DEGREE CURRICULUM

FEEDBACK CONTROL

Academic year 2015-16

Subject's general information

Subject name	FEEDBACK CONTROL
Code	14537
Semester	SEGON
Typology	Optional
ECTS credits	6
Theoretical credits	3
Practical credits	3
Office and hour of attention	Arrange tutoring with teacher. Office 1.06 EPS
Department	Informàtica i Enginyeria Industrial
Modality	Presencial
Important information on data processing	Consult this link for more information.
Language	Catalan Spanish English
Degree	ENGINYER INDUSTRIAL
Office and hour of attention	Arrange tutoring with teacher. Office 1.06 EPS
E-mail addresses	jribo@diei.udl.cat

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Subject's extra information

The optional subject "feedback control" is designed for students from non-specialized degrees in electrical technology, electronic control or can receive specific training to their academic curriculum that integrates the basic principles of the Theory of Automatic Control and Electronics according to the profile of the Masters degree in Industrial Engineering

Within the context of the Master, the subject-face taught in the second semester of the first year. Link Course "Systems Engineering" studied in the first semester of the second year of the Master, "Electronic Systems Design and Control".

The course is divided into two parts:

- First, to address the feedback analysis of physical systems and their response in the time domain and the frequency domain. Part of the definitions and theoretical basis based control rechargeable focused especially on the analysis of transient response, stability and steady analysis of feedback systems.
- The second part addresses some compensation techniques used in Automatic Regulation System and its implementation: electronic systems in the case of continuous and digital systems in the case of discrete time.

As development tools apply typical calculation operational systems in continuous time and discrete time, represented internally or externally.

This presupposes that the student has previously achieved the basics of differential equations, the Laplace and Fourier transformations, as well as technical analysis of signals and systems, complete with discrete transformations and differential equations.

Learning objectives

Although the scope of this subject is very wide, about the number of credits allocated it is considered necessary that the master students, graduates in different fields of electrical, electronics and control technology, acquire knowledge in Automatic Regulation themselves to the powers laid for graduates Master Industrial Engineer

In short, it is intended that students,

Master modeling techniques of systems for external and internal representation of systems to facilitate the analysis of the physical variables involved in industrial processes.

It forms on some techniques of feedback control using appropriate tools, designed for simulation and modeling of systems for the analysis and design of control systems both physical, as its digital implementation.

Competences

Concerning the CIN / 311/2009 of 9 February Order, student, professional future of Industrial Engineering, you must acquire the knowledge of their own scientific and technological aspects of Automatic Control, enabling them,

Being able to design, calculate and design products, processes, facilities and plants.

Being able to direct, plan and supervise multidisciplinary teams.

Doing research, develop and innovate new products, processes and methods.

Technically and economically manage projects, installations and industrial plants.

Apply the acquired knowledge and solve problems in new or unfamiliar environments within broader and

multidisciplinary contexts.

Knowing how to communicate the findings to specialists and non-specialists in clear and unambiguous.

Have the learning skills to continue studying independently.

Being able to understand and interpret the Rules, Regulations and Rules.

Subject contents

1. Introduction to feedback control systems.

Fundamentals of dynamic systems. Basic concepts. Temporal evolution.

Linearity in system dynamics. Laplace transform

Representation and classification systems. External and internal description. State space of dynamical systems.

Representation in continuous time or discrete time.

Open loop systems and closed loop systems

Transfer function of a control system of continuous time

Topology block diagrams or flow signal

Sampling theorem. Reconstruction in discrete time. Z-transform transfer function of discrete-time systems

ITEM 2. Analysis of continuous-time systems and discrete time.

Modeling and simulation of dynamic systems: mechanical, hydraulic, electrical and thermal.

Linearization of nonlinear models.

Simulations. Linear dynamic systems in continuous time external and internal description.

Time response. Sources Test.Sistemes first order. Second order systems

Specifications transient response

Higher order systems.

Transient response of discrete systems. Control system discrete-time closed loop.

Absolute stability of nonlinear systems. Stability in continuous time systems. Stability of discrete-time systems

Steady state analysis. Error steady.

The locus of the roots. Classical rules of construction of the root locus continuous time and discrete time

Correspondence between the plane S and Z. plan

ITEM 3. Frequency analysis of systems with feedback.

Frequency response of continuous-time systems.

Representation of the frequency response.

Nyquist stability criterion. Conformal transformation.

Relative stability. Phase margin and profit margin.

Frequency response of discrete-time systems.

Characterization of the frequency response.

ITEM 4. Design of Control Systems in continuous and discrete time.

Design of closed loop control. Controller design in the time domain and the frequency domain. General features.

Design of regulators by the method of root locus.

Compensation phase lead networks.

Compensation phase delay networks.

Compensation belatedly networks advancement

Proportional control. Integral control action proportional integral action. Proportional integral control.

Derivative control action. Proportional derivative control.

Block diagram of the discrete control. PI control, PD and PID.

ITEM 5. Design of Control Systems in the frequency domain.

Introduction.

Compensation phase lead networks

Compensation phase delay networks.

Compensation networks belatedly phase lead.

Relationship between frequency response and specifications in the time domain.

Normalized profit. Phase margin and maximum sobrepuig

Cutoff frequency and speed of response time

Discretization of compensating frecuenciales

ITEM 6. Implementation of Electronic Control Systems

Introduction to analog control circuits.

The operational amplifier.

Basic circuits with operational amplifiers

Control systems with operational amplifiers

Nonlinear applications of operational amplifiers

Discrete-time control microcontrollers

Methodology

To follow the course is that since the beginning of the course, all students participate actively in class

Through the "Virtual Campus" course participants have the relevant work material consisting references, articles and application examples.

In the classroom, the teacher will mark the objectives and guidelines necessary theoretical study and practical application in solving problems Control Engineering.

Then propose the study of applications that students must solve personally and defended in class. The professor

will coordinate the solution of questions, doubts and suggestions made by the students.

Practical applications will directly simulations with appropriate tools. Mainly used platform and other platforms used in MATLAB simulation control electronics.

Development plan

The course is structured in the following topics

ITEM 1. Introduction to control systems fed back.

ITEM 2. Analysis of continuous-time systems and discrete time.

ITEM 3. Frequency Analysis of feedback systems.

ITEM 4. Design of Control Systems in discrete and continuous time.

ITEM 5. Design of Control Systems in the frequency domain.

ITEM 6. Implementation of electronic feedback control systems

Evaluation

The evaluations will be based on academic caledar of EPS

The first exam will count 30% mark.

The second exam will count 50% of the note.

The resolution and defense work and exercises propossats will be able to achieve 20% of the final grade.

To pass the course is essential to achieve at least 40% in each evaluation and the sum of all the high notes is equal to or more than five points.

Bibliography

REFERENCIES

Sistemas de Control Automático. Benjamin Kuo. Prentice Hall

Ingeniería de Control Moderna. Katsuhiko Ogata. Prentice Hall.

Teoría de Control. Diseño Electrónico. Gomariz. Edicions UPC

Linear Control System Analysis and Design with MATLAB. John D'Azzo. Dekker

Modern Control Systems Analysis and Design Using MATLAB. Bishop. Addison- Wesley

Linear Systems Control, deterministic ans stochastic methods. Hendricks. Springer

Sistemas de Control de Procesos. Aplicación, Diseño y Sintonización. Shinskey. McGraw Hill

Classical Feedback Control with Matlab.Lurie.TKFeBOOK