COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

Syllabus
2024 - 2025

GENERAL INFORMATION

Data of the subject	
Subject name	Advanced Control
Subject code	DEAC-MII-531
Mainprogram	Official Master´s Degree in Industrial Engineering
Involved programs	Máster Universitario en Ingeniería Industrial y Máster Universitario en Sistemas Ferroviarios [First year] Máster Universitario en Ingeniería Industrial + Máster en Industria Conectada / in Smart Industry [First year] Máster Universitario en Ingeniería Industrial [First year]
Credits	4,5 ECTS
Type	Obligatoria
Department	Department of Electronics, Control and Communications

Teacher Information	
Teacher	
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DESCRIPTION OF THE SUBJECT

Contextualization of the subject

Prerequisites

Basic knowledge of modeling dynamic systems.

PID control design based on frequency response.

Programming in Matlab/Simulink.

Course contents

Contents

Theory

1. Limitations of classical control. Conflicting dynamics in monovariable control systems. Multivariable control systems. Need for advanced control.
2. Advanced PID control. Feedforward control. Smith predictor. Cascade control. Multivariable PID control.

3. Multivariable control by state feedback. LQR control. Kalman filter.
4. Model Predictive Control. Fundamentals of Model Predictive Control. Fields of application.
5. Adaptive control. Autotuning. Gain Scheduling. Self-Tuning Regulator and Model Reference Adaptive System. Fields of application of each technique.

Laboratory

The laboratory work is aimed at developing a project, where teamwork, organization, creativity and initiative take on special importance. The activities carried out in the laboratory around a practical control project will be the following:

1. Project planning and distribution of tasks.
2. Modeling based on tests.
3. PID control.
4. Application of an advanced control.

EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
1. Short tests and/or resolution of a practical problem. 2. Final exam and/or practical problem for final assessment.	• Understanding of concepts. • Application of concepts to the resolution of practical problems. • Analysis and interpretation of the results obtained in problem solving. • Written communication.	50
1. Performance during laboratory sessions. 2. Intermediate and final laboratory exams.	• Understanding of concepts. • Application of concepts to the resolution of practical problems. • Analysis and interpretation of the results obtained in problem solving. • Teamwork ability • Oral and written communication.	50

Grading

December Examination Session:

- Final exam with a minimum of 5, 60%.
- Continuous assessment tests during the course, 5%.
- Laboratory grade with a minimum of 5, 35%.

June Examination Session:

- Final exam with a minimum of 5, 60%.
- Continuous assessment tests during the course, 5%.
- Laboratory grade with a minimum of 5, 35%.

The student is not examined in the June Examination Session for the part (theory or laboratory) that he or she has passed in the December

Examination Session. Class attendance is compulsory, according to the Academic Regulations of the Higher Technical School of Engineering (ICAI). The attendance requirements will be applied independently for the theory and laboratory sessions: In the case of theory sessions, failure to comply with this rule may prevent them from taking the exam in the December Examination Session. In the case of laboratory sessions, failure to comply with this rule may prevent them from taking the exam in both the December and June Examination Sessions. In any case, unexcused absences from laboratory sessions will be penalized in the assessment.

BIBLIOGRAPHY AND RESOURCES

Basic References

- Åström, Wittenmark. Adaptive Control. Addison-Wesley, 1989
- Camacho, Bordons. Model Predictive Control, Springer Verlag, 2004.
- Martín-Sánchez, Rodellar. Adaptive Predictive Control, Prentice Hall, 1995