



Aalto University
School of Engineering

MEC-E5003

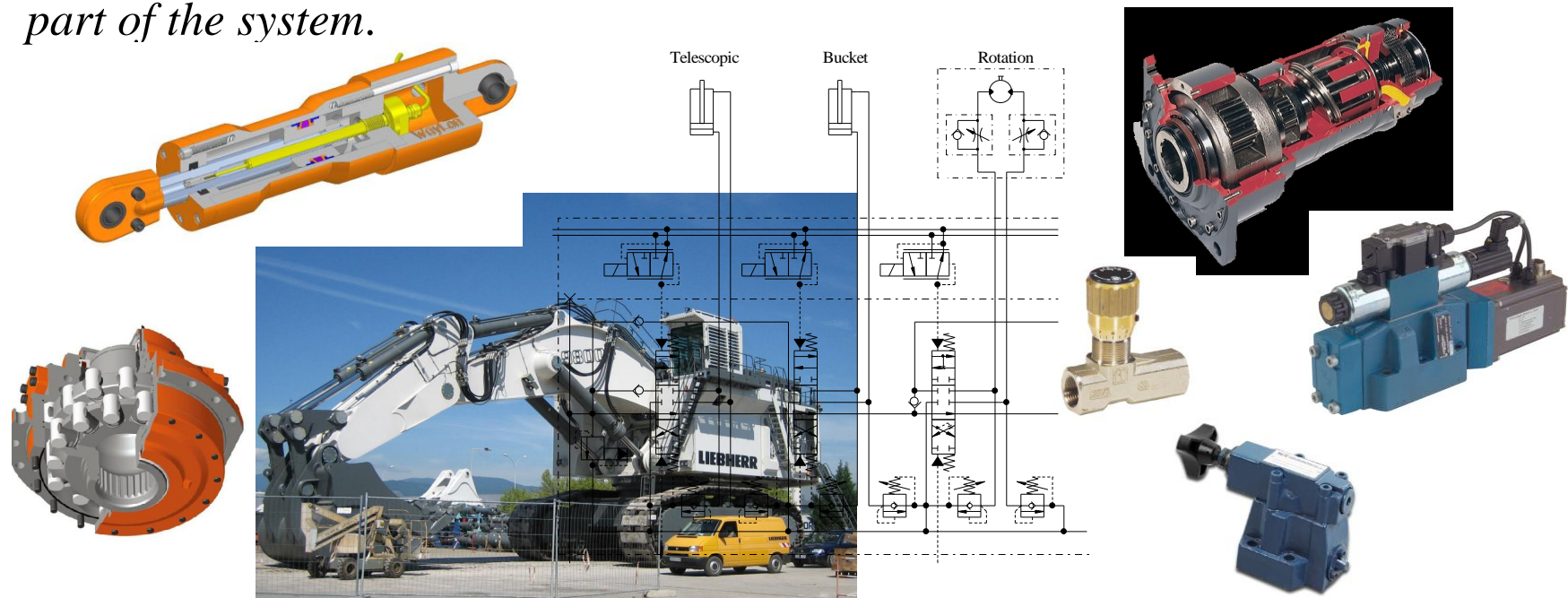
FLUID POWER BASICS

Study Year 2019- 2020

Lecturer: DSc (Tech) Jyrki Kajaste

Course objectives

Course provides general knowledge of technological fundamentals of fluid power (hydraulics and pneumatics), components, and their operation as a part of the system.



Learning outcomes (1/2)

After the course the student is able to

- Describe technical fundamentals of hydraulic and pneumatic systems
- Describe general characteristics of different pressure media
- Analyse the behaviour of pressure and flow in hydraulic and pneumatic systems
- Describe the operation and control of hydraulic and pneumatic components, the factors affecting the operation, and the effect of the components on the system

Learning outcomes (2/2)

After the course the student is able to

- Understand the factors which affect the energy consumption of hydraulic systems and how the energy efficiency can be enhanced by changes in system parameters and architectures
- Analyse and calculate the characteristics, properties and operation of hydraulic and pneumatic systems
- Analyse diagrams of hydraulic and pneumatic systems
- Use firmware/software packages to calculate and analyse hydraulic and pneumatic systems and to draw up diagrams
- Build simple hydraulic and pneumatic systems
- Document hydraulic and pneumatic systems

Course arrangements

Lectures

- Mondays & Thursdays

Obligatory part

- 3 Research Assignments (80% of the course grade altogether)
 - ÿ group works (groups of 3-4 people)
 - ÿ two (2) laboratory exercises (hydraulics & pneumatics) + 1 laboratory demo (groups)
- 1 simulation assignment (Simulink Simscape, 10% of the course grade altogether, individual)
- Quizzes related to lecture material (10% of the course grade altogether, individual)

Voluntary part

- Calculation Exercises 6 (hydraulics), Fridays, first one on 17.1.2020
 - ÿ Two exercises are Controlled Exercises (~exams), from which it is possible to earn extra points
 - ÿ Advice for the next Research Assignment tasks given!

preliminary!

Schedule, v. 1

Week	Weekday	Date	Time	Class	Action	Theme	#	LAB exercises (G)	Assignments (Group)	Assignments (individual)	
2	Monday	6.1.2020								QUIZZES (schedule open)	
	Thursday	9.1.2020	14.15	202	LECTURE	HYDR	1				
3	Monday	13.1.2020	12.15	326	LECTURE	HYDR	2				
	Thursday	16.1.2020	14.15	202	LECTURE	HYDR	3				
	Friday	17.1.2019	14.15	326	EXERCISE	calc, voluntary	1		Assignment 1 OUT		
4	Monday	20.1.2020	12.15	326	LECTURE	HYDR	4				
	Thursday	23.1.2020	14.15	202	LECTURE	HYDR	5				
	Friday	24.1.2019	14.15	326	EXERCISE	calc, voluntary	2				
5	Monday	27.1.2020	12.15	326	LECTURE	HYDR	6				
	Thursday	30.1.2020	14.15	202	LECTURE	HYDR	7		Assignment 1 DEADLINE		
6	Monday	3.2.2020	12.15	MaariCD	SIMU		1		Assignment 2 OUT		
	Thursday	6.2.2020	14.15	MaariCD	SIMU		2	HYDRAULICS			
	Friday	7.2.2019	14.15	326	EXERCISE	CONTROLLED	3			calculation test 1, voluntary (+ points)	
7	Monday	10.2.2020	12.15	Maari CD	SIMU		3				
	Thursday	13.2.2020	14.15	Maari CD	SIMU		4				
	Friday	14.2.2019	14.15	326	EXERCISE	calc, voluntary	4				
8	ASSESSMENT WEEK										
	ASSESSMENT WEEK										
9	Monday	24.2.2020	12.15	326	LECTURE	HYDR	8				
	Thursday	27.2.2020	14.15	326	LECTURE	PNEU	1		Assignment 2 DEADLINE		
10	Monday	2.3.2020	12.15	326	LECTURE	PNEU	2		Assignment 3 OUT		
	Thursday	5.3.2020	14.15	326	LECTURE	PNEU	3	PNEUMATICS			
	Friday	6.3.2019	14.15	??	EXERCISE	calc, voluntary	5			Simulation DEADLINE	
11	Monday	9.3.2020	12.15	??	LAB	DEMO				Laboratory demo (and Quiz + points)	
	Thursday	12.3.2020	14.15	??	MEVEA	DEMO?					
	Friday	13.3.2019	14.15	??	EXERCISE	CONTROLLED	6			calculation test 2, voluntary (+ points)	
12	Thursday	19.3.2019							Assignment 3 DEADLINE		

Research Assignments

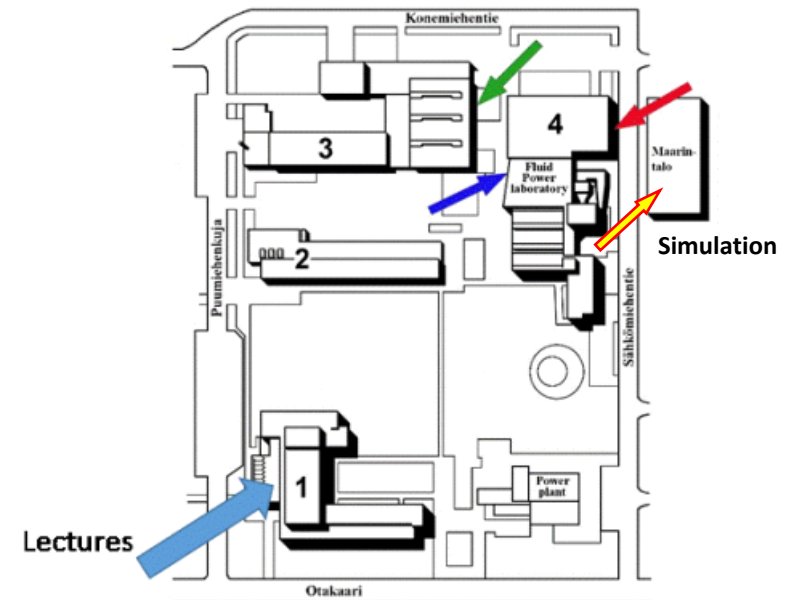
- mainly calculation problems
- two laboratory exercises
- sources: course material, other literature, internet
- groups' self-assessment and feedback from assignment

Support

- guidance is available in the lectures and calculation exercises
- diagram drawing: hydraulic symbols for MS Visio are downloadable in MyCourses -page where are also listed links to other diagram drawing software
- Automation Studio -“simulation” software is available in ICT classes A046a and A046b (located in the cellar of A-wing of the main building of Aalto University). Unfortunately only three program licences are available

Laboratory Exercises

- Hydraulics
- Pneumatics
- done in Research Assignment groups
- optional dates/times in WebOodi
- both exercises include a preliminary task (described in Research Assignments)



BUILDINGS OF MECHANICAL ENGINEERING

1. Mechanical Engineering Main building Otakaari 4	K1
2. Engineering Materials and Production Puumiehenkuja 3	K2
3. Engineering Design and Solid Mechanics Puumiehenkuja 5	K3
4. Energy Technology and Fluid Dynamics Sähkemiehentie 4	K4
 Main entrance	door 4J
 Fluid Power laboratory hall	door 4O
 Industrial Internet Campus	door 5F
 Maarintalo	

Study material

Hydraulics

- lecture slides in MyCourses
- (In Finnish; Kauranne - Kajaste - Vilenius: Hydraulitekniikka)

Pneumatics

- lecture slides in MyCourses
- (In Finnish: Ellman - Hautanen - Järvinen - Simpura: Pneumatiikka)

Calculation Exercises

- material in MyCourses

E-Communication

MyCourses

- general course arrangements, discussions and instructions
- course material
- submitting the Research Assignment Reports
- status of the studies (submitted reports, earned points etc.)

WebOodi

- dates and times of education events
- registrations (obligatory!) for course and Laboratory Exercises

Email

- if needed, personal/group-specific announcements concerning exercises
- informing about sudden cancellations or changes in teaching events

