Machine Design

MEC-E1060 – Week 5

A"
Aalto University
School of Engineering

Kaur Jaakma

2.10.2023

Status

Zulip discussion board
- 71 students and 5 teachers
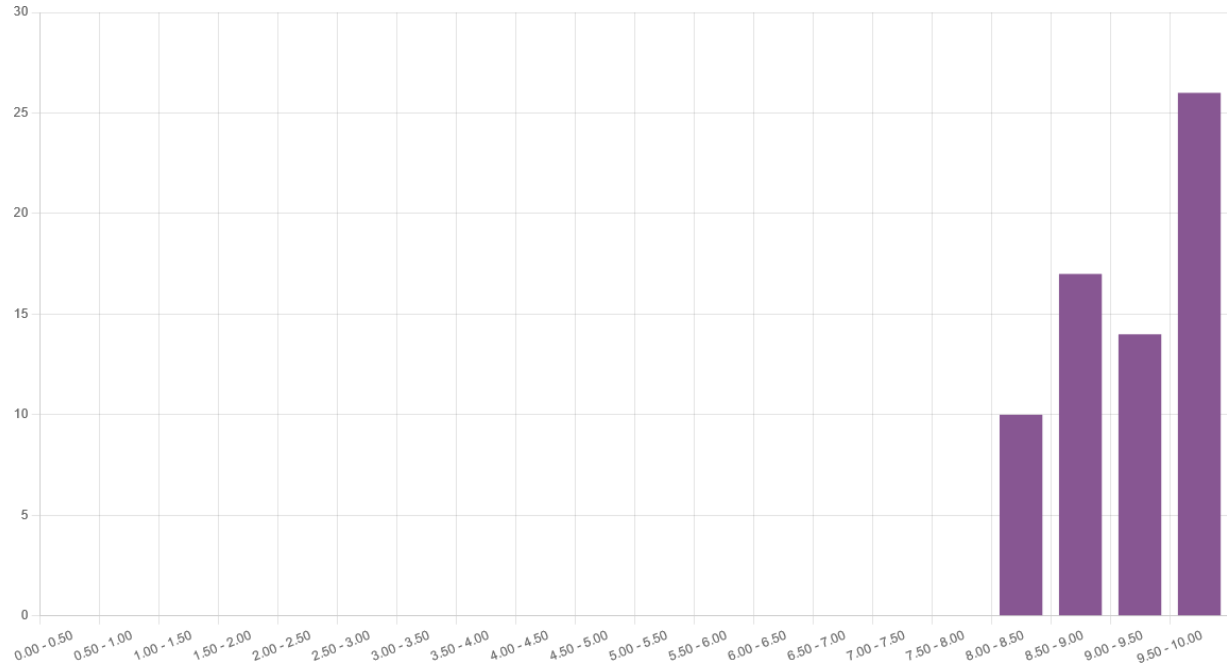
Status Survey Week 4
- 21 answers
- DL this Monday

FEM Report DL this Sunday

FEM Orienting Quiz

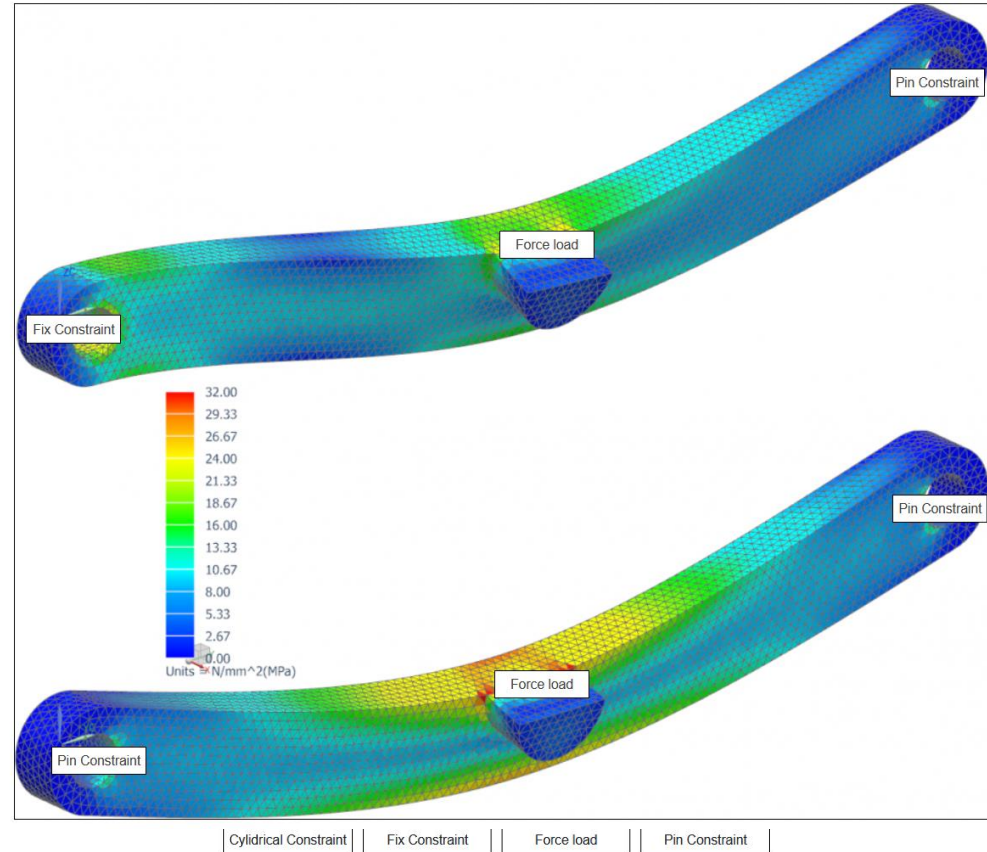|	
Average grade of first attempts	72.01%
Average grade of all attempts	80.99%
Average grade of last attempts	91.65%

67 participants

9.16 average

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FEM Orienting Quiz

Hardest question

- Average grade 1.71/2

MBS Report

Improvement suggestions

Report should act as an independent document
- Include pictures, schematics etc.
- Introduction is also useful, as well as good structure

Result graphs can be collected
- One single graph vs. several graphs
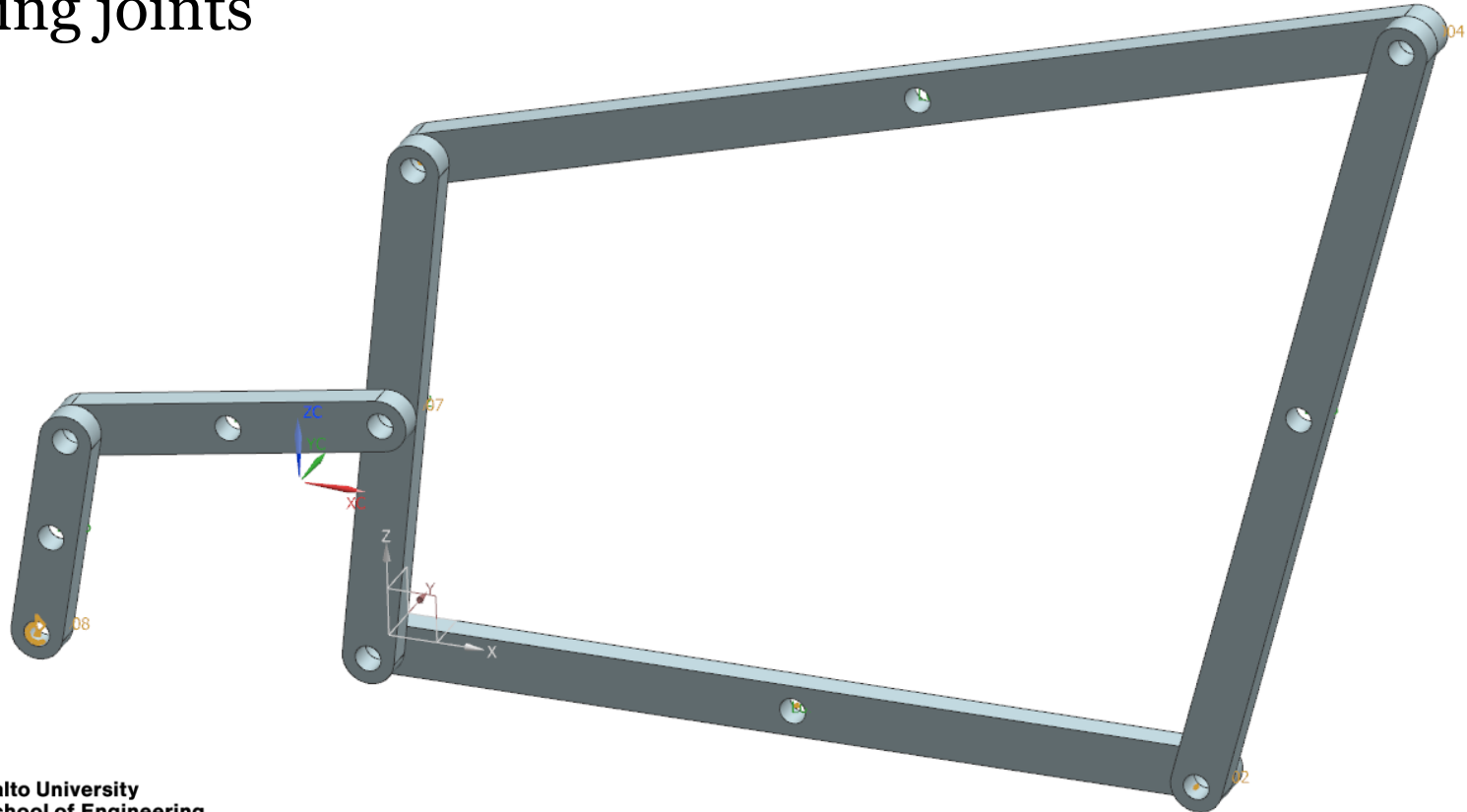
Writing a good report takes time
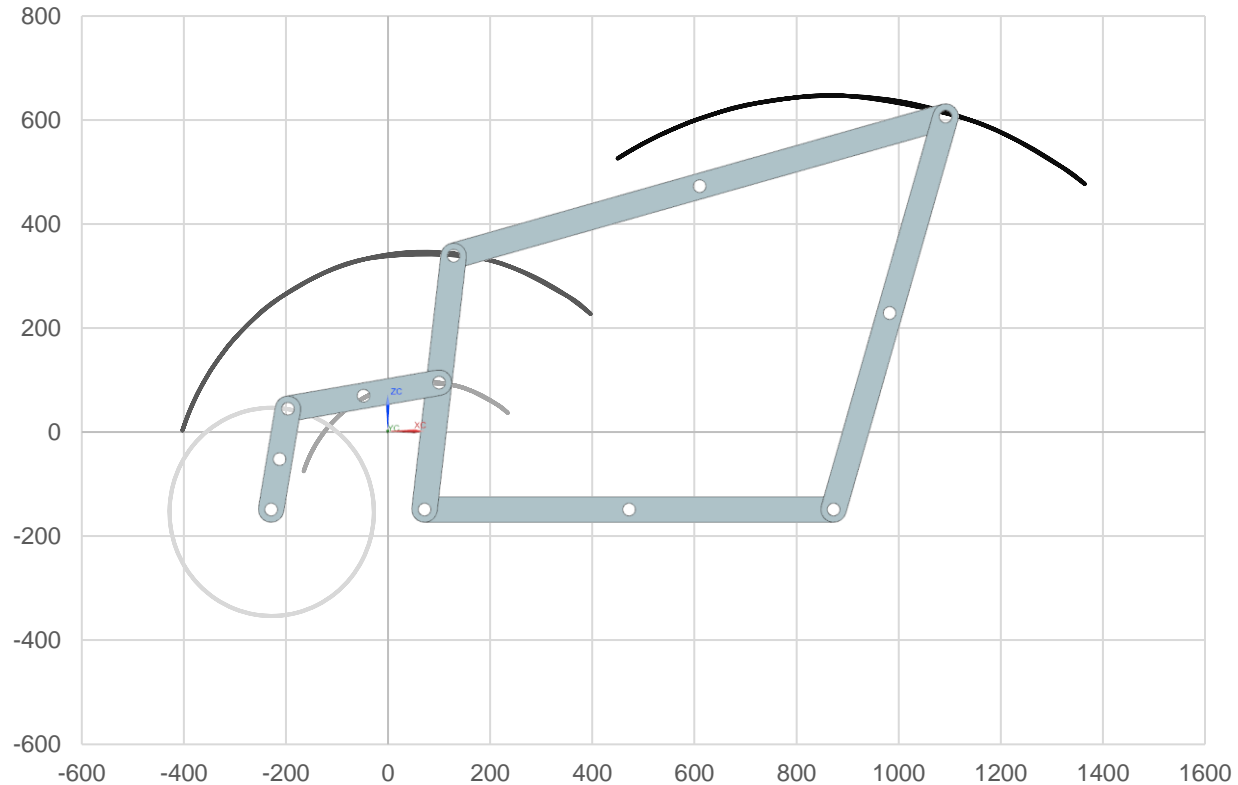- Visualization makes everything look better
- Tables!

Result Graphs

Plotting joints

Result Graphs

Improvement suggestions

Results combined in Excel

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
- About Absolute and Relative joints (in MBS page)

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

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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 8.10.2023)

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 from 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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