ES4A3-15 Automobile Systems, Dynamics and Control

21/22

Department
School of Engineering
Level
Undergraduate Level 4
Module leader
Thomas Popham
Credit value
15
Module duration
10 weeks
Assessment
60% coursework, 40% 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.
- 2. Write appropriate customer and system requirements, following Systems Engineering methodology.
- 3. Implement and evaluate models in simulation environment considering modelling requirements over vehicle lifecycle.
- 4. Model and describe international standard tests and hence evaluate vehicle performance.
- 5. Apply methods from control theory to both passive and active dynamic systems to describe stability and vehicle response.
- 6. Develop and implement a model of an active system evaluating impact on vehicle performance .

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 D3

	Weighting	Study time
Assignment Vehicle Modelling Assignment (max 9 pages)	30%	
Vehicle modelling and control assignment	30%	
Online Examination	40%	

1 HR QMP includes text and numeric entry and some multiple choice.

~Platforms - AEP,QMP

	Weighting	Study time

- 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 Optional for:

- RESA-H6P9 Postgraduate Research Wide Bandgap Power Electronics
  - Year 1 of H6P9 Wide Bandgap Power Electronics (EngD)
  - Year 2 of H6P9 Wide Bandgap Power Electronics (EngD)

This module is Option list A for:

- Year 4 of UESA-H336 MEng Automotive Engineering
- Year 4 of UESA-H114 MEng Engineering
- Year 4 of UESA-H311 MEng Mechanical Engineering
- Year 4 of UESA-HH31 MEng Systems Engineering

This module is Option list B for:

- Year 5 of UESA-H636 MEng Electronic Engineering with Intercalated Year
- UESA-H311 MEng Mechanical Engineering
  - Year 4 of H30L Mechanical Engineering with Automotive Engineering
  - Year 4 of H30N Mechanical Engineering with Systems Engineering

This module is Option list C for:

- UESA-H311 MEng Mechanical Engineering
  - Year 4 of H311 Mechanical Engineering
  - Year 4 of H30J Mechanical Engineering with Appropriate Technology

    - Year 4 of H30G Mechanical Engineering with Business Management
    - Year 4 of H30P Mechanical Engineering with Fluid Dynamics
    - Year 4 of H30M Mechanical Engineering with Robotics
    - Year 4 of H30H Mechanical Engineering with Sustainability
- Year 4 of UESA-H316 MEng Mechanical Engineering
- Year 4 of UESA-H318 MEng Mechanical Engineering with Exchange Year
- Year 5 of UESA-H317 MEng Mechanical Engineering with Intercalated Year