Module Specification

Vehicle Dynamics

Version: 2024-25, v3.0, 25 Jun 2024

Contents

Part 1: Information

Module title: Vehicle Dynamics

Module code: UFMFVS-15-3

Level: Level 6

For implementation from: 2024-25

UWE credit rating: 15

ECTS credit rating: 7.5

College: College of Arts, Technology and Environment

School: CATE School of Engineering

Partner institutions: None

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: Dynamics 2023-24

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: A fundamental aspect of Automotive Engineering, this module starts by reviewing Single Degree of Freedom and Multiple Degree of Freedom (MDOF) vibrations, enhanced by looking at forced MDOF systems, using the quarter car model as a basis. The focus then shifts to the specifics of automotive chassis design and dynamics, discussing SAE coordinate systems, forces and loads on a vehicle, tyres, cornering (steady-state, low and high speed), springs and dampers and suspension types and parameters.

Features: Not applicable

Educational aims: On successful completion of this module, students will be in a position to apply advanced methods of engineering analysis to a range of complex problems that occur in an automotive engineering context.

Outline syllabus: Review of SDOF and MDOF vibration (underpinned by mathematical topics of differential equations, eigenvalue and eigenvectors, matrix algebra and manipulation),

Vehicle coordinate systems, forces and loads on a vehicle,

Tyres,

Steady-state cornering - low and high speed,

Springs and Dampers,

Suspension types and parameters.

Double Wishbone suspension kinematics

Part 3: Teaching and learning methods

Teaching and learning methods: This module will continue the delivery approach of dynamics modules covered at levels 4 and 5 and adopts a flipped delivery supported by recorded and on-line materials to encourage active learning.

Whole cohort teaching sessions are structured and focused on delivering active learning, based on students having conducted a wide range of pre-study activities. This is followed by structured, problem-focussed, tutorial sessions in TEAL spaces or practical laboratory-based activities (smaller groups), making effective use of technology, facilities and engendering peer-learning and tutor facilitation in ad-hoc groups.

Facilitated sessions make extensive of simulation software to visualise and elucidate solutions, and provide methods and approaches to solve complex problems where hand calculations are tedious and/or problematic.

Study time outside of contact hours will be spent on working through pre-study (i.e. new) material (via notes and videos), exercises and example problems. The learning on the module is strongly supported by the use of technology and students are encouraged to engage in this material both prior to and after class contact sessions.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Apply and implement knowledge of scientific and mathematical principles and methods necessary in the dynamics of vibrations, enabling appreciation of engineering context and the real-world application to vehicle dynamics. (SM1b, SM2b, EA1b, P8)

MO2 Select and apply mathematical methods, tools and notations proficiently in the analysis and solution of vibrational problems in the context of automotive chassis dynamics. (EA2, G1)

MO3 Apply and integrate knowledge of other engineering disciplines to support the study of vehicle dynamics involving complex systems. (SM3b)

MO4 Critically evaluate the performance of automotive chassis systems and components through the use of analytical, quantitative and qualitative methods and modelling techniques. (EA3b, P8, G1)

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 hours

Total = 0

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link http://www1.uwe.ac.uk/its/itresources/software/softwareoncampus.aspx

Part 4: Assessment

Assessment strategy: The principal method of assessment is through an examination with a small element of assessment to support the flipped class delivery strategy.

Examination:
The interactive style of delivery leads to students receiving frequent formative feedback on their progress and hence students should be prepared to do the end of module assessment which takes the form of a 3 hour end of semester examination.. Questions in exam focus on a mix of technical competency, analysis of real-world applications of content, and questions focussed on understanding, interpretation and practical applications of analysis of vehicle dynamics.

Online Assignments:
E-quizzes taken are an additional means of ensuring engagement in delivery process and, while Pass/Fail, provide a formative feedback to students as a measure of understanding.

The resit assessment has the same profile as the first sit

Assessment tasks:

Examination (First Sit)
Description: End of module examination, assessing technical procedure, scenario-based investigation and fundamental vehicle dynamics knowledge (3 hours).
Weighting: 100 %
Final assessment: Yes
Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4

Online Assignment (First Sit)
Description: A series of tests (regular short online e-assessment that provide regular feedback and points of engagement)
Weighting:
Final assessment: No
Group work: No
Learning outcomes tested: MO2, MO4

Examination (Resit)
Description: Exam (3 hours)
Weighting: 100 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4

Online Assignment (Resit)
Description: A test (short online e-assessment)
Weighting:
Final assessment: No
Group work: No
Learning outcomes tested: MO2, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Automotive Engineering {Foundation}[Sep][SW][Frenchay][5yrs] BEng (Hons) 2020-21

Automotive Engineering {Foundation}[Sep][FT][Frenchay][4yrs] BEng (Hons) 2021-22

Automotive Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2021-22

Automotive Engineering [Sep][SW][Frenchay][5yrs] MEng 2021-22

Automotive Engineering [Frenchay] MEng 2022-23

Automotive Engineering [Frenchay] BEng (Hons) 2022-23

Mechanical Engineering [Sep][PT][Frenchay][7yrs] MEng 2021-22

Mechanical Engineering {Foundation}[Sep][SW][Frenchay][5yrs] BEng (Hons) 2020-21

Mechanical Engineering {Apprenticeship-UCW} {Top-Up} [Frenchay] BEng (Hons) 2023-24

Mechanical Engineering {Apprenticeship-GlosColl} {Top-Up} [Frenchay] BEng (Hons) 2023-24

Mechanical Engineering {Apprenticeship-UCS} {Top-Up} [Frenchay] BEng (Hons) 2023-24

Mechanical Engineering {Foundation}[Sep][FT][Frenchay][4yrs] BEng (Hons) 2021-22

Mechanical Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2021-22

Mechanical Engineering [Sep][SW][Frenchay][5yrs] MEng 2021-22

Mechanical Engineering [Frenchay] MEng 2022-23

Mechanical Engineering [Frenchay] BEng (Hons) 2022-23

Mechanical Engineering [Sep][PT][Frenchay][6yrs] BEng (Hons) 2021-22