Tárgytematika / Course Description

Internal Combustion Engine Control

AJNM_BMTA035

Tárgyfelelős neve / Teacher's name: dr. Knaup Jan Christopher

Félév / Semester: 2019/20/1

Beszámolási forma / Assesment: Vizsga

Tárgy heti óraszáma / Teaching hours(week): 2/0/2

Tárgy féléves óraszáma / Teaching hours(sem.): 0/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

Introduction of system and hardware architectures of engine control units, of the BUS systems used nowadays in the powertrain. Brief explanation how LIN, CAN, FlexRay and MOST work, introduction of their advantages and disadvantages. Development and hardware features of µC's and development of the software for the ECU generations. Explanation of the operating principles "prevention, detection and response" based on specific features of manipulation protection. Requirements for the engine control unit and their implementation under given conditions. Diagram of sensors and actuators used nowadays in gasoline and diesel engines. Software architecture of ECUs (principles, goals, motivation, software functions, self-development, program status, integration planning). Functional development from the idea to the finished function. Introduction of Matlab Simulink and ASCET softwaretools, the INCA-MDA application tool, and the "Design of Experiment" (DoE). Presentation of the procedure, and the DoE model types. Introduction of the functional development and testing of the powertrain in MiL / SiL / HiL environments.

TANTÁRGY TARTALMA / DESCRIPTION

Short content:

1. Introduction of the subject:

- Requirements
- Plans for the semester

2. Basics of control systems in vehicles:

- Tasks and brief summary of control systems
- Control technology in vehicles

3. System Architecture of ECUs:

- Definition and classification of system architectures
- System architecture and the V-Model
- Requirement Management
- Core Process

- Classification of logical and technical architectures
- System architecture of the engine control unit
- Examples

4. Communication systems (LIN, CAN, FlexRay, MOST), tuning protection:

- Basic functions of tuning protection in engine control units: prevention, detection, response
- Communication systems: What it is and for what areas of application?
- Communication systems in the powertrain.

5. Hardware architecture of engine control units:

- Requirements for an engine control unit, motivation and history
- Development and operation in the vehicle
- Implementation of the requirements in engine control units
  - Assembling technology
  - Reading and processing of signals (including networking)
  - Controlling the actuators
  - Microcontroller architecture

6. Basics of sensors and actuators in vehicles:

- Motivation (protection of components, widen of module boundaries, compliance with emissions, compliance with emission standards, compliance with local requirements "OBD")
- Requirements (temperatures, vibration, fluids, pressure, pulsation, permanent contact, vehicle electrical system, EMC)
- Function groups / components / signals (speed detection, air flow, charge detection, cooling system, oil system, fuel system, exhaust gas system)
- Protocols

7. Functional requirements:

- Why are powerful engine management systems necessary? Motivation
- Software architecture principles, procedures, rules
- Development process using the V-Model
- Linking software functionality with engine control hardware

8. Function development:

- Development from the idea to the finished function

9. Software tools:

- Matlab-Simulink as a software tool for concept and function development:
- ASCET as a competitive tool for Matlab-Simulink

10. Application Tools:

- INCA-MDA as visualization tool

11. Design of Experiment (DoE):

- What is DoE?
- DoE procedure
- Model types

12. Application:

- What is application?
- How does application work?

13. System testing (MiL, SiL, HiL):

- Model-based functional development
- MiL / HiL / Sil tests
- Rapid Control Prototyping
- Test and calibration of the vehicle

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

Evaluation: Exam

Grade:

90 – 100 % = 5
75 – 89 % = 4
60 – 74 % = 3
50 – 59 % = 2
< 50 % = 1

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

Slides of the lessons