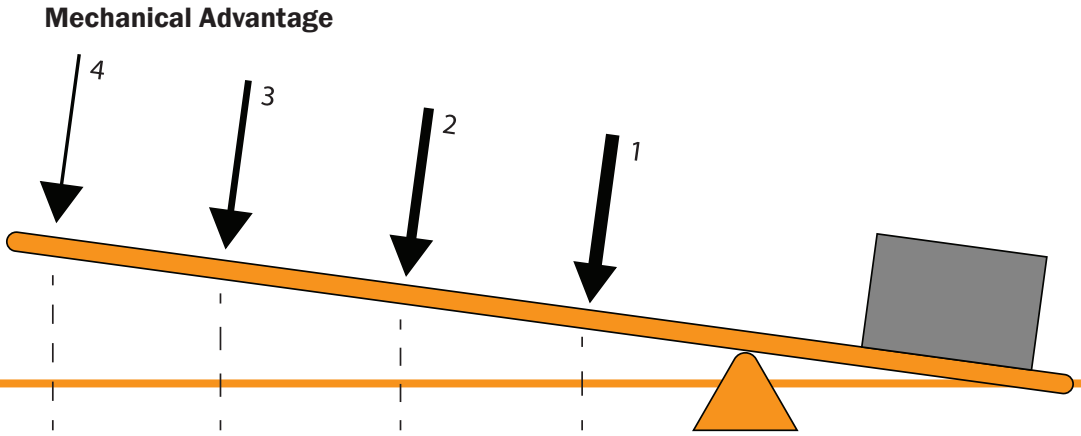
TRANSMISSION & MECHANICAL ADVANTAGE

CONCEPT Transmission and mechanical advantage are important concepts in robotics as they help in achieving efficient and effective motion control. Transmission is the process of transferring power from the source to the destination and involves the use of gears, pulleys, belts, and other mechanical components that help to transform the motion or force of the robot's motor into a desired motion. Mechanical advantage refers to the amplification of force or motion achieved by using mechanical components such as levers, gears, and pulleys. By leveraging mechanical advantage, robots can lift heavy loads or perform complex motions that would be difficult to achieve with the robot's motor alone.



BACKGROUND

In the 1950s and 1960s, the development of electric motors and electronics led to the introduction of servo motors and control systems. In 1961, the first industrial robot, the Unimate, was developed by George Devol and Joseph Engelberger. It used a system of hydraulic actuators and gears to achieve precise and repeatable motion control. In early 1980s, the PUMA 560, was introduced by Unimation. It used a system of gears and pulleys to achieve high-speed and high-precision motion control. Since then, there have been numerous innovations, including the use of harmonic drives, planetary gearboxes, and direct drive motors.

Make sure it measures up

FORMULAS

GEAR RATIO: Ratio of the number of teeth on the input gear to the number of teeth on the output gear. The gear ratio is an important factor in determining the speed and torque of a robot's motor.
Gear Ratio = Number of Teeth on Input Gear / Number of Teeth on Output Gear.

MECHANICAL ADVANTAGE: Ratio of the force output of a mechanical system to the force input. The mechanical advantage is an important factor in determining the lifting capacity and speed of a robot's lifting mechanism.
Mechanical Advantage = Force Output / Force Input.

TORQUE: A force's ability to rotate an object around an axis. Torque is an important factor in determining the power and efficiency of a robot's motor.
Torque = Force x Distance from Axis.

APPLICATION

Exoskeletons are wearable devices that provide external mechanical support to the wearer's body, enabling them to perform tasks that would otherwise be impossible or difficult to perform. Exoskeletons use a combination of gears, motors, and actuators to transfer power and motion from the device to the wearer's body. The mechanical advantage provided by these systems allows wearers to lift heavier objects and perform repetitive tasks with less effort and strain on their body.

The Ekso EVO, developed by Ekso Bionics, is a wearable exoskeleton designed to support workers performing overhead tasks, such as in manufacturing or construction. The device uses a system of gears and springs to transfer the weight of the wearer's arms to their hips, reducing the strain on their shoulders and back. It enables workers to perform tasks for longer periods of time with less fatigue and risk of injury. This application of transmission and mechanical advantage in robotics highlights the potential for these technologies to improve human performance and enhance quality of life.

EXAMPLES

GEARS: Transmit motion and power between two or more rotating shafts. They help to increase or decrease the speed and torque of the robot's motor and are commonly used in robot arms and manipulators.

PULLEYS AND BELTS: Transfer power and motion between two or more non-adjacent shafts. They are often used in robots that require a long reach or flexible motion.

LEVERS: Amplify force or motion in a robot's joint or actuator. They can be used to increase the torque or speed of the robot's motor.

WORM GEARS: Used to achieve high torque reduction in a small space. They are commonly used in robot joints and gearboxes.