Tárgytematika / Course Description

Simulation of Internal Combustion Engines

AJNM_BMTA045

Tárgyfelelős neve / Teacher's name: dr. Knaup Jan Christopher
Félév / Semester: 2019/20/2
Beszámolási forma / Assesment: Vizsga
Tárgy heti óraszáma / Teaching hours(week): 0/2/0
Tárgy féléves óraszáma / Teaching hours(sem.): 0/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

Aim

The course aims to extend existing basic knowledge of simulation methods with more advanced topics of internal combustion engine simulation. Students will learn the concept of coupled thermal-mechanical analysis, modal analysis, steady-state dynamics and multibody dynamics through practical examples.

TANTÁRGY TARTALMA / DESCRIPTION

Content

1st Week: Introduction: requirements, goals and deadlines. A brief refreshment of existing knowledge on mechanical, thermal and fluid dynamics simulations.

2nd Week: Coupled thermal-mechanical analysis: the effect of thermal load on geometric details and dimensional tolerances.

3rd Week: Modal analysis: eigenfrequencies and eigenmodes of engine components and subassemblies.

4th Week: Steady-State Dynamics: torsional vibration, resonance and damping of a crank shaft.

5th Week: Multibody dynamics analysis of a valve train and crank mechanism.

6th Week: Semester project definition and task selection.

7th – 14th Week: Elaboration of individually chosen project tasks.

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 presented areas of simulation methods. 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