TKP4140 Process Control. Autumn 2020. Schedule / updated as we go along

Week (lectures)	Week 2020	Topic lectures (book chapters from Seborg In parenthesis)	Exercise (out Tuesday, help Monday 16-18, hand in Wednesday at 16:00, solution Thursday)
1 (1-3)	34	Control fundamentals («crash course, part 1») NOTE: First lectures are 1015-1200 on Monday 17 August 2020 in room BT-Gal4	Ex.1 reactor control structure. "Shower process", Help session is the following Monday, so 24 Aug 1615-1800 in R2. EXTRA: Monday 17 Aug 16-18 (R2): Introduction to Matlab and Simulink
2 (4-6)	35	Intro to dynamics and SIMC PID tuning («crash course, part 2») (Skogestad ch. 11)	Ex.2. Distillaton. Modelling + control (Simulink)
3 (7-9)	36	Models: balances, state space form, linearization. Simulation (Ch.2, Skogestad ch. 11)	Ex.3 Linearization, Laplace
4 (10-12)	37	Laplace (App. A), Transfer functions, Poles and zeros, responses, time delay, response of first- and second-order systems, (ch. 3-5)	Ex.4 Transfer functions
5 (13-15)	38	Continue responses, 2nd order system (ch.4), block diagrams, Closed-loop response	Ex.5. 2nd order response (Simulink) Lab. In 2nd floor K4 (required for all students) Tue: Lecture project part 1 (Simulink). 17-19, (Location to be decided)
6 (16-18)	39	Zeros, FOD approx, half rule (ch.5). Closed-loop response (ch.10), SIMC rules	Ex.6 (closed-loop TF, SIMC).
7 (19-21)	40	Derivation of SIMC PID tuning rules (ch. 11). PID tuning, ZN rule. PID implementation, windup, bumpless transfer, discrete control (7.6).	Ex.7. Closed-loop responses (Ex.1 revisit) Friday 02 Oct. 2020: Project part1 deadline (project)
8 (22-24)	41	Midterm week. No lectures. Thursday 08 Oct.. **Midterm** (90 min.). Time and place to be decided.	Ex.8: Tuning ZN+Shams Tue: Lecture project part 2: 17-19, (Location to be decided)
9 (25-27)	42	Stability,closed-loop poles, Routh Hurwiz, effect of feedback (root locus). Start frequency analysis	Ex.9: Routh-Hurwitz, complex no.s
10 (28-30)	43	Frequency analysis (ch. 13), stability conditions, robustness,	Ex. 10: Bode diagrams. Friday: 23 Oct 2020 Project part 2 deadline
11 (31-33)	44	Freq. Analysis, continued. Advanced process control, cascade	Ex. 11: Bode stability condition. GM, PM Tue: Lecture project part 3 17-19, (Location to be decided)
12 (34-36)	45	More advanced control, feeforward, selectors, split range control RGA, Cascade control, feedforward control (ch. 14, 15). Industrial examples.	Ex.12: RGA
13 (37-39)	46	More examples. MIMO control. RGA, Decoupling	Ex.13: Feedforward, cascade, decoupling Friday: 13 Nov 2020 Project deadline.
14 (40-42)	47	MPC (ch. 16), Controllability analysis, summary	

Instructors: 1. Professor Sigurd Skogestad (room K4-211). Phone 91371669 (mob), 735 94154 (office). Email: skoge@ntnu.no

2. Dinesh Krishnamoorthy

Lectures: Monday 10:15 – 12:00 (BT Gal4)

. Thursday 14:15 – 13:00 (H2)

Exercises: Monday 16:15 – 18:00 (R2). *May have lectures instead some weeks.*

Project help sessions : 2 sessions each week (3x3 weeks)

Instructors exercises/lab/project

vit.ass. David Perez Pineiro (main responsible)

vit.ass. Cristina Zotica

vit.ass. Zawadi Mdoe

vit.ass. Haakon Eng Holck

stud.ass. Vemund Tjessem

stud.ass. Mari Elise Rugland

stud.ass. Espen Karlsen

Required exercises: 50% + required lab + required project

Grading: 60% final exam, 20% midterm, 20% lab/project (lab 5% and project 15%)

Note that the midterm will only count positive. If you do not take the midterm or if the midterm grade is lower than on the final exam, then the final exam will count 80% and the midterm 0%

Midterm test (08 October): 90 min written test. Digital. No notes or books allowed. Bring pen/pencil, allowed calculator and student ID card**. (could be changed)**

Final exam (date not available): 4 hour written digital exam. You may bring one (1) A4 double-sided piece of paper with your handwritten notes to the exam. No other books or help is allowed **(changed for 2020 to all books allowed, because digital home exam).** Standard calculator is allowed.

Course material:

- D.E. Seborg, T.F. Edgar, D.A. Mellichamp, F.J. Doyle: Process Dynamics and Control, Wiley, 3rd ed. 2011.
- S. Skogestad: Chemical and Energy Process Engineering, CRC Press, 2009, Chapter 11 on “Process Dynamics” (available on course home page)

More information: http://www.ntnu.edu/studies/courses/TKP4140/2020