Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: CONTROL SYSTEMS DESIGN			
ACADEMIC YEAR: 2018/2019			
TYPE OF EDUCATIONAL ACTIVITY: Characteristic			
TEACHER: FRANCESCO PIERRI			
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Language: Italian			
ECTS: 6	n. of hours: 56	Campus: Potenza Dept./School: School of Engineering Program: Computer Engineering	Semester: II

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The goal of the course is providing the basic tools for the analysis and design of time invariant linear feedback control systems, both in frequency and time domain. It also provides the basic tools for numerical simulations of control systems by means of Matlab/Simulink.

- **Knowledge and Understanding**
  System modeling and analysis, designing single-loop controllers, evaluating control system performance via numerical simulations.

- **Applying Knowledge and Understanding**
  Being able to apply feedback control methodologies in practical context. Being able to design linear controllers via frequency response approaches.

- **Making judgements**
  Being able to evaluate the system properties and to develop a control system able to satisfy the design specifications.

- **Communication skills:**
  Ability to produce written text in the relevant discipline medium and to express verbally by using adequate technical language.

- **Learning skills:**
  Ability to integrate knowledge from various sources in order to achieve a broad understanding of issues related to the design of control systems.

PRE-REQUIREMENTS

Basic knowledge of the methodologies and skills learned in the mathematics and dynamical system theory courses.

SYLLABUS

Basic concepts of system analysis (10 hours)
system's frequency response; Bode plots; asymptotic approximations of Bode plots.

The problem of automatic control (4 hours)
open loop and closed loop control; control system classification; examples of automatic control systems.

Properties of feedback control systems (4 hours)
parameter sensitivity; disturb sensitivity; effects on bandwidth due to feedback.
Steady-state errors for feedback systems (6 hours)
steady-state error for test input signals; steady-state error for disturbances; feedforward compensation.

Stability of closed loop systems (10 hours)
Nyquist criterion; singular cases of the Nyquist criterion; stability margins.

Relationship between open loop and closed loop poles (4 hours)
Nichols charts; locus roots.

Specifications and guidelines for controller design (3 hours)
stability and stability robustness; steady-state performance; transient-state performance; control effort.

Controller design via frequency response (6 hours)
lag compensation; lead compensation; lag-lead compensation; numerical examples.

PID controllers (6 hours)
proportional, integral and derivative terms; PID controller design; PID controller tuning.

Introduction to Matlab/Simulink for dynamic system simulation and control system design (3 hours)

TEACHING METHODS

Lectures and development of numerical case studies.

EVALUATION METHODS

The evaluation is based on the discussion of a project work and an oral test.
The project work is assigned at the end of the course to groups of 1 or 2 students. The project work must be submitted before the exam (usually 1 week before) and is evaluated by the teacher. Only students who receive a sufficient evaluation of the project work are admitted to the oral exam.
The oral test is aimed at discussing the project work, so as to evaluate problem solving and presentation skills, and assessing the knowledge and the ability to link and compare the topics covered during the course.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- Lectures notes provided by the teacher and available online at www.informatica.unibas.it
- S. Chiaverini, F. Caccavale, L. Villani, L. Sciavicco, Fondamenti di Sistemi Dinamici, McGraw-Hill Libri Italia.
- Paolo Bolzern, Riccardo Scattolini, Nicola Schiavoni, Fondamenti di controlli automatici (2/ed), McGraw-Hill Libri Italia

INTERACTION WITH STUDENTS

Office hours: Monday 15:00-17:00 – Friday 9:00-11:00, Floor IV, room 10.

The teacher can be contacted at the end of the lessons and/or by e-mail as well.

EXAMINATION SESSIONS (FORECAST)[1]

1st Session: 23/01/2020, 27/02/2020,
2nd Session: 02/04/2020, 07/05/2020, 09/07/2020, 30/07/2020,
3rd Session: 10/09/2020, 08/10/2020, 19/11/2020, 17/12/2020.

SEMINARS BY EXTERNAL EXPERTS YES ☐ NO ☒

FURTHER INFORMATION

[1] Subject to possible changes: check the web site of the Teacher or the Department/School for updates.