



Course Code MENG-434	Course Title Vehicle Dynamics	ECTS Credits 6
Department Engineering	Semester Fall, Spring	Prerequisites MENG-252
Type of Course Elective	Field Engineering	Language of Instruction English
Level of Course 1 st Cycle	Year of Study 4 th	Lecturer(s) Dr Andreas Loizou
Mode of Delivery Face-to-face	Work Placement N/A	Co-requisites None

Objectives of the Course:

The purpose of the course is to give students basic knowledge and theoretical principles of operation of the dynamics of vehicles and their specific subsystems. It also focuses on of the vibrations and the measurement of vibrations in vehicles.

Learning Outcomes:

Upon completion the students should be able to:

- Understand vehicle and tire dynamics
- Appreciate the importance of suspension geometry and components
- Calculate the natural frequencies of suspension
- Calculate vehicle dynamic performance parameters

Course Contents:

1. Introduction
 - 1.1. Defining Vehicle dynamics
 - 1.2. Ride quality
 - 1.3. Vibration excitation sources
 - 1.4. Vehicle response properties and suspension isolation
2. Tires
 - 2.1. Tire Axis System
 - 2.2. Stiffness / hardness of the tires
 - 2.3. Tire construction
 - 2.4. Rolling resistance
 - 2.5. Longitudinal and lateral load
 - 2.6. Tractive properties
 - 2.7. Cornering forces and equations
 - 2.8. Slip Angle
3. Suspension Dynamics

- 3.1. Rigid axle suspension
- 3.2. Independent suspension
- 3.3. Toe, caster and camber angles
- 3.4. Vehicle roll center calculation
- 3.5. Cornering effects
- 3.6. Kinematic and dynamic needs of the system
- 4. Suspension Springs and dampers
 - 4.1. Torsion springs
 - 4.2. Coil Springs
 - 4.3. Leaf Springs
 - 4.4. Dampers (shock absorbers)
- 5. Vibrations
 - 5.1. Calculation of natural frequencies
 - 5.2. Mode shapes calculation
 - 5.3. Eigenvalues and eigenvectors
 - 5.4. Simplified systems for calculating vibrations
 - 5.5. Full model of vehicle vibration
- 6. Active Systems
 - 6.1. Active and semi-active suspension
 - 6.2. Skyhook control principle
- 7. Acceleration and braking performance
 - 7.1. Power and traction limited acceleration
 - 7.2. Deceleration and braking forces
- 8. Road loads
 - 8.1. Aerodynamic Loads
 - 8.2. Rolling Resistance

Learning Activities and Teaching Methods:

Lectures, demonstrations, and homework assignments

Assessment Methods:

Coursework, Mid Term Exam, Final Examination

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Gillespie, T. D.	Fundamentals of Vehicle Dynamics	Society of Automotive Engineers	1992	9781560911999
Rajamani, R.	Vehicle Dynamics and Control	Springer.	2012	9781461414322