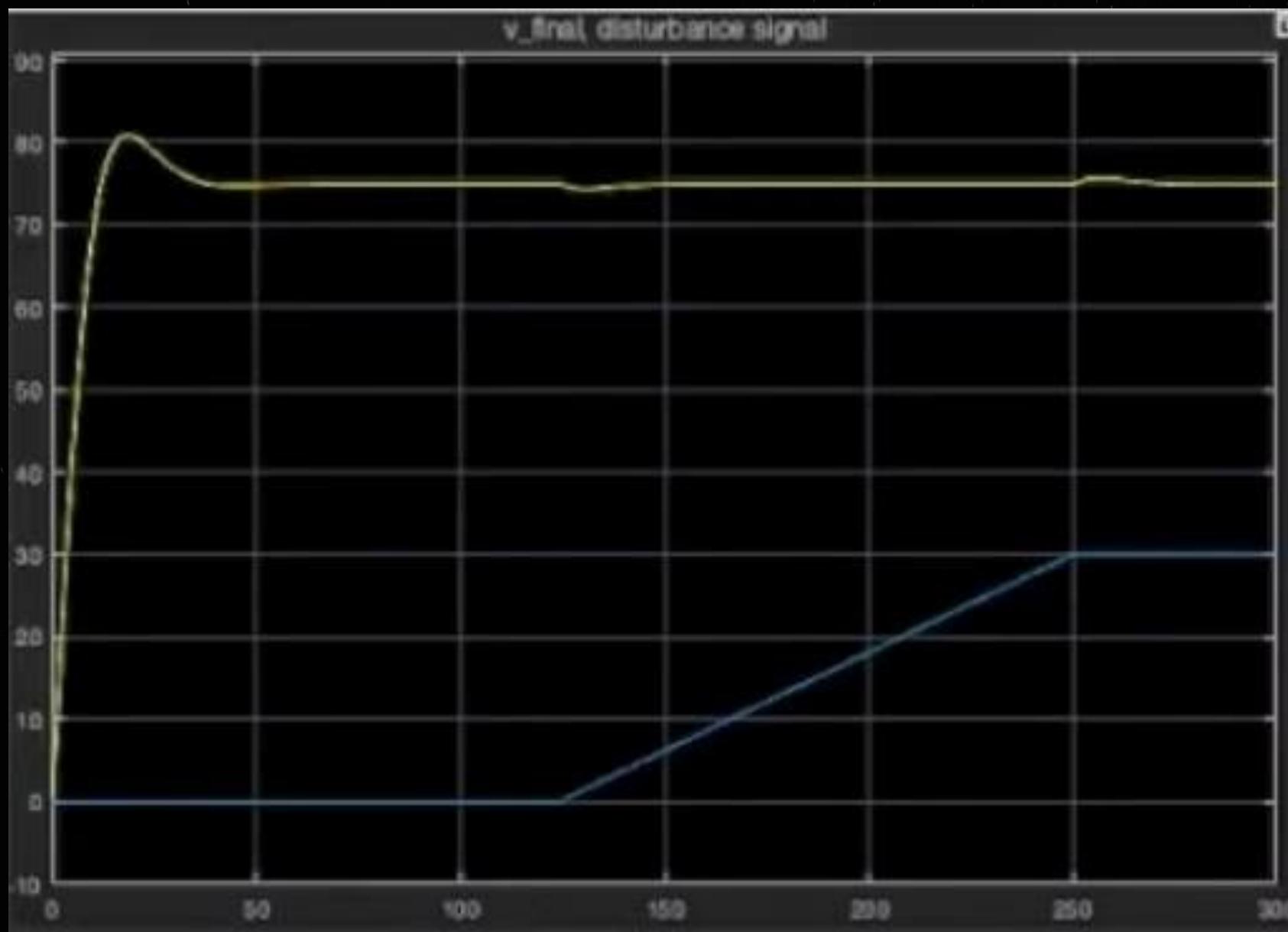
## • Assumptions

- The car is moving on a flat road with zero slope
- Drag force is calculated using Stoke's law where  $F_d \propto v$

# SIMULATION



# OUTPUT



# The Future of Cruise Control Technology



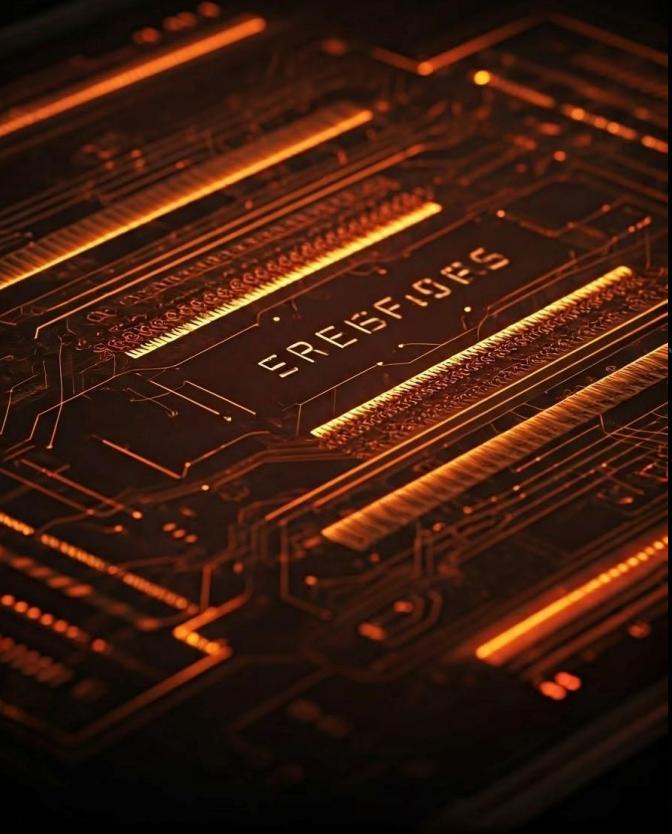
## Advanced User Interface

Cruise control systems will become more intuitive and user-friendly through advanced interfaces, such as heads-up displays.



## Integration with Autonomous Driving

Cruise control will play a crucial role in the development of autonomous driving technologies.



# conclusion

**Summary:** Cruise control is an essential feature in modern vehicles, improving comfort, safety, and efficiency.

**Looking Ahead:** As technology advances, cruise control systems will continue to evolve toward fully autonomous driving.

# Key References for Cruise Control Systems

- **SAE J1939:** This standard defines the communication protocols and message formats for electronic control systems in vehicles, including cruise control.
- **ISO 15622:** This international standard specifies the performance requirements and test procedures for adaptive cruise control systems in road vehicles.
- **NHTSA Regulations:** The National Highway Traffic Safety Administration (NHTSA) in the United States has issued regulations governing the design and safety of cruise control systems.
- **OEM Technical Documents:** Vehicle manufacturers provide detailed technical manuals and service information for the cruise control systems in their specific models.
- **Research Papers:** Academic and industry publications explore the latest advancements in cruise control technology, such as sensor integration and autonomous driving applications.