WM9SA-15 Intelligent Navigation and Control

27/28

Department
WMG
Level
Taught Postgraduate Level
Module leader
Sulakshan Rajendran
Credit value
15
Module duration
4 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module addresses the challenges in automated systems and control to enable a smooth transition between automated to autonomous vehicles. It gives insight into how adaptive strategies including machine-learning based methods such as fuzzy logic could be adopted to design intelligent adaptive control systems for improved vehicle autonomy. Moreover, it discusses the challenges in vehicle path planning and decision making considering cooperative control paradigms.

Module aims

The aim of the module is to provide a comprehensive understanding and practical experience of automated systems and control within an automotive context. Developing both theoretical and practical understanding of the automated systems and adaptive, self-learning control system design by establishing effective connection with the concepts such as sensor fusion, machine-human interaction and machine learning learnt from other taught modules.

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.

Classical control systems
Machine learning-based self-tuning/adaptive strategies for automated systems.
Observers and filters for estimation.
Design of adaptive control systems for automated vehicles.
Decision system concepts: shared control and path planning.

Learning outcomes

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

- Critically evaluate different control approaches and demonstrate understanding in the system nonlinearities and uncertainties, (AHEP4, M2, M3, M4, M5, M6, M17).
- Critically evaluate different control strategies, ranging from classical to intelligent approaches to attain increased autonomy (AHEP4, M1, M2, M3).
- Demonstrate the skills to design adaptive vehicle control systems by identifying the right control and estimation approaches (AHEP4, M2, M3, M5).
- Demonstrate the skills to develop an intelligent strategy to resolve the challenges in autonomous navigation and vehicle cooperative control (AHEP4, M4, M5, M6, M17).

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

Understand Vehicle dynamics
Evaluating different adaptive strategies
How to design an adaptive control system for an automated vehicle.
Evaluating the challenges in implementing adaptive strategies in real-time.
Critically evaluating challenges in path planning and cooperative control

Transferable skills

Technology literacy
Dependability
Communication
Adaptability.
Developing a technical proposal and presentation.

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (13%)
Tutorials	10 sessions of 1 hour (7%)
Online learning (independent)	12 sessions of 1 hour (8%)
Private study	48 hours (32%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Practising simulation tools.
Reviewing and refreshing the knowledge of linear algebra and engineering mathematics.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time	Eligible for self-certification
Assessment component			
Modelling and preliminary controller design	20%	12 hours	Yes (extension)

Students are expected to complete questions on modelling (system dynamics, nonlinearity and linear models) and controller design using simulation tools.

Reassessment component			
Modelling and preliminary controller design			No

Students are expected to complete questions on modelling (system dynamics, nonlinearity and

	Weighting	Study time	Eligible for self-certification

linear models) and controller design using simulation tools.

Assessment component

Automated Vehicle Controller Design	80%	48 hours	Yes (extension)

Design an adaptive controller for an automated vehicle. The students are expected to produce a proposal, a design report.

Reassessment component

Automated Vehicle Controller Design			No

Design an adaptive controller for an automated vehicle. The students are expected to produce a proposal, a design report.

Feedback on assessment

For both assessments written feedback and overall mark.

Availability

There is currently no information about the courses for which this module is core or optional.