Machine Design

MEC-E1060 – Week 4

Aalto University
School of Engineering

Kaur Jaakma

25.9.2023

Status

Zulip discussion board

- 51 students and 5 teachers

Status Survey Week 3

- 26 answers
- DL this Monday

MBS Reports

- Earliest return Thursday 21st 15:47
- Latest return Monday 25th 01:30

Lectures

Week	Monday 10-12 @ K213a	Visiting lecturer
36	PLM in Industry	Tuomas Ruippo, Kone Oyj
37	MBS	Milla Vehviläinen, VTT Oy
38	Design Automation	Harri Taskinen, Evian Oy
39	FEM in Industry	Tuomo Kuusi, Entop Oy
40	Case from Industry	Niko Tapanainen, Bluefors Oy
41	Cases from research and education	Panu Kiviluoma, Aalto University

Group Work

Topic	Deliverables	DL
Preliminary Design	Analyzed case chosen, requirements list, and free-body diagram	10.9.
Mechanism Analysis	Multi-body simulation model of the concept MBS models, results, and plan how to validate	24.9.
Strength Analysis	Updated geometry of the concept FEM models, results, and plan how to validate	8.10.
Detailed Design	Selected machine components (bearings, motors etc.) Final assembly with updated geometry	15.10.

Material in MyCourses

FEM Orienting Quiz

Documents

- Slides about FEM Phase and process in NX
- FEM Model with NX
- Debugging FEM, and flexible MBS
- Basics of FEM

Videos

- How to divide a face
- How to update part geometry

FEM Tasks

Update CAD models of your mechanism
- More detailed models as for MBS, no overlapping geometry, as Revision B in TC

Create FEM models for all the main parts (moving parts and body)
- Define boundary conditions (constraints, materials, forces)

Calculate displacements/stresses of all parts
- Forces from MBS phase, materials from requirements etc.

Test different shapes for mechanism parts
- Mechanism dimensions should stay untouched (joint distances etc.)

Optimize the most critical part
- using the optimization study tool

Run MBS simulation again with updated geometries
- Update also FEM models accordingly

FEM Report (DL 8.10.2022)

Return a PDF report containing

- Updated CAD models for your mechanism (More detailed models as for MBS, no overlapping geometry)
- FEM models from all the main parts (moving links and ground, remember to show constraints and forces)
- Calculated displacements/stresses of all parts
- Tested different shapes for mechanism parts
- Optimization results for one part
- Analyze how the mechanism performance has changed during FEM phase (required power, size, etc.)
- Explanation how to validate simulation results
- Included learning outcomes and your own grade estimate

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