Assignment 1

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Types of robots

1) Manipulators

   Industrial robots

   The showcased robots in the video are mostly industrial robots. These robots are all manipulators. Some of the robots are high speed, some are used for very high precision, some are used for heavy lifting. These robots have different degrees of freedom from 2 to 6. Some manipulators are series types and some have parallel geometry.

2) Mobile Robots

   Robopod & Omron LD Mobile Robot Open Day

   The above video shows the autonomous wheeled robots. They can transport the item from one place to another place and support in many tasks.

   Dog Off on ICRA 2019 in Montreal

   This video shows the legged mobile robots including Boston Dynamics' Spot.

3) Aerial Robots

   Design, Modeling and Control of Aerial Robot DRAGON

   The above video shows the motion of the DRAGON robot. It is an aerial robot which can change its shape mid air and can pass through narrow places.

4) Underwater Robots (AUV)

   Meet Aquanaut, the Underwater Transformer

   Aquanaut is an underwater robot which can transform into a manipulator. It can perform tasks such as repairing tasks ,collecting samples .

5) Soft Robots

   Why Robots That Bend Are Better

   The soft robot shown in the video is made from nylon tubes filled with air. The robot can change its shape to move around. The robot walks around by toppling on its other faces.

6) Micro Robots

   Magnetic Micro-Robots

   The micro robots showcased in the above video are controlled by changing magnetic fields around it. The robots are made by aligning very small magnets in a certain direction for each part of the robot.

7) Hybrid Robots
   Introducing Handle
   The above video shows the hybrid robot from Boston Dynamics. This robot uses wheels to move around and legs to balance itself.

Types of Motors

1) Brushed DC
   This type of motor uses DC current to rotate. The rotor has a metal core with copper wire coiled around it. There are multiple such coils in a single motor. The outer cover of the motor has two permanent magnets. There are two copper or carbon brushes connected to the rotating shaft. This at a time the brushes are connected to only one coil which generates the magnetic field which rotates the shaft, after certain rotation, the brushes connect to a second coil which further adds torque to the shaft and this process continues. We can control the speed of the motor by varying the current passed and change the direction of rotation by changing the polarity of the supply voltage.

2) Brushless DC(BLDC)
   These motors also use DC current to rotate but in this the coils are stationary and the permanent magnets rotate. The rotating shaft contains the array of magnets with alternate arrangement of poles. The motor has three input wires and three different coils. At a time, one input is connected to the voltage, one input is connected to the ground and the third input is kept as a float. When the current passes through the coils, it creates the magnetic field which rotates the shaft. The input to the wires are switched in a certain sequence and a certain frequency. The direction of the motor can be changed by reversing the switching sequence and speed can be controlled by changing the frequency of switching the inputs.

3) Stepper Motors
   Stepper motors are used to achieve the steps instead of the continuous rotation. An array of permanent magnets with alternate pole arrangements. There are two coils with min two windings each opposite to each other. When the current flows through one coil, the two opposite windings create a magnetic field and the rotor aligns in a certain position. This becomes one step. We can change the angle of one step by changing the number of magnets on the rotor and changing the winding number of windings of one coil.

4) Servo Motors
   The Servo motors are basically dc motors with additional components. It has a position control to determine the position and a gearbox to increase the torque.

5) AC Synchronous
   As the name suggests, this motor uses AC current to rotate. The coil is at the side of the rotor and the rotor contains rings of ferromagnetic rings. The magnetic field produced from the coil causes the rotor to rotate. The speed of the rotor is directly proportional to the frequency of the AC current.

6) AC Asynchronous
   This motor is also known as an induction motor. It uses AC current and induction principle to apply the torque to the rotor. An array of magnets are connected to the rotor and the coils wrapped on the outer part of the motor produces an alternating magnetic field which applies torque to the rotor.