

Code No: 07A60309

R07**Set No. 2**

III B.Tech II Semester Examinations, December 2010

ROBOTICS**Automobile Engineering****Time: 3 hours****Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the working of Brushless DC servo motor.
(b) At time t , the excitation voltage to a resolver is 24 V and the voltage across the two pairs of stator terminals will be 24 V and 0 V. What is the shaft angle? [8+8]
2. Explain the functions of an inverse kinematics algorithm. [16]
3. Explain Direct and Inverse dynamics with a block diagram applied to a simple task. [16]
4. (a) What are the advantages and disadvantages of multiple end effector systems?
(b) What will artificial skin allow the next generation of robots to do? [8+8]
5. Write the correct sequence of movements that must be made in order to “unrotate” the spherical coordinates and to make it parallel to the reference frame. About what axes are these rotations supposed to be? [16]
6. (a) Explain the various drive systems of a robot.
(b) Explain the various control systems used in robotics. [8+8]
7. (a) Explain the application of industrial Robots in stamping - press operation.
(b) What are the requirements of the Robot for spray painting applications? Explain. [8+8]
8. (a) Explain Branching in robot programs by considering palletizing operation.
(b) Using the 8×8 grid of a robot with one rotational axis and one linear axis, show the path taken by the robot if it is directed to move between point (2, 1) and point (8, 2) in the grid using linear interpolation. [8+8]

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R07**Set No. 4**

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ROBOTICS

Automobile Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
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1. (a) Compare the Hydraulic and Electrical drives.
(b) What is the velocity of the piston and the force generated by the piston in a hydraulic actuator if the fluid pressure is 12 Mpa inside the cylinder, the piston is 50 mm in diameter and the flow rate is $2.5 \text{ cm}^3/\text{sec}$. [8+8]
2. Name five different types of robot end-effectors. Compare and contrast the end-effectors from the view-point of their functions. [4+12]
3. (a) What are the capabilities and features of Robots in spot welding? Explain.
(b) Discuss the problems for robots in arc welding. [8+8]
4. (a) Explain the sensor commands of Robot languages.
(b) Discuss the important characteristics of robot - oriented language - position specification. [8+8]
5. (a) Explain the degrees of freedom of a robot with sketches.
(b) Explain the various types of joints used in robotics with sketches. [8+8]
6. Consider the forward transformation of the two-joint manipulator shown in figure 1. Given that the length of joint 1, $L_1=12\text{in}$, the length of joint 2, $L_2=10\text{in}$., the angle $\theta_1=30^\circ$ and the angle $\theta_2=45^\circ$, compute the coordinate position (x and y coordinates) for the end-of-the-arm Pw. [16]

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Set No. 4

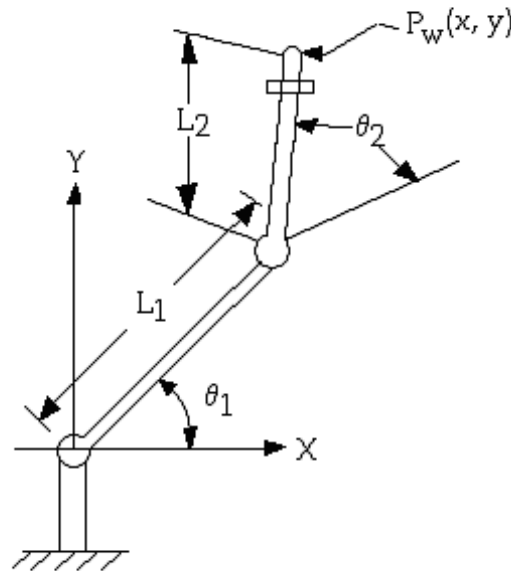


Figure 1

7. A cartesian coordinate robot of configuration LLL is to move its three axes from position $(x, y, z) = (0, 5, 5)$ to position $(x, y, z) = (20, 35, 15)$. All distance measures are given in inches. The maximum velocities for the three joints are, respectively, 20 in./sec, 15 in./sec, and 10 in./sec.
- Determine the time required to move each joint if skew motion is used.
 - Determine the time required to move the arm to the new position and the velocity of each joint, if joint-interpolated motion is used. [8+8]
8. Differentiate clearly between forward Newton-Euler equations and Backward Newton-Euler equations, with a simple example. [16]

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R07**Set No. 1**

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- Discuss the essential characteristics of spot welding Robotic manipulators.
 - Explain the single station Robotic Assembly system. [8+8]
- Define and explain about homogeneous coordinates. [16]
- Explain the principle of working of potentiometer.
 - At time t , the excitation voltage to a resolver is 24 V and the voltage across the two pairs of stator terminals will be $12\sqrt{3}$ V and 12 V. What is the shaft angle? [8+8]
- The joints and links of the RR: R manipulator in figure 1a, figure 1b have the following values: $\theta_1=45^\circ$, $\theta_2=45^\circ$, $\theta_3=-135^\circ$, $L_1=500\text{mm}$, $L_2=400\text{mm}$ and $L_3=25\text{mm}$. Determine the values of x and z in world space coordinates. [16]

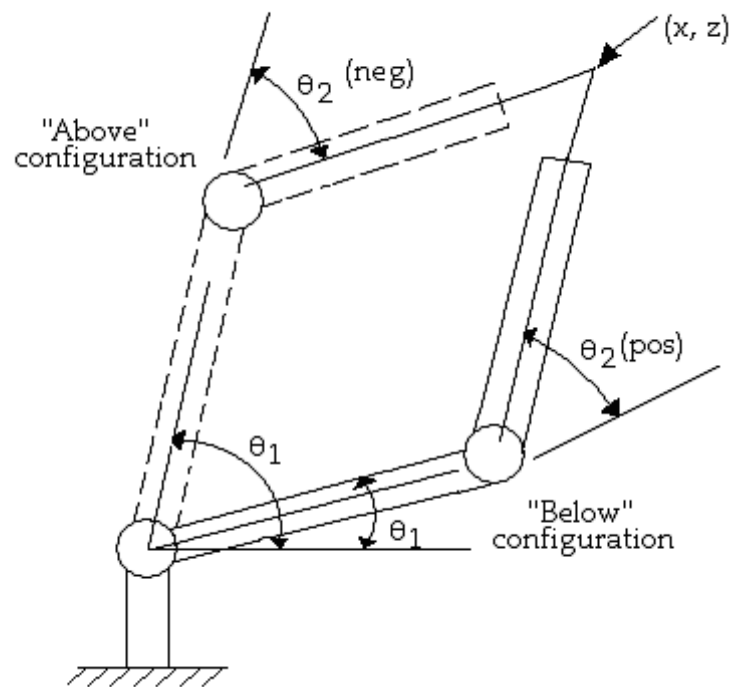


Figure 1a

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Set No. 1

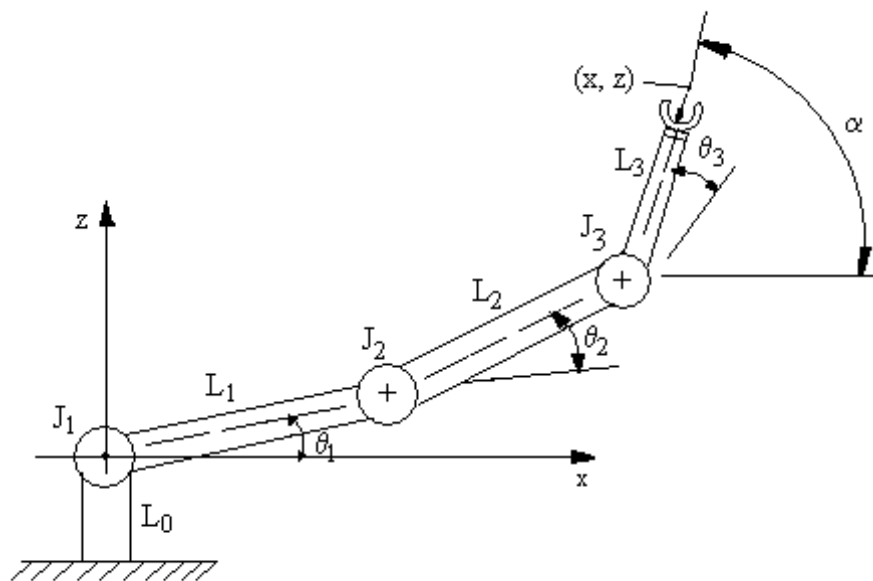


Figure 1b

5. (a) What are the various types of joints used in robots?
 (b) Compare an articulated robot and Cartesian robot with respect to work envelope, manipulative ability and ease of control. [6+10]
6. Distinguish between two-point and three-point centering of robot gripper. [16]
7. (a) Discuss the Monitor mode commands of Robot languages.
 (b) Discuss the important characteristics of robot - oriented language - sensing and flow of control. [8+8]
8. Determine the Jacobian and Singularities 3R Row-Pitch-Yaw wrist. [16]

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R07**Set No. 3**

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1. (a) Explain about the D-H notation joint coordinate system.
 (b) Explain about the world coordinate system. [8+8]
2. Discuss the geometry based direct kinematic analysis for the following robots: [4+4+4+4]
 - (a) Cartesian robot
 - (b) Cylindrical robot
 - (c) Spherical robot
 - (d) Articulate robot.
3. (a) Discuss the straight line path and circular path of the Cartesian space techniques.
 (b) The second joint of a SCARA manipulator is required to move from 30° to 15° in 5 seconds. Find the cubic polynomial to generate the smooth trajectory for the joint. What is the maximum velocity and acceleration for this trajectory? [6+10]
4. Discuss suitable design of robot end-effectors to grip objects like:
 - (a) Shafts
 - (b) Rings
 - (c) Flanges. [16]
5. (a) Discuss the applications of Robots in palletizing and related operations.
 (b) Discuss the general considerations in Robot material handling. [8+8]
6. (a) What do you mean by linear stepper motor ? Explain.
 (b) For an absolute optical encoder with 10 tracks, determine the value of the number of pulses per radian and the encoder constant. If the shaft angle of the encoders were 0.73 rad, determine its output value: [8+8]
7. (a) What is precision of movement of a robot? Explain the terms special resolution, accuracy and repeatability?
 (b) A robot with single degree of freedom has one sliding joint with a full range of 1.0m. The robot's control memory has a 12-bit storage capacity. Determine the control resolution for this axis of motion. [8+8]

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8. Determine the manipulator Jacobian matrix for the 3 DOF articulated arm Shown in figure 1. [16]

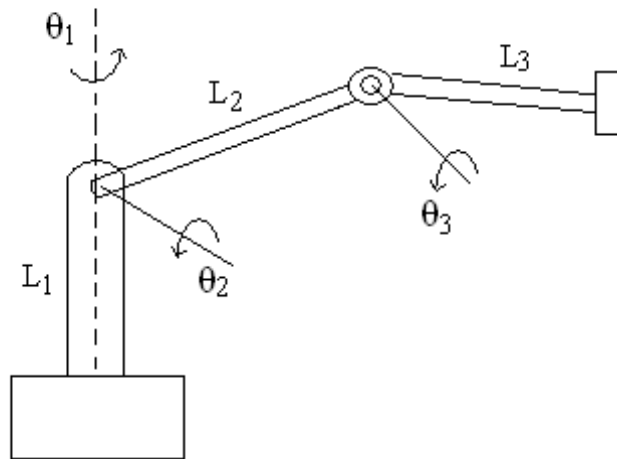


Figure 1
