Syrian Arab Republic

Higher Institute for Applied Sciences and Technology

HIAST

Course Specification Document

Title	Robotics 1

Credits	3.5 ECTS

Aims	This course aims to enable the student to find the geometric and kinematic model of serial robots and to identify singular positions near which the robot has a special behaviour, and to get an introduction to trajectory generation.

Intended learning outcomes

On successful completion of this course, the student will be able to:

- Understand the concept of homogeneous transformations between coordinate frames.
- Understand the methods for calculating the geometric and kinematic models of the robot.
- Understand trajectory generation methods for the robot tool.
- Understand the behaviour of real robots and the diagrams and mathematical relationships expressing their modeling.
- Model a robot using suitable computer programs (Matlab, MscAdams).
- Simulate the robot to validate the theoretical study.
- Discover abnormal positions of the robot and propose initial solutions to avoid singularity problems.

Syllabus

- **Homogeneous transformations - defining the position of a body in space - Differential transformations:** Constructing the matrix that expresses the new position of a set of coordinates after it has undergone rotation and retraction, methods for defining the position of a body in space and comparing them.
- **Direct and inverse engineering model of a robotic arm:** Linking the coordinate systems to the different parts of the robot according to Denavit-Hartenberg terminology, linking the relational and operational variables of the robot to each other in both directions in preparation for the idea of controlling the robot tool, simple modeling of robots using the MscAdams program.
- **The direct and inverse differential kinematic model of the robot:** The Jacobian matrix and the abnormal positions of the robot and their problems, using the inverse geometric model to control the movement of the tool (path and speed), modeling robots, generating paths, and controlling by the inverse geometric model using the Matlab program.
- **Trajectory generation:** Generation of paths in the relational space (forms of path functions), generation of paths in the operational space, minimum time to complete the task.