Tárgytematika / Course Description

Development of Internal Combustion Engines

AJNM_BMTA036

Tárgyfelelős neve / Teacher's name: dr. Hanula Barna
Félév / Semester: 2021/22/1
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

Aim:

The course aims to give students an overview of the design process of internal combustion engines. In addition to the discussion of recent trends and current design philosophy, students will get a hands-on experience of computer aided design through tutor-lead workshops and an individually chosen project assignment.

TANTÁRGY TARTALMA / DESCRIPTION

Content:

Week 1 and 2: Introduction and discussion of recent development trends; Challenges, possibilities, and requirements of engine development

Week 3 and 4: Introduction to finite element strength analysis in engine development, concepts, structure and workflow on a selected engine component; Workshop: strength analysis of a connecting rod

Week 5 and 6: Introduction to computational fluid dynamics in engine development, basic theory, concepts, structure and workflow on a selected engine component; Workshop: computational fluid dynamics analysis of a simplified cooling water jacket

Week 7 and 8: Introduction to multibody dynamics and vibration analysis in engine development, concepts, structure and workflow on a selected subassembly of an engine; Workshop: vibration analysis of the crank mechanism of an internal combustion engine; Individual project assignment

Week 9 through 14: Individual work; consultation as required

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

Assessment:

In order to complete the course, students have to meet the following premises. Each student has to choose and elaborate one project based on the three presented areas of computer aided development:

- Computational fluid dynamics analysis of a simplified cooling water jacket, or
- Finite element strength analysis of a connecting rod, or
- Vibration analysis of a crank mechanism

The task involves solving the problem under distinct load cases. The project can only be considered completed if the analysis can be performed and produces results in all cases. The student should interpret the results and explain the differences between load cases in the project report.

A written project report has to be submitted before the end of the 14th week of the semester. The project report must contain the following:

- An introduction to the problem, description of the part to be analysed, structure / workflow of the analysis procedure, parameters and boundary conditions for the analysis,
- Presentation and interpretation of the results,
- Comparison of results from different load cases,
- Summary of the project work, including the applicability of the results.

The general structure, style and formatting of the project report must comply with the following criteria:

- A clear, impartial formulation should be used, with appropriate technical terms,
- A clean and stylish graphical representation of models, results and the workflow itself is preferable, which shows the necessary information without overwhelming the reader,
- The report should give a detailed description of the analysis process, making it possible for third parties to reproduce the results,
- The report should be submitted in MS Word .docx format, and therefore must utilize the built-in formatting and styling capabilities of the software.

Unformatted texts and unstructured reports will be rejected without further explanation.

The project work will be graded based on the technical content, formulation and formatting of the submitted project reports at the end of the semester.

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

Literature:

- Richard Stone, Introduction to Internal Combustion Engines, 2.ed., Palgrave Macmillan, 1992, ISBN 978-0-333-55084-7, DOI 10.1007/978-1-349-22147-9
- Richard Van Basshuysen, Fred Schaefer, Internal Combustion Engine Handbook, 2.ed., SAE International, 2016, ISBN 978-0-7680-8024-7
- Amar Khennane, Introduction to Finite Element Analysis Using MATLAB® and Abaqus, 1.ed., CRC Press, 2013, ISBN 9781466580206
- Joel H. Ferziger , Milovan Peric, Computational Methods for Fluid Dynamics, 3.ed., Springer-Verlag Berlin Heidelberg, 2002, ISBN 978-3-540-42074-3, DOI 10.1007/978-3-642-56026-2
- John F. Wendt, Computational Fluid Dynamics - An Introduction, 3.ed., Springer-Verlag Berlin Heidelberg, 2009, ISBN 978-3-540-85055-7, DOI 10.1007/978-3-540-85056-4