Industrial Robotics

Academic Year: (2020 / 2021) **Review date: 23/07/2020 17:23:48**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: GONZALEZ VICTORES, JUAN CARLOS

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Linear Algebra
Computer programming

OBJECTIVES

Understand the different types of industrial robots, components, architecture and kinematic and dynamic modelling. Different methods of programming robots are discussed. Students will gain experience in handling and programming real industrial robots. They acquire skills about design, simulate and program robotic industrial applications. Thanks to simulation proposed work the student will get by himself different functionalities about a common and commercial IDE for industrial robot programming.

The aim of the course is the introduction to Industrial Robotics from both theoretical and practical aspect. The importance of industrial applications and future.
Enable students to acquire basic knowledge of control and programming of industrial robots. For this we have tried to achieve a balance between the theoretical aspects, the study of the components that make up a robot (mechanical, computer and control), and applications (programming and implementation criteria of robotic systems).

This course has a strong theoretical component. However, it has been preferred in this case the theoretical limit and it is intended that the student receives in addition a good knowledge of a real industrial system and the right tools to use. The kinds of problems should be supported by tools such as Matlab robotics library of Corke, in order to present realistic problems in time that is available. With the proposed practices, which are performed on industrial and educational robots, is intended to reinforce the knowledge acquired in the lectures.
Practical component is completed with simulation work in the commercial IDE has been to design, program and test a robot manufacturing station that implements a production process chosen by the student.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
1.1 Definitions and terms
1.2 Historical evolution
1.3 Industrial Robot market and regulations
1.4 Statistics and trends in Industrial Robots Market

2. Morphology and robotic technologies
2.1 Structures and basic configurations
2.2 Review of main sub-systems: mechanical
2.3 Review of main sub-systems: actuators and drives
2.4 Review of main sub-systems: sensors
2.5 End effector and tools

3. Control architecture of Industrial controllers

3.1 Control architecture issues
3.2 Man-machine interface and communications
3.3 Controller functionalities

4. Industrial Robotic Applications
4.1 Classification
4.2 Case Studies

5. Kinematic Control
5.1 mathematical tools
5.2 Kinematic modelling
5.3 Direct and inverse kinematic problem formulation and resolution
5.4 Differential modelling
5.6 Trajectories calculus and generation
5.7 Kinematic control of trajectories

6. Dynamic modelling
6.1 Dynamic Control problem formulation
6.2 Euler-Lagrange formulation
6.3 Direct and inverse dynamics main issues.
6.2 Dynamic control issues

7. Programming of robots
7.1 Classification and programming methods
7.2 Programming languages for commercial robots
7.3 Coordinate systems and spatial references
7.4 Advanced programming concepts and methods with RAPID (ABB)

8. Industrial implantation criteria and relevant issues
8.1 Design aspects for Flexible Manufacturing Cells based on industrial robots and trends
8.2 Safety assurance in Industrial robots
8.3 Introduction to Collaborative Robots

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures, doubts solving classes in small groups, student presentations, tutorials and personal work, oriented towards acquisition of theoretical knowledge (3 ECTS).
- Lab and exercises in small groups, individual tutorials and personal work, especially by final practice proposal related to simulation and programming of a robotised cell;aimed at the acquisition of practical skills related to the program of the course (3 ECTS).

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Practical sessions will be performed:

1. Getting started with ABB industrial robot manipulators and controllers.
2. Robot programming by demonstration and by RAPID.
3. Robot programming by means of simulation.
4. Robot programming of a simple flexible manufacturing system by means of simulation.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

The continuous evaluation will be based on the two partial assessment tests (30% + 30%) and the qualification of a simulation exercise (40%) . To habilitate the computation of the simulation work score a minimum of 4 point for the media of the two partial assessment must be obtained in order to calculate the continuous assessment score. If the student does not pass the continuous assessment shall be submitted to the final exam with a 60% exam and 40% of the simulation work; The simulation work assignment is taken into account for extraordinary call.

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% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- A. Barrientos, L.F. Peñin, C. balaguer, R. Aracil Fundamentos de Robotica (2ª edicion), McGraw Hill.