Course
Specifications
Valid as from the academic year 2019-2020

Computer Control of Industrial Processes (E007920)

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
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<tbody>
<tr>
<td>6.0</td>
<td>180 h</td>
<td>60.0 h</td>
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Course offerings and teaching methods in academic year 2019-2020

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

B (semester 1)  Dutch  group work  30.0 h
                 guided self-study  30.0 h

Lecturers in academic year 2019-2020

Ionescu, Clara-Mihaela

Offered in the following programmes in 2019-2020

<table>
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<tr>
<th>Programme</th>
<th>crds</th>
<th>offering</th>
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<tbody>
<tr>
<td>Bridging Programme Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)</td>
<td>6</td>
<td>A</td>
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<tr>
<td>Bridging Programme Master of Science in Industrial Engineering and Operations Research</td>
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<tr>
<td>Master of Science in Sustainable Materials Engineering</td>
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<td>A</td>
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<tr>
<td>Master of Science in Chemical Engineering</td>
<td>6</td>
<td>B</td>
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Teaching languages

Dutch, English

Keywords

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

Position of the course

To learn the principles of controlling an industrial process by means of a computer.

(Approved)
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): practical extensions of PID 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 critically assess the choice for trade-off between performance of closed loop and robustness to disturbances and process model variations.
4. To possess insight into the choice between model based control strategies and to apply them in practice.
5. To identify the interactions between sub-processes and to understand the effect of this interaction on the global performance of the total process.
6. To apply simplifying techniques to complex systems and to analyze the effects of these simplifying assumptions.
7. 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.
8. 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 the electronic learning platform)

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 Postlethwaite: "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

(Approved)
Examination methods in case of periodic evaluation during the second examination period
   Written examination

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;
   During semester: graded project reports followed by test (written)

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