GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2018-2019

Computer Control of Industrial Processes (E007920)

Course size (nominal values; actual values may depend on programme)

Credits 6.0	Study time 180 h	Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	English	group work	30.0 h
		guided self-study	5.0 h
		lecture	25.0 h
B (semester 1)	Dutch	group work	30.0 h
		guided self-study	30.0 h

Lecturers in academic year 2018-2019

Ionescu, Clara-Mihaela	TW08	lecturer-in-charge

Offered in the following programmes in 2018-2019	crdts	offering
Bridging Programme Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	6	A
Bridging Programme Master of Science in Industrial Engineering and Operations Research	6	A
Bridging Programme Master of Science in Chemical Engineering	6	A
Bridging Programme Master of Science in Industrial Engineering and Operations Research	6	A
Bridging Programme Master of Science in Chemical Engineering	6	B
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	6	A
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	6	A
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	A
Master of Science in Industrial Engineering and Operations Research	6	A
Master of Science in Chemical Engineering	6	A
Master of Science in Computer Science Engineering	6	A
Master of Science in Computer Science Engineering	6	A
Master of Science in Industrial Engineering and Operations Research	6	A
Master of Science in Sustainable Materials Engineering	6	A
Master of Science in Chemical Engineering	6	B

Teaching languages

Dutch, English

Keywords

digital control systems, system identification, computer assisted design (CAD), PID-autotuning, model based control strategies (Model Predictive Control), multivariable control

Position of the course

To learn the principles of controlling an industrial process by means of a computer.
To learn - and to apply - the techniques for modelling and identification of physical systems, starting from measured process signals.
To learn - and to apply - a selection of advanced control methods which are of increasing industrial interest.

Contents

- Recap:Sampling, Discrete-time Approximations
- Recap: Time and Frequency Domains, Dynamics of 2nd order processes, Stability Margins
- System Identification (via Matlab/Simulink): Principles, System and Signal Models, Non-Parametric Identification Methods, Parametric Identification Methods
- Computer Assisted Design (CAD via Matlab/Simulink) and autotuning methods for PID controllers
- Model based Control (via Matlab/Simulink): Dynamic Matrix Control (DMC), Predictive Control of dynamical systems, practical extensions of predictive control (nonlinear systems, multivariable systems, constraints)
- Multi-Input Multi-Output (MIMO) systems (via Matlab/Simulink): analysis of MIMO control loops, decentralized control, decoupling control, multivariable control

Initial competences

signals and systems; modelling and control of dynamical systems; control engineering

Final competences

1 To understand the effect of analog-to-digital and digital-to-analog converters on system dynamics.
2 To be able to develop a mathematical model formulation through signal processing techniques (identification methods).
3 To evaluate when model-based and non-model based control should/can be applied.
4 To critically assess the choice for trade-off between performance of closed loop and robustness to disturbances and process model variations.
5 To possess insight into the choice between model based control strategies (predictive control) and to apply them in practice.
6 To identify the interactions between sub-processes and to understand the effect of this interaction on the global performance of the total process.
7 To apply simplifying techniques to complex systems and to analyze the effects of these simplifying assumptions.
8 To be able to communicate and cooperate within a team, to manage a project towards the end-objectives and to report the obtained results in a critical objective assessment.
9 To be able to use control-engineering related software (Matlab/Simulink)

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Guided self-study, group work, lecture

Learning materials and price

course syllabus and slides (freely distributed via Minerva)

References

- Aström and Wittenmark. "Computer Controlled Systems".
- Ljung. "System Identification".
- Camacho and Bordons. "Model Predictive Control".
- Astrom and Hagglund: "Advanced PID control".
- Bequette: "Process Control. Modelling, Design and Simulation"
- Skogestad and Postletwaithe: "Multivariable Feedback control"

Course content-related study coaching

The lecturer is available during and after the lectures for further explanation; there is support for projects; individual explanation and feedback is available on appointment; feedback from projects and discussion sessions are also available.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination, simulation

Examination methods in case of periodic evaluation during the second examination period

Written examination, simulation

Examination methods in case of permanent evaluation

Written examination with open questions, written examination with multiple choice questions, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

During examination period: closed-book written exam; practical (computer) open-book exam
During semester: graded project reports, quiz (written)

Calculation of the examination mark

Evaluation throughout semester as well as during examination period; throughout semester: 2 projects (40%). The applications in these projects are tailored for the various student's specialisations taking this course.