Date of Submission:

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Due date:

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Assignment-2

Robotics

1. What are the advantages and applications of DC Servo motor.

Advantages:

1. Precise Control and Accuracy: DC servomotors are provide high precision in controlling position, speed and torque, making them ideal for tasks requiring exact movements and repeatability.
2. Fast Response: These motors can quickly respond to control signals, allowing for rapid adjustments and smooth operation in dynamic environments, essential in robotics and automation.
3. Lightweight and Portable: Due to their compact and lightweight design, DC servomotors are easy to integrate into various systems, including portable and space-constrained applications.
4. Four Quadrant Operation: DC servomotors can operate in all four quadrants of the torque-speed curve offering versatile performance for complex applications.
5. High Torque at Low speeds: These motors can deliver significant torque an even at low speeds, which is crucial for applications requiring strong and precise movements without compromising control.
6. Compact Size: The compact size of DC servo motor allows in them to be used in small or intricate systems.

Applications:

1. Automation Industry: DC servomotors help machines in factories to do tasks like moving parts and packing with high precision.

2. Aviation: In planes, these motors control parts like flaps, and rudders, ensuring smooth and safe flight.

3. Robotic Industry: Robot use DC servo motors to move their arms and joints accurately, making the capable of performing tasks like assembling parts.

4. Manufacturing Industry: These motors are used in machines that cut, shape and assemble products, ensuring everything is done accurately.

5. Pharmacy: In medicine production, DC servomotors control machines that mix and package pills and liquids, ensuring correct dosages.

6. Food Services: The power machines that package and storage sort food, helping keep the process fast and hygienic.

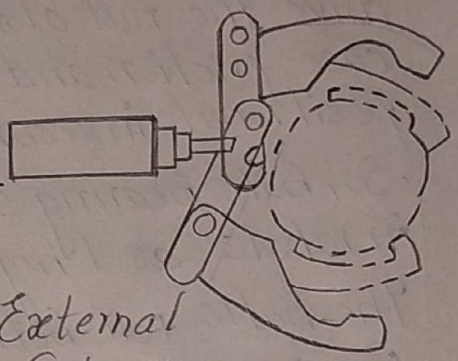
7. Toys and Radio-Controlled Cars: In Toys and RC cars, these motors control movement, making them responsive and fun to use.

8. Cameras and Photography Equipment: DC servomotors are used in camera lenses to control focus & zoom with precision, allowing photographers to quickly and accurately adjust their shorts.

2. Explain the working of Internal & External Grippers.

External Grippers:

This is the most popular method of holding objects. It is the most simplistic and it requires the shortest stroke length. When the gripper jaws close, the closing force of the gripper holds the object.

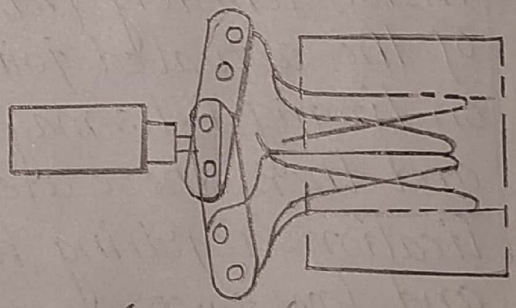


External Gripper

- External grippers work by closing around the outside of an object to grasp it. They have jaws or finger that move inward to apply pressure to the outer surfaces of the object.
- The gripper typically clamps down the external surface of the object, creating a secure hold.

Internal Grippers:

In some applications, the object geometry or the need to access the exterior of the object will require that the object is held from the center. In this case the opening force of the gripper will be holding the object.

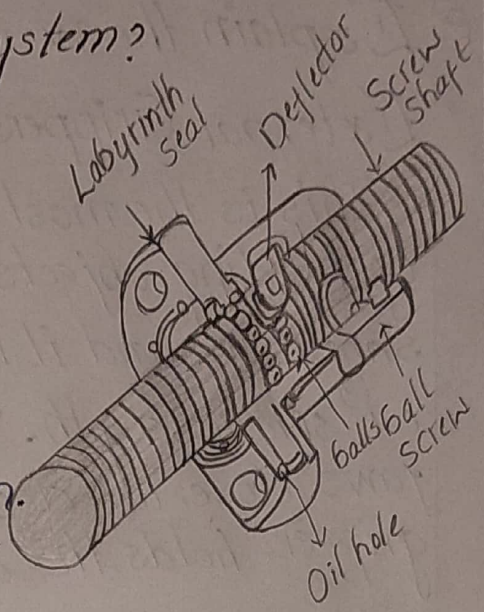


Internal Gripper

- Internal Grippers operate by expanding outward to hold an object from the inside. They typically have fingers or jaws that move outward when activated.
- The gripper is inserted into a hallow or recessed part of the object and once inside, the jaws expand to create a secure hold from within.

3. Illustrate Mechanical Drive System?

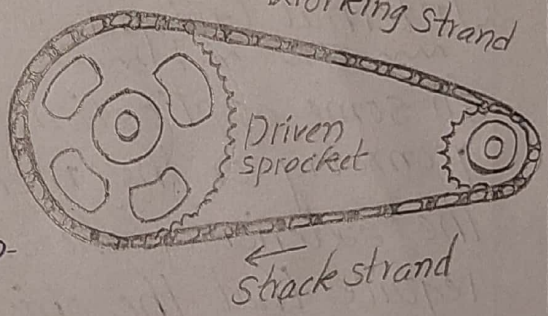
Ball Screws:



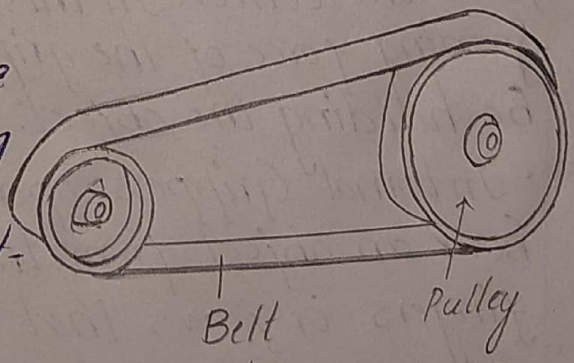
- Sometimes lead screws rotate to drive the nut along a track but case friction and wear, causing positional inaccuracy.
- So, ball bearing screws are used in robots as they have low friction. The balls roll between the nut and the screw.
- A cage is provided for recirculation of the balls.
- The rolling friction of the ball enhances transmission efficiency to about 90%.

Bell and Chain Drives:

These are equivalent from a kinematic viewpoint and are employed to locate the motor remotely from the axis of the actuated joint. The strees on timing belts may cause strain, and then these are used in applications requiring high speeds and low forces.



- On the other hand, chains are used in applications requiring low speeds since they are large mass may induce vibrations at high speeds.



4. Write the Advantages and applications of Stepper Motor.

- Repeatability: Stepper motors can return to their original position after a full detour.
- Efficiency: Stepper motors are accurate and cost effective, allowing for more efficient programmed movements.
- Accuracy and Precision: Stepper motors are known for their high accuracy and precision, making them suitable for applications that require precise positioning.
- Control by microController: Stepper motors can be easily controlled with a microcontroller.
- Low speed Torque: These motors have excellent low-speed torque and smoothness.

Applications:

1. 3D printers: Stepper motors move the print head and platform to build precise 3D objects.
2. CNC Machines: They control the tools and materials in CNC machines, ensuring accurate cutting and shaping.
3. Robotics: These motors allow robotic arms to move and position parts with precision.
4. Textile Machinery: They control spindles and looms ensuring consistent fabric production.
5. Camera Gimbals: Stepper motors stabilize cameras, helping capture smooth, steady footage.
6. Antenna Positioning: Stepper motors adjust antennas for the best signal reception
7. Welding Equipments, Gaming etc.

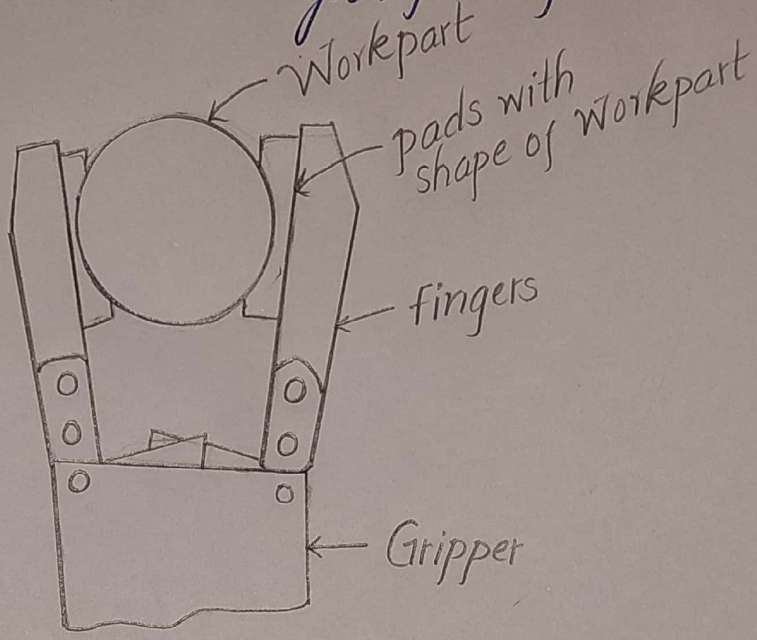
5. Write the selection and Design Considerations of End Effector.

- The Part Surface to be grasped must be reachable.
- The size of variation of the part must be accounted for, and how this might influence the accuracy of locating the part.
- The gripper design must accommodate the change in size that occurs between part and unloading.
- Consideration must be given to the potential problem of scratching and distoring the part during gripping, if the part is fragile or has delicate surfaces.
- If there is a choice between two different dimensions on a part, the larger dimension should be selected for grasping.
- Grippers can be designed to conform to the part shape by using resillient pads or self-aligning fingers.
- Consideration of the part being of grasped consistently about its centre of mass.
- Coefficient of friction between the object and gripper fingers.

6. Explain about Mechanical Grippers?

A mechanical gripper is an end effector that uses mechanical fingers actuated by a mechanism to grasp an object. The fingers, sometimes called Jaws, are

the appandages of the gripper that actually make contact with the object. The fingers are either attached to mechanism or are integral part of it.



- The function of the gripper mechanism is to translate some form of power pin input into the grasppping action of the fingers against the part.
- The require magnitude of gripper force (F_g),

$$\mu n_f f_g = W_g$$

Where

μ = Coefficient of friction of finger contact,
n_f = number of contacting fingers,
W = weight of the object to be lifted &
g = the g factor.