GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2017-2018

Bioprocess Control (I001131)

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

Credits	**5.0**	**Study time**	**135 h**
Contact hrs	60.0 h		

Course offerings and teaching methods in academic year 2017-2018

A (semester 1)	Dutch	guided self-study	5.0 h
	Dutch	lecture	25.0 h
	Dutch	seminar: practical	30.0 h

Lecturers in academic year 2017-2018

Nopens, Ingmar	LA26	lecturer-in-charge

Offered in the following programmes in 2017-2018	crdts	offering
Master of Science in Chemical Engineering	5	A
Master of Science in Sustainable Materials Engineering	5	A
Master of Science in Chemical Engineering	5	A
Master of Science in Bioscience Engineering: Chemistry and Bioprocess Technology	5	A
Master of Science in Bioscience Engineering: Environmental Technology	5	A

Teaching languages

Dutch

Keywords

Process control, nonlinear systems, bioprocess technology, optimal control, observers, software sensors

Position of the course

The (non-)linear and adaptive characteristics of biosystems necessitate the introduction to modern control theory. Moreover, attention is paid to data-acquisition in view of practical application of process control.

Contents

1. Modern control
1.1. Controllability of linear systems
1.1.1. Evaluation of controllability
1.1.2. Canonical system description, standard controllable form
1.2. Design of linear controllers: State feedback
1.2.1. State feedback control
1.2.2. Optimal control (LQ-controller)
1.2.3 Variants of LQ-controllers
1.3. State estimation
1.3.1. Observability
1.3.2. State estimators (Observers), Luenberger reduced order observer
1.3.3. The Kalman filter: optimal state estimator
1.4. Separation principle

2. Model-based predictive control (MBPC): the DMC-algorithm
3. Linearising control
4. Introduction to data acquisition

Initial competences

Bioprocess Control builds on certain learning outcomes of course unit Modelling and Simulation of Biosystems ; or the learning outcomes have been achieved differently.

Final competences

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, lecture, seminar: practical PC room classes

Extra information on the teaching methods

Theory is provided in oral lectures. Working lectures consist of blackboard exercises and computer exercises.

Learning materials and price

A dutch syllabus is available. Material for the work colleges is available through Minerva.

References

Bastin G. and Dochain D. (1990) On-line Estimation and Adaptive Control of Bioreactors. Elsevier, Amsterdam. pp. 379
Levine W.S. (1995) The Control Handbook. CRC Press, Boca Raton, Florida. pp. 1548
Oggunaike B.A. and Ray W.H. (1994) Process Dynamics, Modeling, and Control. Oxford University Press, New York. pp. 1260
Van Impe J.F., Vanrolleghem P.A. and Iserentant D. (1998) Advanced Instrumentation, Data Interpretation and Control of Biotechnological Processes. Kluwer Academic Publishers, Dordrecht, The Netherlands. ISBN 0-7923-4860-5. pp. 464

Course content-related study coaching

Study coaching is offered before and after each of the theory lectures and practicals or after appointment.

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination

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

Written examination

Examination methods in case of permanent evaluation

Report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.
Exercises (PE): written examination (open book)
Exercises (NPE): reporting in group concerning (1) the implementation of the DMC-algorithm and (2) data acquisition and signal processing

Calculation of the examination mark

Exercises (PE): 60%
Exercises (NPE): 40%
Students who eschew periodic and/or permanent evaluations for this course unit may be failed by the examiner.