Course guide
240172 - 240172 - Automatic Control

Last modified: 06/07/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).
BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Roberto Griñó

Others: Roberto Griñó - Enric Fossas - Miguel A. Mañanas - Carlos Ocampo - Vicenç Puig - Maria Serra - Joaquim Triginer - Stefano De Pinto - Leidy Y. Serna - Angel Santamaria - Alejandro Clemente

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Capacity to design control systems and industrial automation.
2. Knowledge on automatisms' fundaments and control methods.
3. Knowledge on automatic regulation and control techniques and their application in industrial automation.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	12,0	8.00
Hours large group	48,0	32.00

Total learning time: 150 h

CONTENTS

(ENG) Tema 1 Introduction to digital control

Description:
Digital control systems. Digital controllers and control algorithms. Architecture of a digital control system.

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

(ENG) Tema 2 Sampling of signals

Description:
Sampling and holding. A/D and D/A converters. Mathematical study of sampling. Properties of the Laplace transform of a sampled function. Sampling Theorem. Reconstruction of sampled signals.

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

(ENG) Tema 3 Discrete-time systems

Description:
Definition of z transform. Properties of the z transform. Correspondence between the s-plane and the z-plane. Calculation of z transforms. Calculation of inverse z transforms. z domain transfer function. Block diagrams. Simplification. Closed-loop systems. Open-loop transfer functions (L) and closed-loop transfer functions (T,S).

Full-or-part-time: 19h
Theory classes: 7h
Self study : 12h

(ENG) Tema 4 Time-domain analysis

Description:
Time response of discrete-time systems. Configuration of poles in the z-plane and temporal response. Stability and internal stability. Jury's stability criterion. Precision. Steady-state error and type. Internal model principle. Comparison of responses of continuous and discrete time systems.

Full-or-part-time: 37h
Theory classes: 12h
Laboratory classes: 3h
Self study : 22h

(ENG) Tema 5 Frequency domain analysis

Description:
Frequency response of discrete-time systems. Nyquist plot. Bode plot. Nyquist's stability criterion. Bode's simplified criteria. Gain and phase margins.

Full-or-part-time: 25h
Theory classes: 7h
Laboratory classes: 3h
Self study : 15h

(ENG) Tema 6 Design and implementation of digital controllers

Description:
Control algorithms and digital controllers. Digital PID controllers. Frequency domain design of lead and lag controllers. Algebraic design of digital controllers: Pole assignment and other specifications, general controllers and PID controllers. Control algorithms programming. Selection of the sampling period. Quantification and computation time effects.

Full-or-part-time: 51h
Theory classes: 13h
Laboratory classes: 6h
Self study : 32h

GRADING SYSTEM

BIBLIOGRAPHY

Basic:
- Kuo, Benjamin C. Sistemas de control digital. México: Compañía Editorial Continental, 1997. ISBN 9789682612923.
- Basañez, Luis ; Caminal Magrans, Pere. Control digital : problemas [on line]. Barcelona: Edicions UPC, 2002 [Consultation: 12/09/2017]. Available on: http://hdl.handle.net/2099.3/36164. ISBN 8483015897.
- Causí, O., Mañanas, M. A., Costa, R. , Basañez, L. Estudi de sistemes de control digital mitjançant Matlab TM. Barcelona: C.P.D.A, 2007.
- Basañez, L. ; Costa, R. ; Fossas, E. ; Mañanas, M. A. ; Puig, V. ; Riera, J. ; Rosell, J. ; Villà, R. Treballs pràctics de control digital. Barcelona: C.P.D.A, 2013.
- Costa Castelló, Ramon; Fossas Colet, Enric. Sistemes de control en temps discret [on line]. Barcelona: Universitat Politècnica de Catalunya. Iniciativa Digital Politècnica, 2014 [Consultation: 21/07/2022]. Available on: https://upcommons.upc.edu/handle/2099.3/36857. ISBN 9788498804621.

Complementary:
- Phillips, Charles L; Nagle, H. Troy. Sistemas de control digital: análisis y diseño. 2ª ed. Barcelona: Gustavo Gili, 1993. ISBN 84-252-1335-5.
- Ogata, Katsuhiko. Ingeniería de control moderna [on line]. 5ª ed. Madrid: Pearson Educación, cop. 2010 [Consultation: 06/10/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1259. ISBN 9788483226605.
- Ogata, Katsuhiko. Sistemas de control en tiempo discreto. 2ª ed. México: Prentice Hall Hispanoamericana, cop. 1996. ISBN 9688805394.
- Aström, Karl J; Wittenmark, Björn. Sistemas controlados por computador. Madrid: Paraninfo, 1988. ISBN 84-283-1593-0.