

ES4A3-15 Automobile Systems, Dynamics and Control

24/25

Department

School of Engineering

Level

Undergraduate Level 4

Module leader

Mathias Foo

Credit value

15

Module duration

10 weeks

Assessment

50% coursework, 50% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

ES4A-15 Automobile Systems, Dynamics and Control

[Module web page](#)

Module aims

Automobiles are made up of primary subsystems which individually behave as dynamic systems. The aims of this module are: to introduce techniques and computer tools for modelling, predicting, analysing and understanding the behaviour of the individual primary systems in automobiles, and the interactions between these primary systems; and to promote understanding of the role of on-board active systems in automobiles.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Introduction to systems engineering approach, vehicle attributes and the context

Modelling and simulation in automotive
Tyre behaviour and modelling
Steering behaviour and modelling
Load transfer and handling
Braking and stability control
Ride behaviour and modelling
Roll behaviour and modelling
Active systems e.g. active suspension

Learning outcomes

By the end of the module, students should be able to:

- 1. Mathematically model the dynamic behaviour of primary subsystems which govern the operation of automobiles and their interaction [M1, M2].
- 2. Write appropriate customer and system requirements, following Systems Engineering methodology [M6].
- 3. Implement and evaluate models in simulation environment considering modelling requirements over vehicle lifecycle [M3].
- 4. Model and describe international standard tests and hence evaluate vehicle performance [M6].
- 5. Apply methods from control theory to both passive and active dynamic systems to describe stability and vehicle response [M1, M2]
- 6. Develop and implement a model of an active system evaluating impact on vehicle performance [M1, M2, M3, M12].

Indicative reading list

Close, C.M., Frederick, D.K. and Newell, J.C., Modelling and Analysis of Dynamic Systems (3rd Edition ISBN 0471394424), Wiley, 2002.

Wong J.Y., Theory of ground vehicles, (4th edition) Hoboken, N.J.: Wiley, 2008

Kiencke U. & Nielsen L., 2005. Automotive control systems: for engine, driveline, and vehicle, Berlin: Springer.

Pacejka H.B., 2006. Tyre and vehicle dynamics, Oxford: Butterworth-Heinemann.

Blundell, Michael, and Damian Harty. The multibody systems approach to vehicle dynamics. (2nd edition ISBN 0080994253) Elsevier, 2015.

Subject specific skills

TBC

Transferable skills

TBC

Study

Study time

Type	Required
Lectures	25 sessions of 1 hour (17%)
Seminars	4 sessions of 1 hour (3%)
Project supervision	1 session of 3 hours (2%)
Other activity	2 hours (1%)
Private study	116 hours (77%)
Total	150 hours

Private study description

116 hours guided independent learning

Other activity description

2 x 1hr revision class

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group C1

	Weighting	Study time
Vehicle Modelling and Control Assignment	50%	
Develop vehicle model that will be used for control design (max 10 pages)		
Online Examination	50%	
1 HR QMP includes text and numeric entry and some multiple choice.		
~Platforms - AEP,QMP		

- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper

Feedback on assessment

- Model solutions to past papers.
- Support through office hours.
- Written feedback on assignment.
- Cohort-level feedback on assignment.
- Cohort-level feedback on final exam.

[Past exam papers for ES4A3](#)

Availability

Courses

This module is Core for:

- Year 4 of UESA-H336 MEng Automotive Engineering
- Year 5 of UESA-H337 MEng Automotive Engineering with Intercalated Year

This module is Optional for:

- Year 4 of UESA-H114 MEng Engineering
- Year 5 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-HH31 MEng Systems Engineering
 - Year 4 of HH31 Systems Engineering
 - Year 4 of HH35 Systems Engineering
- Year 5 of UESA-HH32 MEng Systems Engineering with Intercalated Year
- Year 1 of TESA-H341 Postgraduate Taught Advanced Mechanical Engineering

This module is Core option list A for:

- Year 4 of UESA-H316 MEng Mechanical Engineering
- Year 5 of UESA-H317 MEng Mechanical Engineering with Intercalated Year