

# Automotive Control Systems

MKT5125 - Department of Mechatronics Engineering, YTU

Fall 2022

## Instructor and Assistant Information

### Instructor

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### Email

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### Office Location & Hours

Dean's Office / by appointment.

## General Information

### Description

This course provides an intensive introduction to the vehicle handling dynamics and control of road vehicles. The contents of the course include - Overview of Tire Models, Lateral Vehicle Dynamics and Control, Longitudinal Vehicle Dynamics and Control, Electronic Stability Control, Rollover Prevention Control, and Automotive Suspensions and Control.

### Expectations and Goals

Understand the basic principles used to numerically simulate mathematical models of vehicle systems; Use these principles to numerically simulate dynamic system responses of vehicle systems; introduce the use of modeling and analysis in the design of automatic controls for vehicle systems. **Experience in MATLAB/Simulink and coding is expected.**

### Course Learning Outcomes

1. Develop and implement computer models of vehicle dynamics behaviour and analyze results from simulations
2. Identify and mathematically characterize linear and nonlinear tire behaviour and the influence of this behaviour on vehicle performance
3. Identify suspension characteristics influencing vehicle chassis performance and stability
4. Understand and characterize the change in vehicle performance and vehicle/roadway interaction due to automated subsystems such as ABS, ESC, SBW, and active suspension
5. Construct specifications for vehicle control systems

## Course Materials

### Required Materials

- None.

### Optional Materials

- Rajamani, Rajesh. Vehicle Dynamics and Control. 2nd. ed., Springer US, 2012.
- Wong, Jo Yung. Theory of ground vehicles. Wiley. com, 2001.
- Kiencke, U., and Lars N. Automotive control systems: for engine, driveline, and vehicle. Springer, 2005.
- Pacejka, Hans B. "Tire and vehicle dynamics. Society of Automotive Engineers." Inc., Warrendale, PA (2002).
- Abe, Masato. Vehicle handling dynamics: theory and application. Butterworth-Heinemann, 2009.
- Gillespie, Thomas D. Fundamentals of Vehicle Dynamics. SAE, 1992.
- Dixon, J.C., Tires, Suspension and Handling, 2nd Edition, SAE Press, 1996.

## Course group

Go to Google Classroom ([classroom.google.com](https://classroom.google.com)) and join the class with the code: **jkjwfm3**  
<https://classroom.google.com/c/NDkwMjk5NDU1Mjky?cjc=jkjwfm3>

## Course Schedule

Week	Topic
1	Introduction + Tire Mechanics
2	Tire Mechanics
3	Lateral Vehicle Dynamics + Control
4	Lateral Vehicle Dynamics + Control
5	Lateral Vehicle Dynamics + Control
6	Longitudinal Vehicle Dynamics + Control
7	Longitudinal Vehicle Dynamics + Control
8	Longitudinal Vehicle Dynamics + Control
9	Midterm
10	Roll Dynamics + Control
11	Roll Dynamics + Control
12	Vertical Dynamics + Control
13	Vertical Dynamics + Control
14	Vertical Dynamics + Control
15	Final

## Additional Information and Resources

### Grading

$0.3*MT + 0.4*Final + 0.3*HWs$

\* This syllabus is tentative and subject to changes. Announcements, updates and other information will be released either during live lecture or via e-mail.