PROCESS SYSTEMS ENGINEERING GROUP

Førsteamanuensis
Tore Haug-Warberg

Professor
Heinz Preisig

- Process modelling
  - Including thermodynamic modelling
- Process optimization and control
- Process simulation and design
- Systems biology

Førsteamanuensis
Nadi Skjøndal-Bar

Professor
Sigurd Skogestad

4th year courses

Autumn:
TKP4140* Process control (Prosessregulering)

Spring:
TKP4135 Chemical process systems engineering

5th year courses, autumn

TKP4555 PROCESS- SYSTEM ENGINEERING specialization

Select two modules from the following:

- **TKP10 Process Control, Advanced Course**
- **TKP11 Advanced Process Simulation**
- **TKP12 Thermodynamics, Advanced Course**
- **TKP13 Feedback systems in biology**

It is also possible to select other modules, but this has to be approved in advance.

- TKPX Kjemisk prosessteknologi, spesielle emner (distillation)
- TTK16 Modellprediktiv regulering (MPC) og optimalisering (Institutt for teknisk kybernetikk)
- TEP9 Termisk kraft/varme - produksjon (Institutt for termisk energi og vannkraft)

TKP10 Process Control, Advanced Course

- **Lecturer:** Professor Sigurd Skogestad
- **Learning outcome : B**e able to design plantwide control system
- **Content:**
  - Control structure design for complete chemical plants.
  - Selection of controlled variables (self-optimizing control).
  - Consistent inventory Control.
  - Regulatory control.
  - Tuning of PID controllers.
  - Multivariable control.
  - Decentralized control.
  - RGA. Introduction to MPC. Use of dynamic simulators.
- **Teaching activities:** Lectures, computer simulation. exercises.
- **Course material**: Copies from scientific papers and books including Chapter 10 in Skoegstad and Postlethwaite, "Multivariable Feedback Control, Wiley, 2010

TKP11 Advanced Process Simulation

- Lecturers: Professor Heinz Preisig (coordinator) and professor Magne Hillestad
- **Contents:** Simulators solve sets of equations representing the behaviour of plants, namely mathematical models for the plant. The topic of the course is to shed some light on what is under the hood of these simulators.
  - The subject is extended by optimisers which are superimposed on the simulators upwards and physical property interfaces downwards.
  - The course touches on the theoretical subjects associated with the methods used in simulators and optimisers, such as graph theory for the representation of networks, sequential modular approaches and simultaneous equation approaches and possibly integrators.
- **Course form:** Lectures, tutorials and project. The course is largely project oriented.
- **Prerequisites:** Course in numerics, optimisation and preferably TKP4135 Chemical Process Systems Engineering
- Compulsory activities: exercises, presentations, project work

TKP12 Thermodynamics, Advanced Course

- **Lecturer:** Associate professor Tore Haug-Warberg
- **Content:**
  - Thermodynamic methods (Euler functions and Legendre transformations) with applications to thermodynamic state theory.
  - Systematic derivation of basic equations in canonical state variables.
  - Conservation principles of mass and energy used in the analysis of practical problem solutions connected to phase and reaction equilibria.
  - Introduction to thermodynamic modelling.
  - The course is adapted to individual needs if feasible (more weight on the modelling and less weight on the problem analysis, or vice versa).
- **Teaching activities:** Regular teaching and colloquiums.
- **Course material:** Lecture notes and copies of articles.

TKP13 Feedback systems in biology

- **Lecturer:** Associate Professor Nadi Skjøndal-Bar
- **Aim of the course**: To present the concept of feedback in relation to biological intra- and intercellular processes
- **Prerequisites:** TKP4140 process control or equivalent knowledge in control
- **Module description:** The concept of feedback is well known from control theory, and is quite abundant in biology. C
  - Concept of negative and positive feedback inside the cells and in genetic circuits.
  - Cellular response to combinations such as negative-negative, positive-negative feedback structures
  - Oscillations and bi-stability
  - Effect of feedback on the evolution of species.
- **Teaching methods:** Seminars, self study, exercises/project work with presentations.
- **Course material:** Articles and excerpts from textbooks.

Tore Haug-Warberg

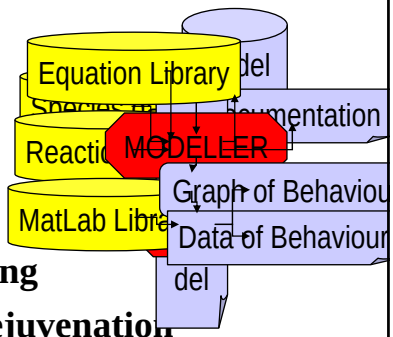
Research projects

1. **Thermodynamics of LNG using the GERG equation of state.**

1. **Taylor-expansion of thermodynamic equilibrium states arising from flash calculations.**

Heinz Preisig

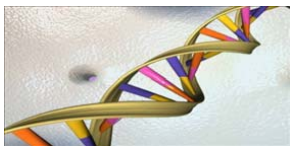
Research projects



- **1: Computer-aided modelling**
- **2: Control and Felles lab rejuvenation**
- **3: Automatic Safety and Hazard Analysis**
- **4: Simple Thermo Server**
- **5: On time scaling in chemical processes**
- **6: Frequency Analysis of Distillation**
- **7: Process Identification using Wavelets**

Nadi Skjøndal-Bar

Research projects



1. **Cancer Research**

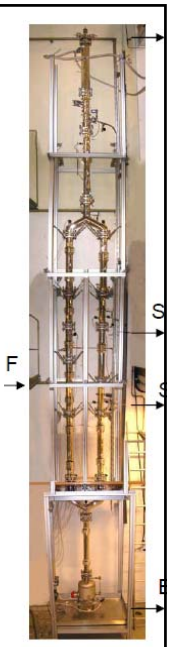
   The project (and thesis) will be conducted by collaborating with the GastroCenter at St. Olav's hospital.

2. **Eukaryotic initiation factors (eIF-)**

Sigurd Skogestad

Research projects

1. ***Simulation and operation of CO2 capturing process***
2. ***Simulation, design and optimal operation of liquefaction process for natural gas*** *(2.1, 2.2)*
3. ***Design of integrated distillation columns for separation of multicomponents mixtures (3.1, 3.2 3.3)***
4. ***Design, simulation and Optimal operation of offshore process.***
   In cooperation with Statoil Porsgrunn (Vidar Alstad). Not yet clarified…
5. ***Stabilization of two-phase flow in risers from reservoirs (anti-slug control) (in cooperation with Siemens)***
   - *5.1: Controllability analysis of simple nonlinear models.*
   - *5.2: Comparison of alternative simple models.*
   - *5.3: Experimental study on small-scale rig.*
6. ***Dynamic simulation of alternative control strategies***
7. ***Modelling and Control of District heating systems***
8. ***Validation of new closed PID tuning rules***
9. ***Controlled variables from operation data (chemiometrics project)***



Distillation column.

Conclusion: Welcome to K4 – 2nd floor!