

Q1)

Configurations of a robot when the jacobian starts losing rank.

Making certain directions of motion unattainable. Near singularities there will be no solution or infinitely many solutions to the inverse kinematics problem

The robot might be in a singular configuration if the determinant of the Jacobian is 0.

If the configuration is near a singularity then the determinant is very close to 0.

Q7)

- Direct Drive Configuration:
 - Actuator (motor) is directly connected to one or both of the revolute joints.
 - No additional linkage elements between the motor and joints.

Advantages:

- Simpler design, lower cost and better control.

- Remotely-Driven Configuration:
 - Actuator (motor) is located at a distance from the joints.
 - Transmission elements (belts, gears, linkages) transmit motion from the motor to the joints.

Advantages:

- Flexibility in design, torque can be increased or decreased through gear ratios.
Potential for larger workspace

- 5 - bar parallelogram arrangement
 - The 5-bar parallelogram linkage consists of additional links and joints that create a parallel mechanism.

Advantages:

- Improved stability and rigidity due to the parallel arrangement.
- Reduced singularities and increased stiffness in certain regions of the workspace.
- Potential for more balanced load distribution among joints.