

Longitudinal Speed Control with PID

Course 1, Module 5, Lesson 2



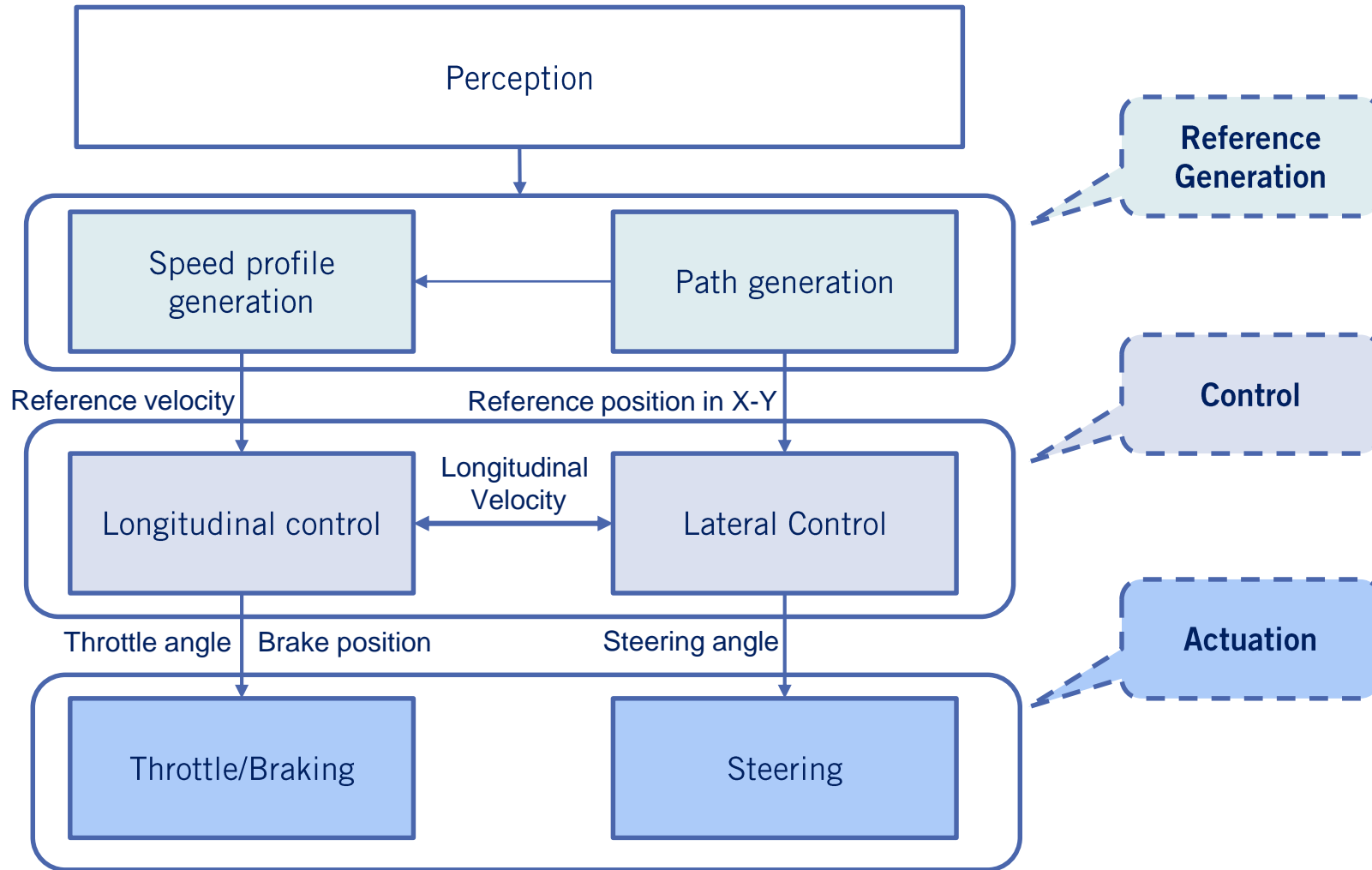
UNIVERSITY OF TORONTO
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Learning Objectives

In this video, you'll ...

- Define the full vehicle planning and control architecture
- Design a PID controller for cruise control/speed regulation

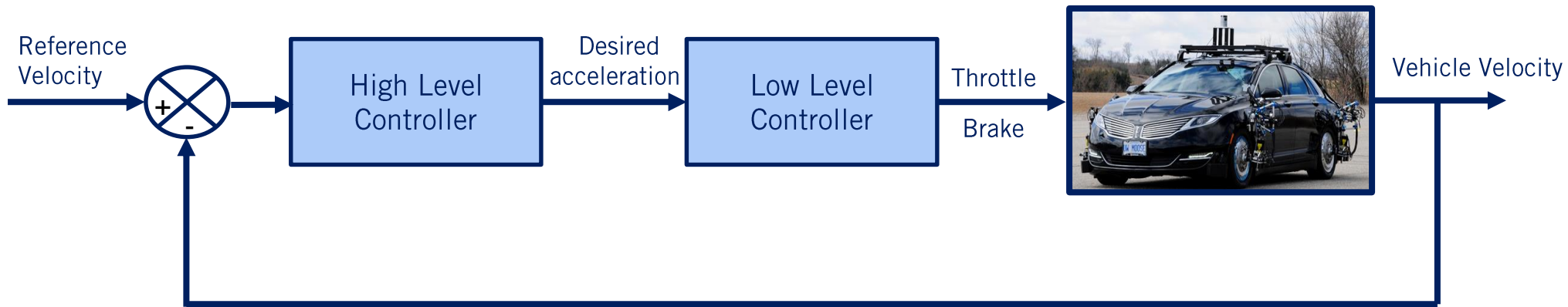
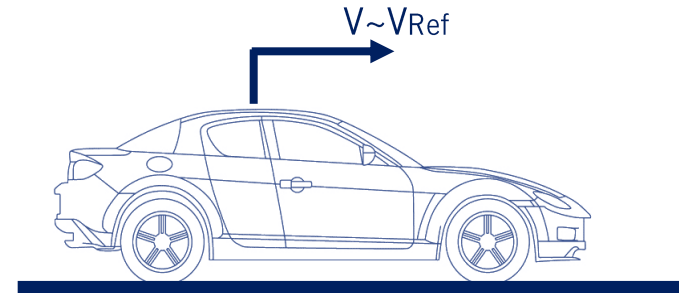
Architecture of Vehicle Control Strategy



Longitudinal Speed Control

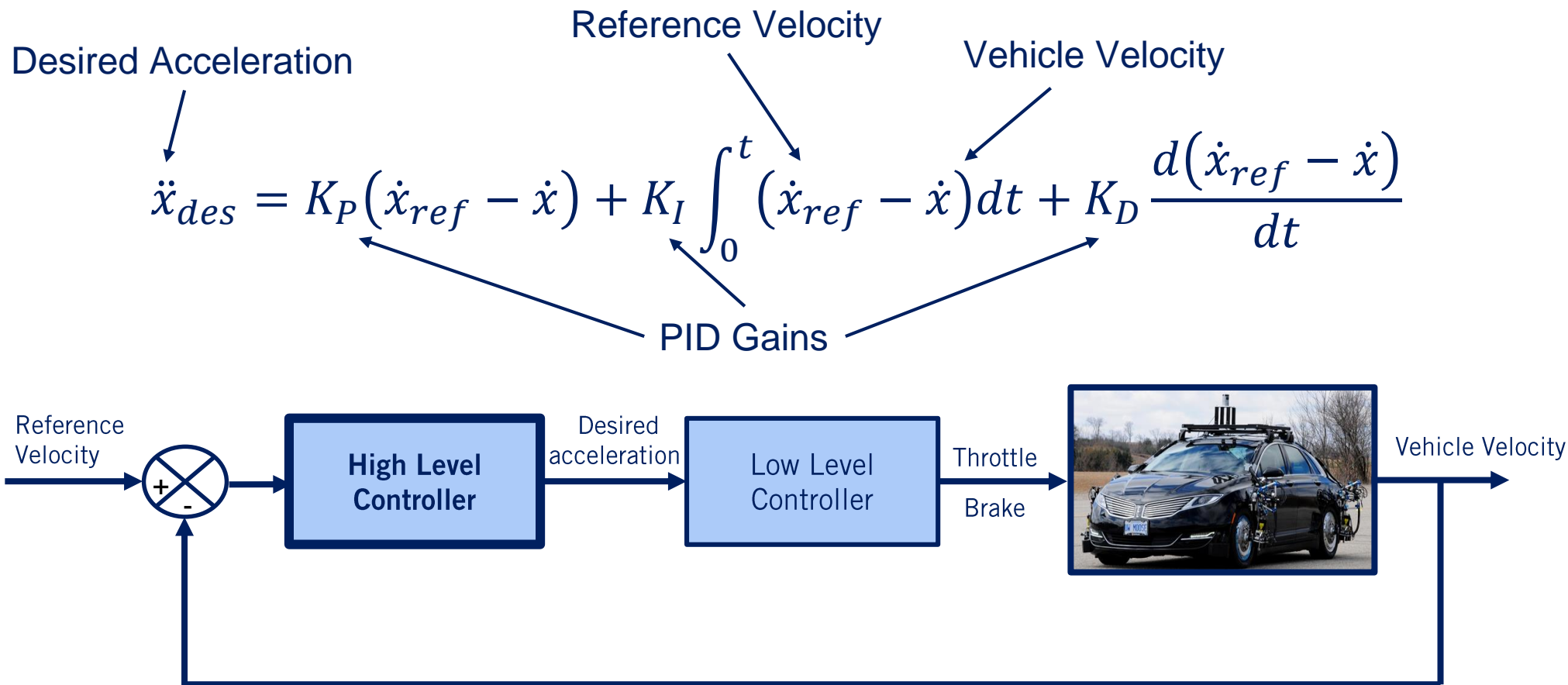
Cruise control:

- Speed of the vehicle is controlled (by throttling and braking) to be kept at the reference speed



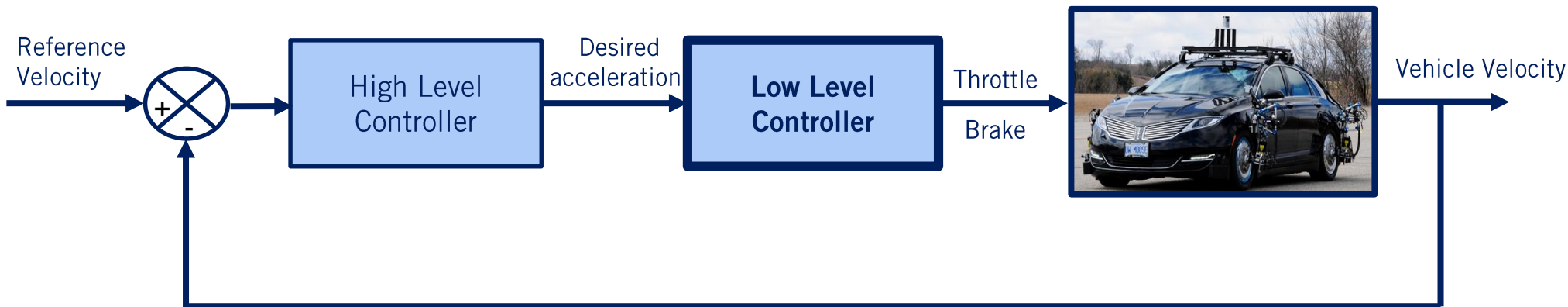
Upper Level Controller

- Determines the desired acceleration for the vehicle (based on the reference and actual velocity).

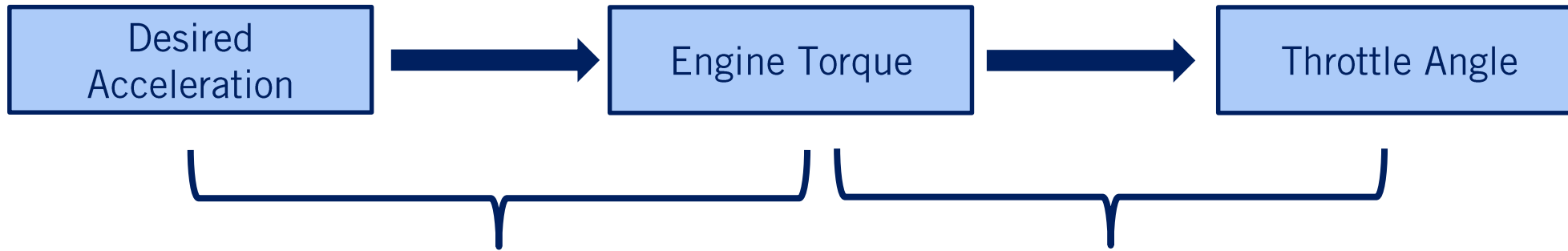


Lower Level Controller

- Lower Level Controller:
 - Throttle input is calculated such that the vehicle track the desired acceleration determined by the upper level controller
- Assumptions:
 - Only throttle actuations is considered (no braking)
 - The torque converter is locked (gear 3+)
 - The tire slip is small (gentle longitudinal maneuvers)

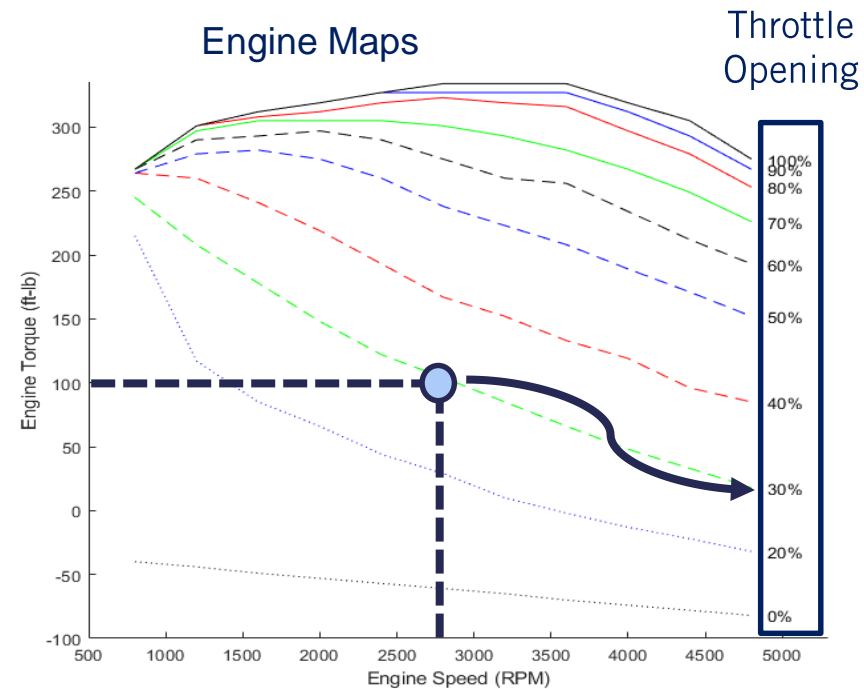


Lower Level Controller

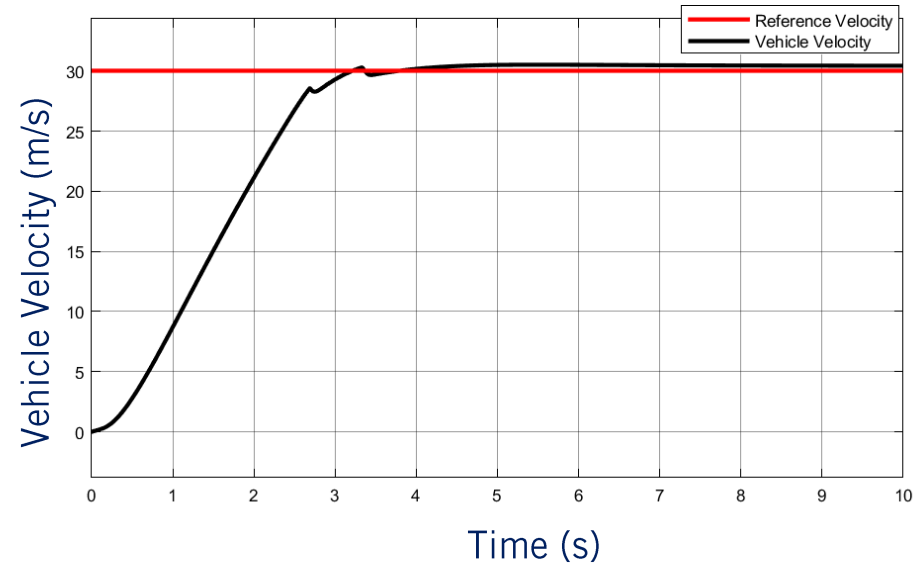
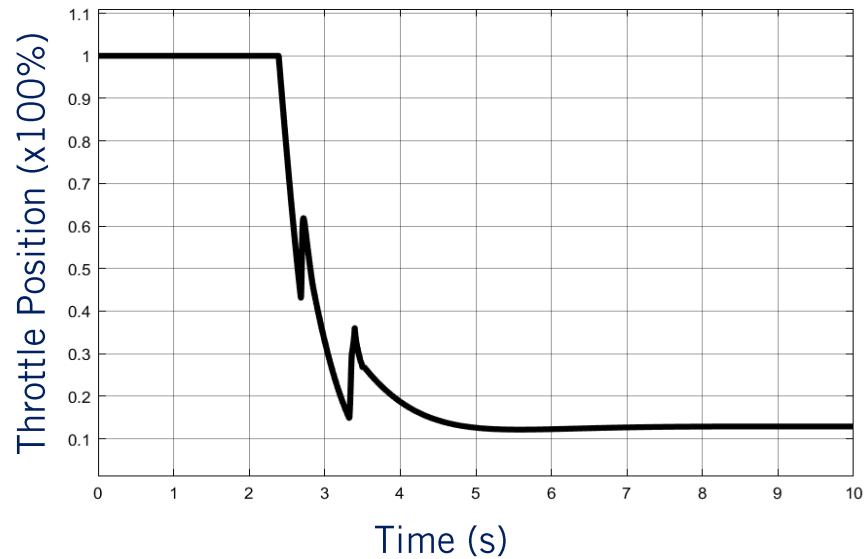
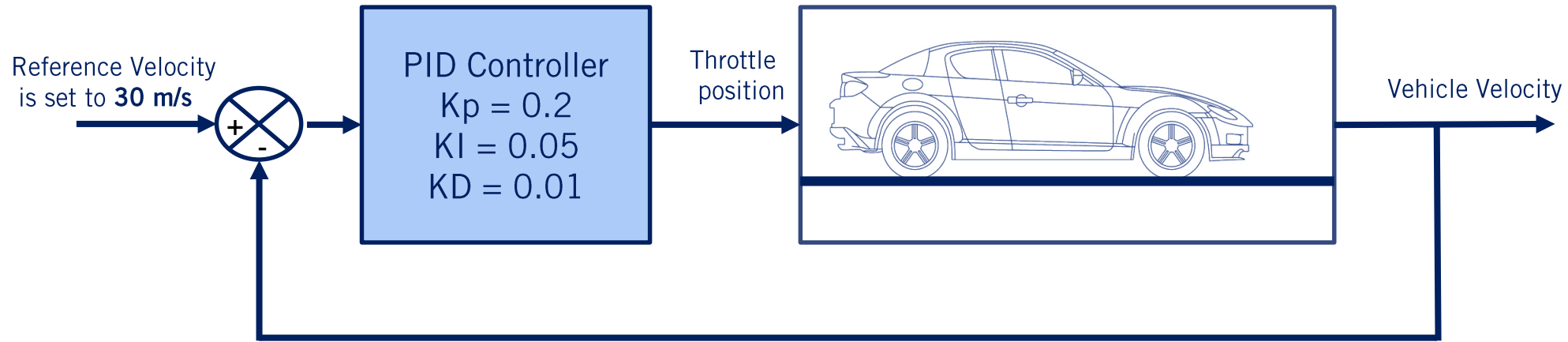


Vehicle Drivetrain Dynamics
(Previous Module)

$$T_{Engine} = \frac{J_e}{(r_{eff})(GR)} \ddot{x}_{des} + T_{Load}$$



Simulation Example



Summary

What we have learned from this lesson:

- Vehicle longitudinal cruise control
- High and low-level control structure based on PID and engine maps

What is next?

- We will go through the vehicle feedforward control design