Simulation of dynamic systems

Academic Year: (2023 / 2024) **Review date: 17-04-2023**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: RODRIGUEZ URBANO, FRANCISCO JOSE

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

SKILLS AND LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG3. Ability to design a system, component or process in the field of Industrial Technologies to meet the required specifications
CG4. Knowledge and ability to apply current legislation as well as the specifications, regulations and mandatory standards in the field of Industrial Engineering.
CG5. Adequate knowledge of the concept of company, institutional and legal framework of the company. Organisation and management of companies.
CG6. Applied knowledge of company organisation.
CG8. Knowledge and ability to apply quality principles and methods.
CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA3. Engineering Design: To be able to design industrial products that comply with the required specifications, collaborating with professionals in related technologies within multidisciplinary teams.
RA4. Research and Innovation: To be able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.

OBJECTIVES

By the end of this subject, students will be able to :
1. To have the knowledge and understanding of the principles related to scientific computing for modelling and simulation of dinamical systems.
2. Apply their knowledge and understanding of dynamical systems to identify, formulate and solve modelling and simulation problems of engineering systems using established methods;
3. To select and apply relevant analytic and modelling methods.
4. To have an understanding of the different programming methods used for implementing mathematical algorithms on scientific computation computer programs, and the capacity to apply them to solve engineering problems.
5. To have the workshop and laboratory skills to work with scientific computation programs.

6. Select and use appropriate mathematical tools and programming methods to solve engineering problems related to modelling and simulation of dinamical systems.
7. To combine theory and practice to implement on a computer program the solution to engineering problems regarding modelling and simulation of dynamic systems;
8. Understand the applicable techniques and methods in modelling and simulation of dynamic systems, and their limitations;

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to modeling and simulation.
a. Definition an basic concepts.
b. Basic types of models of dynamical systems.
2. Modeling and simulation languages review.
a. Introduction to block oriented languages for simulation.
3. Basic techniques for Matlab programming.
a. Vectors an Matrices handling.
b. Functions and flow control components.
c. Special functions and libraries.
d. Graphics management.
4. Development of examples and applications on several application domains.
a. Application to vibrational systems.
b. Application to control systems.
c. Examples of biological systems.

LEARNING ACTIVITIES AND METHODOLOGY

Teoretical and Practical sessions mainly on computer rooms with Matlab software. Tuition session for the development of practical problems for subject evaluation. Some evaluation session interleaved during the classes.

ASSESSMENT SYSTEM

Classroom exercises interleaved with the theoretical sessions. Final modeling and simulation project. Final examination of basic modeling and simulation concerns.

% end-of-term-examination:	20
% of continuous assessment (assigments, laboratory, practicals…):	80

BASIC BIBLIOGRAPHY

- Edward B. Magrab An Engineers guide to Matlab third edition, Prentice Hall, 2010