Techno College of Engineering Agartala

Department of Mechanical Engineering

Robotics Lab

An Initiative for the Hands on Knowledge against the Theory Subjects like Mechatronics System (PEME 608/2) and Robotics (PEME 801/2)

List of the experiments:

1. Introduction to different components of a Robot, Mechanical Joints, and transformation of different frames

i. Components of a Robot
ii. Mechanical Joints
a. Linear joints (Sliding & Prismatic)
b. Rotary (Twisting & Revolute)
c. Hooke's joint
d. Spherical joints
iii. Frame transformation
a. Frame translation
b. Frame rotation
c. Combination

2. Introduction of various motions of the manipulator and motion matrix.

i. Motion matrix for translation (about X, Y & Z)
ii. Motion matrix for Rotation (X, Y & Z)
iii. Compound matrix

3. Introduction of various DH-parameters to formulize the robotic motion.

i. DH parameters & their utility
ii. Link parameters (Size of the link, angle of twist)
iii. Joint Parameters (Link off-set, joint angle)
iv. DH-parameter table
v. Compound DH-parameter matrix

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4. Study of the forward & inverse kinematics of a pick-and-place arm of 3 DoF.

i. About the arm, components used, and joints
ii. DH-parameter table
iii. Calculation of final transformation matrix for forward kinematics
iv. Calculation for final transformation matrix for inverse kinematics
v. Observation & Conclusions

5. Study of the forward & inverse kinematics of a pick-and-place arm of 6 DoF.

i. About the arm, components used, and joints
ii. DH-parameter table
iii. Calculation of final transformation matrix for forward kinematics
iv. Calculation for final transformation matrix for inverse kinematics
v. Observation & Conclusions

6. Study of the forward & inverse kinematics of a Robot assisted spot welding setup.

i. About the arm, components used, and joints
ii. DH-parameter table
iii. Calculation of final transformation matrix for forward kinematics
iv. Calculation for final transformation matrix for inverse kinematics
v. Observation & Conclusions

7. Study of different sensors and actuators used in robotics.

i. Classifications of the sensors
ii. Internal and external sensors
iii. Tactile and non-tactile sensors
iv. Servo-motor, Stepper motor, DC motor

8. Introduction to PD and PID control Schemes.

i. About the PD and PID control scheme
ii. Block diagram
iii. Components of control scheme
iv. Formula used for the torque control
v. PD and PID controller

9. Study of the PID control scheme to control a DC/Stepper motor.

i. About the scheme, integral formula
ii. Working of DC/ stepper motor

iii. Useful controller iv. Control scheme diagram v. Observation & Calculations

10. Study of the Robot-assisted MIG-welding set-up.

i. About the arm, components used, and joints ii. DH-parameter table iii. Calculation of final transformation matrix for forward kinematics iv. Calculation for final transformation matrix for inverse kinematics v. Analysis of the nature of the welding produced v. Observation & Conclusions

11. Study of different programming interfaces, commands, programming approaches and introduction to ROS.

i. About the online and offline programming ii. Teach pendent programming approach iii. Versatile assembly language (VAL) iv. Introduction to Robot operating systems (ROS) v. Block diagram vi. Different commands used in Robotics

12. Robotics with Python and embedded C.

Coding practice sessions on different robotic related problems