3bsau30 Control theory and applications

Nom de l'UE	3bsau30 Control theory and applications			Obligatoire
Cursus	Bachelier en sciences de l’ingénieur industriel - ingénierie de la santé		**Bloc**	3
Crédits	3	**Heures**	Q2 29	
Prérequis	2baom20	**Corequis**	3bmra30	
Responsable	Franky DE BRUYNE	**Langue**	EN FR	

Contribution au programme

This teaching unit introduces the student to control structures for controlling various processes in closed-loop in real-time.

Code	**Activité**	**Heures**		**%**	**Type d'évaluation**			**Enseignants**	**Langue**	
		Q1	**Q2**		**Q1**	**Q2**	**Q3**		**Ens.**	**Eval.**
S3080	Control theory and applications		29	100%		C+E	E	DBR	FR+EN	EN

Acquis d’apprentissage spécifiques

(AAS5.1) The student establishes the underlying process behaviour (dynamics, time constants, disturbances) when confronted to a process control problem.

(AAS16.1) The student tunes the different control actions (Proportional, Integral and Derivative) and parameters associated with the PID controller to meet specific performance objectives using trial-and error or model-based methods.

(AAS16.2) The student is able to code a PID controller with saturation, anti-wind-up, interlocks and feedforward.

Description du contenu

Outline of the **theoretical course 3bsau3C “Control theory and applications”:**

1. Introduction
2. System theory
3. Process behaviour
4. PID controller and feedforward
5. Dictionary

The **related video-course** is available online:
https://www.youtube.com/playlist?list=PLKqQa2b_GjJL3qDPvVr0FsjGgDs-zjr5F

Subscribe to the channel in order to get the latest updates. The videos will be published as soon as they become available.

Laboratory assignment: 4 sessions dedicated to the identification of the process dynamics, the implementation of a discrete-time PID controller with feedforward and the optimisation of the PID controller using the IMC tuning method on a laboratory set-up.

General info:

The use of a personal laptop with a working and preinstalled MATLAB installation is **mandatory** during the laboratory sessions. All the necessary toolboxes for the MATLAB laboratory are covered by the “MATLAB and SIMULINK Student Suite” (https://nl.mathworks.com/academia/student_version.html).

Méthodes d'enseignement

1 introductory class-room lecture + video lectures

Control class room laboratory based on MATLAB SIMULINK

If the health measures do not allow class-room lectures/laboratories, these will be organized using virtual means.

Méthodes d'évaluation

3bsau3C “Control theory and applications” (DBR):

Theory: closed-book WISEflow exam in **PC lockdown mode** with **webcam facial recognition** and **without** the possibility of **backward navigation** in the assignment. Questions are in **English**. There is **no direct contact with the examiner**. **For multiple choice type questions: correct answer: +1, incorrect answer: -0.25**.

Laboratory evaluation: quality (structure, neatness, bring understanding of the theory to the front, elements of originality, etc.) of the report. The laboratory reports must be handed over at a date that is set in the assignment. Delays will incur a penalty:

- Less than one-day delay incurs a penalty of -2/20.
- In between one and two days' delay incurs a penalty of -5/20.
- More than two days' delay will result in a mark of 0/20.

It is essential that the learning outcomes of both the theoretical component and the practical laboratory component are met.

Attendance to the control laboratory is compulsory provided that the health measures allow class-room teaching activities**.** The final mark for the control report is directly proportional to the attendance time, i.e. there is a penalty for late arrival. A **minimum penalty** of **-0.5/20** is applied per late arrival, i.e. at beginning the control lab or after a break. An unjustified absence will result in a 0/20 mark for the corresponding laboratory session. In case of a justified absence (medical certificate), contact the supervisor ASAP to reschedule the session. If this is not possible, a substitution assignment will be imposed.

The control laboratory report **cannot be re-evaluated in September**.

One global mark for the teaching unit.

Support de cours

Slides of the theoretical course are available online on the web page dedicated to the course.

Video course

Bibliographie

L. F. Chaparro, "Signals and Systems using MATLAB", Academic Press, Elsevier, 2011.

G. F. Franklin, J. D. Powell and A. Emami-Naeini, "Feedback Control of Dynamics Systems", Pearson International Edition, Prentice Hall, 2009.

R. Longchamp, "Commande numérique de systèmes dynamiques", Presses Polytechniques et Universitaires Romandes, Méthodes de base et Méthodes avancées, Vol. 1 et 2, 2010.

C. L. Smith, ``Practical Process Control: Tuning and Troubleshooting'', Wiley, New Jersey, 2009.