



Club Founder
Dr. Mahmoud Bahgat



Co-Founder & Club Host
Dr. Mohamed El Mezewdy



Mechanics & Engineering Basics

مبادئ الهندسة و الميكانيكا



Monday 16th SEP 2024



Dr. Mustafa Elkady
Little Engineer Center



Online ZOOM Meeting



7 pm Egy

7 pm KSA

8 pm UAE

ABOUT OUR SPEAKER

Dr. Mustafa is an assistant professor at the Faculty of Engineering, **Ain Shams University**. Prior to this, he has been associate professor at **Lebanese International University** (LIU) till 2020.

He obtained his PhD in mechanical engineering at the Department of Computing, Engineering and Technology, **University of Sunderland, UK** (2012).

He has been an academic director at a robotic academy named **Little Engineer Center** since 2020.



Dr. Mustafa Elkady
Little Engineer Center

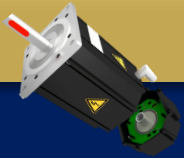


International **ROBOTICS**
Club

September 2024



Mechanics & Engineering Basics



International **ROBOTICS**
Club

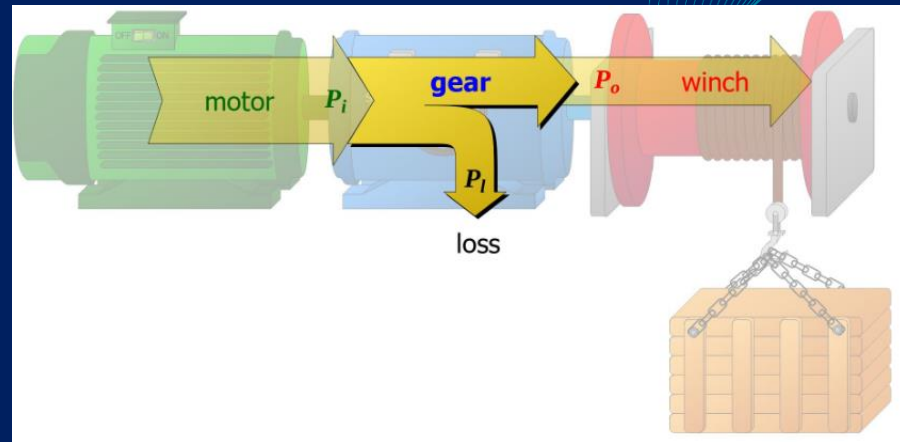
September 2024



GEARS

POWER TRANSMISSION

Power transmission is the movement of energy from its place of generation to a location where it is applied to performing useful work



GEARS

TYPES OF GEARS

According to the position of axes of the shafts:

A. Parallel

1. Spur Gear
2. Helical Gear
3. Rack and Pinion

b. Intersecting

Bevel Gear

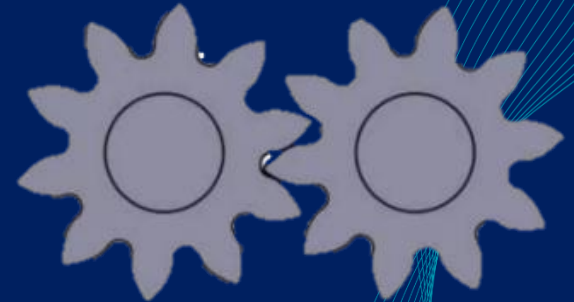
c. Non-intersecting and Non-parallel worm and worm gears



GEARS

SPUR GEAR

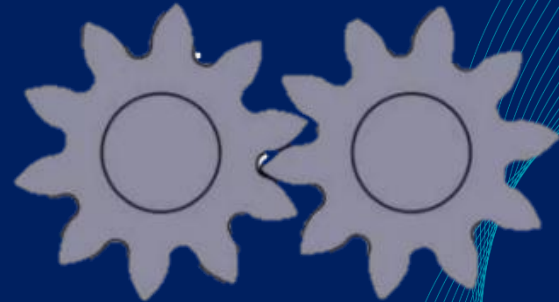
- Simplicity in design
- Economy of manufacture and maintenance
- Slow speed gears



GEARS

SPUR GEAR

- Used in Electric screwdriver, windup alarm clock, washing machine.



GEARS

HELICAL GEAR

- Helical gears operate much more smoothly and quietly than spur gears
- Helical gears can take higher loads than spur gears
- These gears are considered as high-speed gears



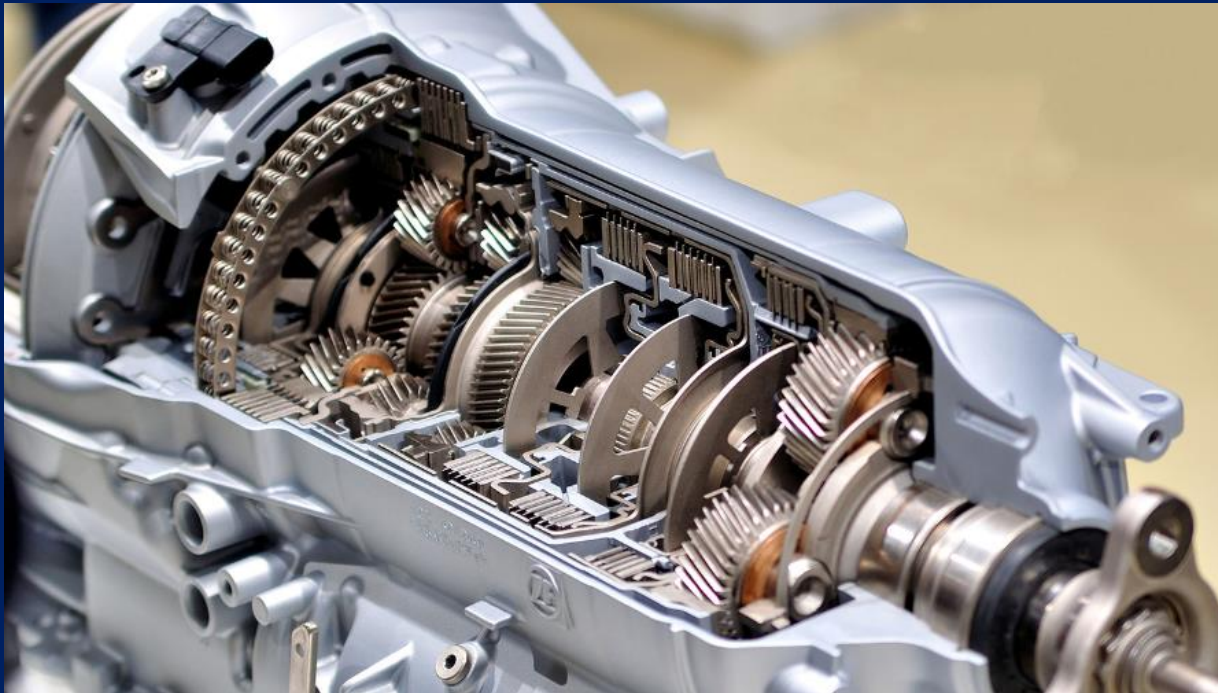
GEARS

HELICAL GEAR



GEARS

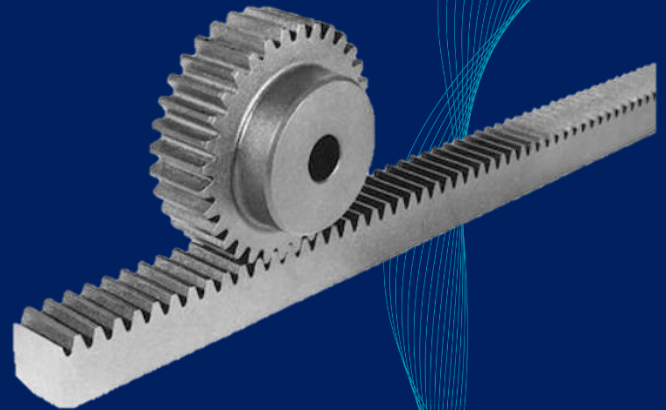
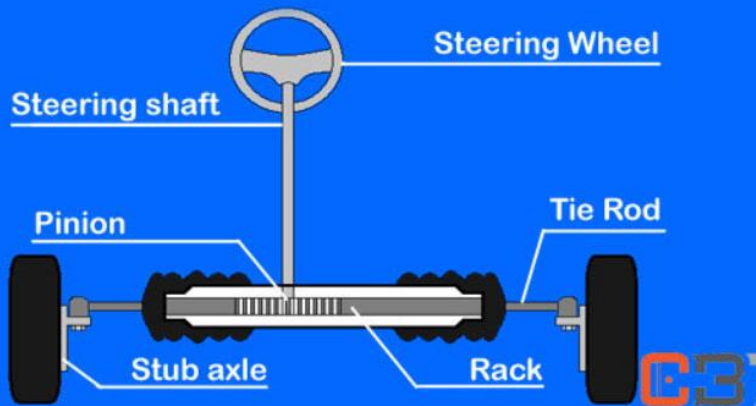
HELICAL GEAR



GEARS

RACK AND PINION

Rack & Pinion Steering



GEARS

BEVEL GEARS



International **ROBOTICS** Club

September 2024



GEARS

BEVEL GEARS

- locomotives, automobiles, printing presses, machines, etc.



GEARS

WORM AND WORM GEAR

- Worm gears are used when large gear reductions are needed. It is common for worm gears to have reductions of 20:1, and even up to 300:1 or greater



GEARS

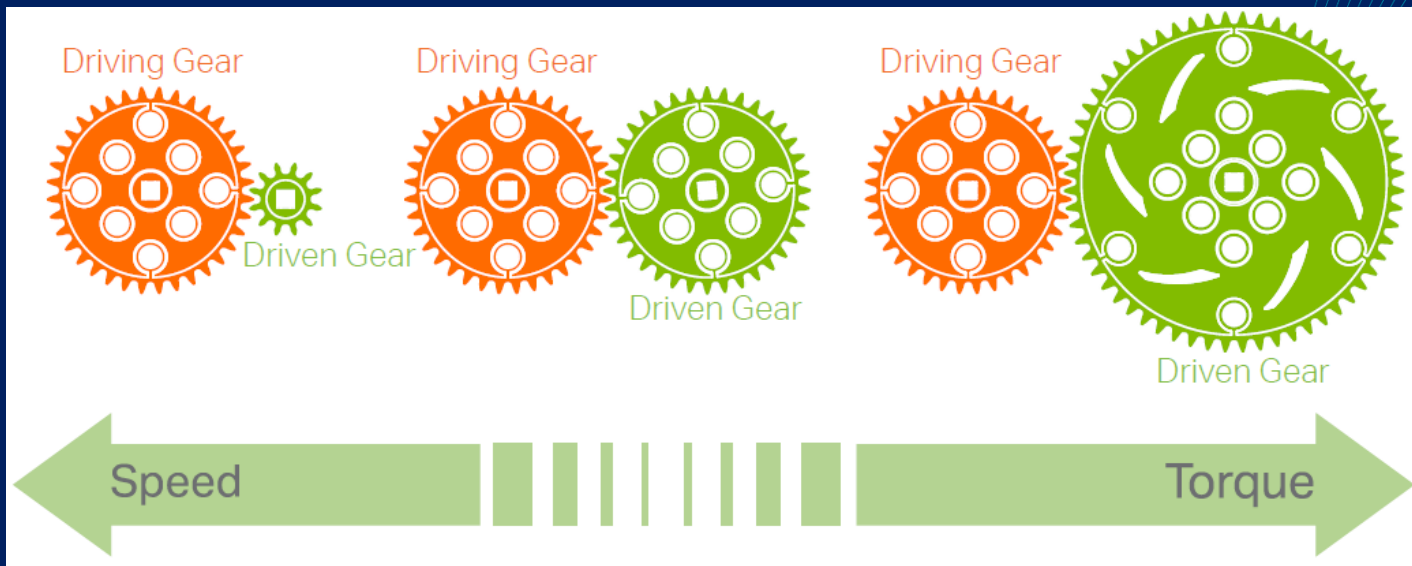
WORM AND WORM GEAR

- The worm can easily turn the gear, but the gear cannot turn the worm
- Worm gears are used widely in material handling and transportation machinery, machine tools, automobiles etc.



GEARS

GEAR RATIO



GEARS

GEAR RATIO

Gear Ratio is expressed this way:

$(\text{Driving Gear Teeth}) : (\text{Driven Gear Teeth})$

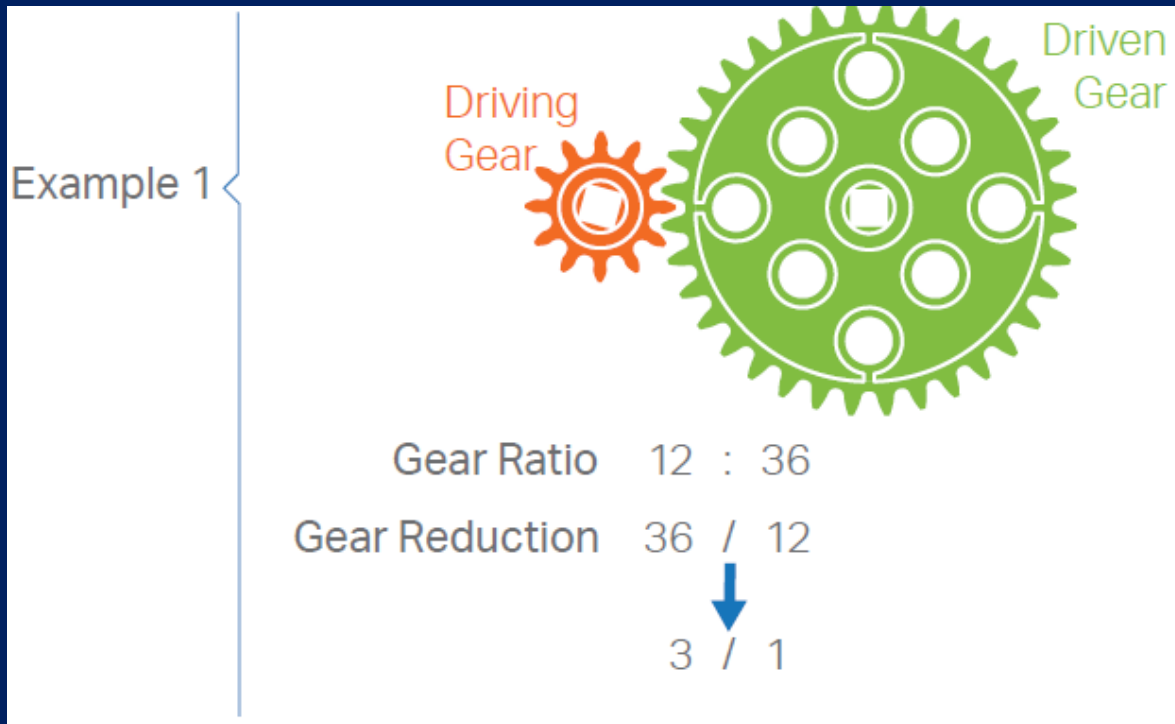
Gear Reduction is expressed in reverse:

$(\text{Driven Gear Teeth}) / (\text{Driving Gear Teeth})$



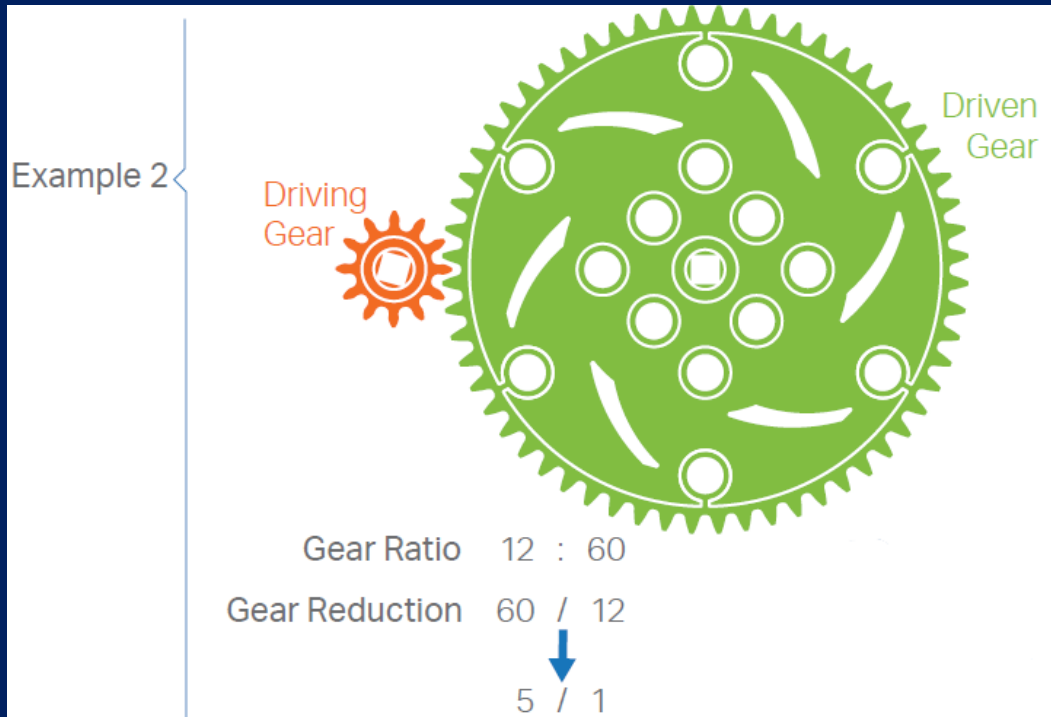
GEARS

GEAR RATIO



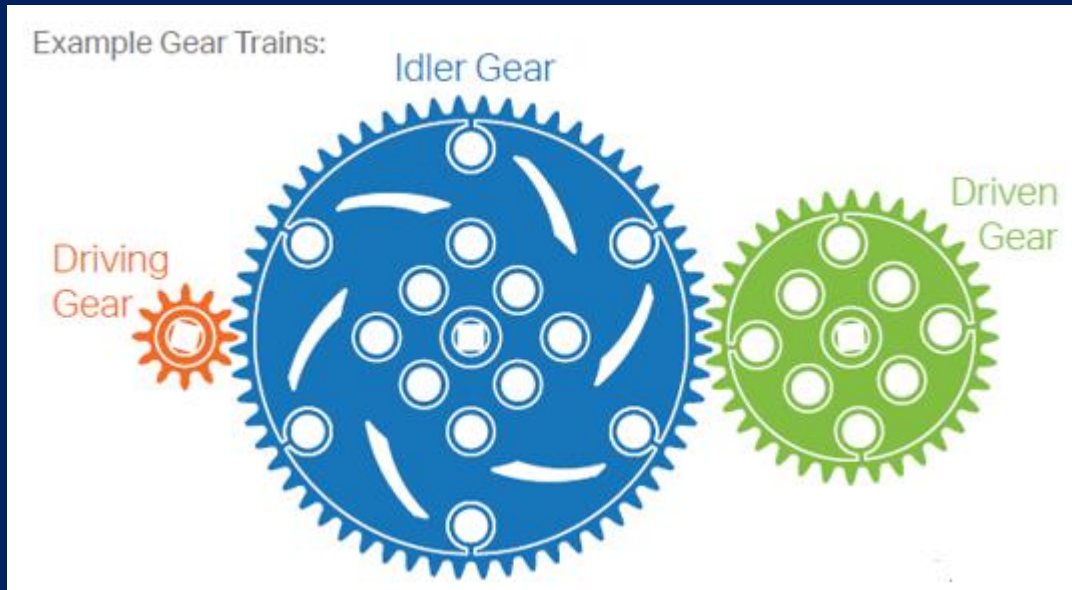
GEARS

GEAR RATIO



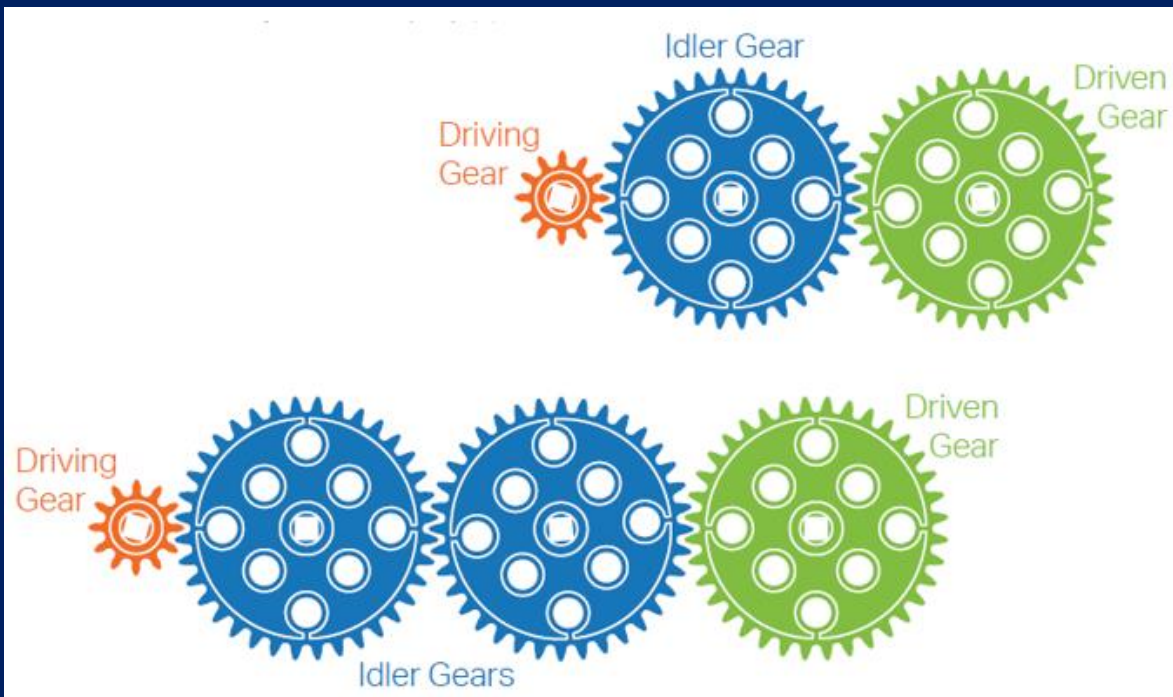
GEARS

GEAR TRAINS AND IDLER GEARS



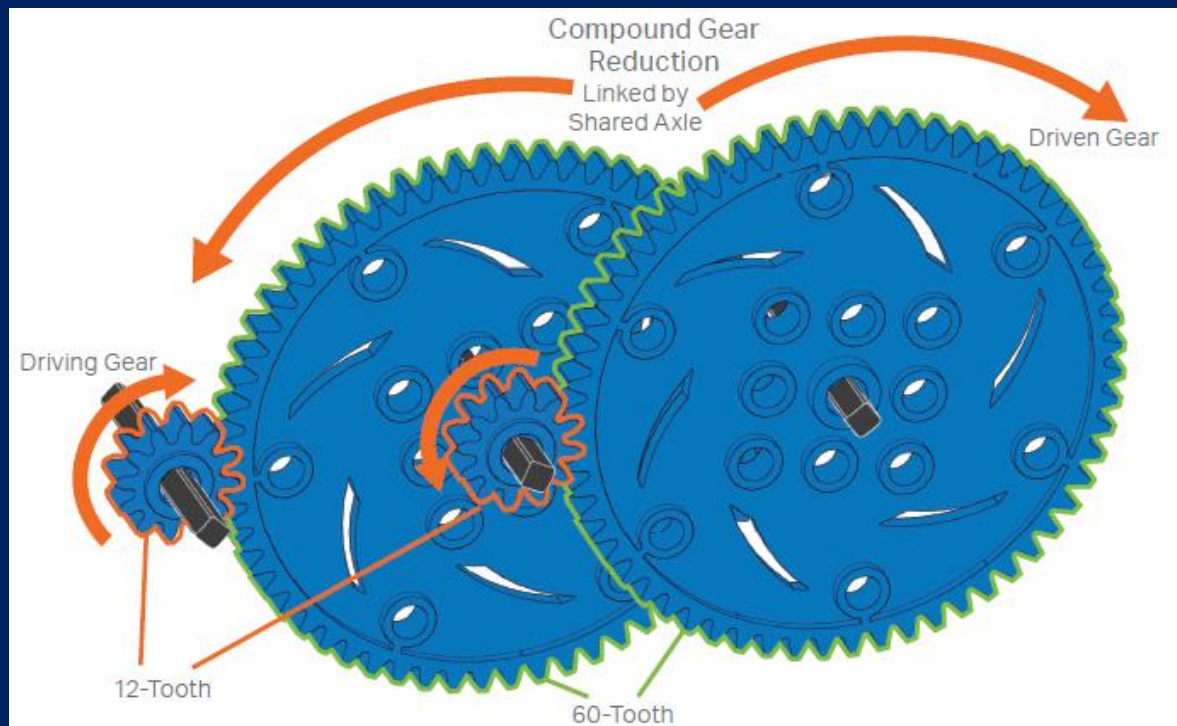
GEARS

GEAR TRAINS AND IDLER GEARS



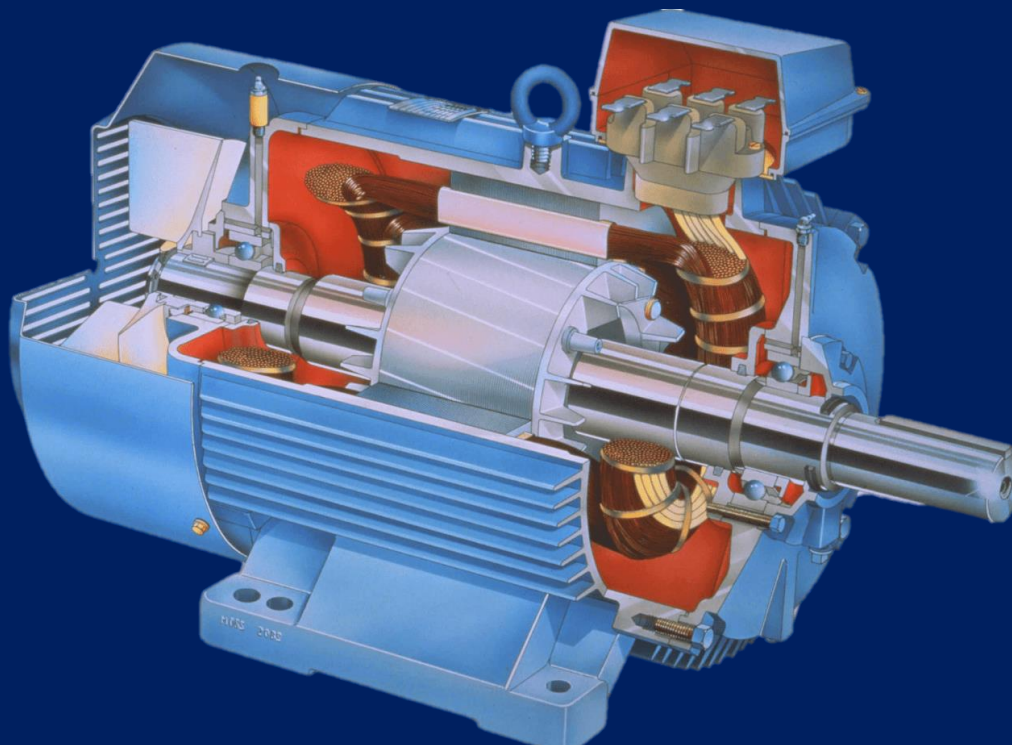
GEARS

COMPOUND GEARS



MOTORS

AC MOTORS



International **ROBOTICS** Club

September 2024



MOTORS

DC MOTORS



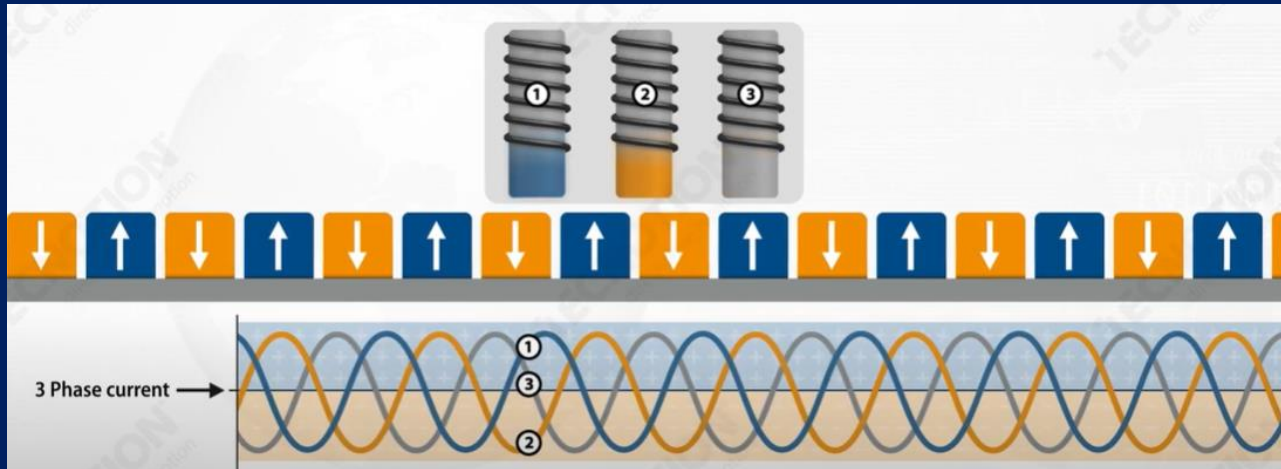
MOTORS

DC BRUSHLESS MOTORS



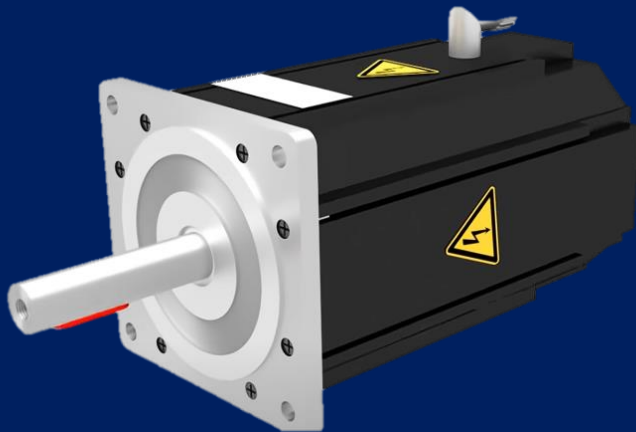
MOTORS

LINEAR MOTORS



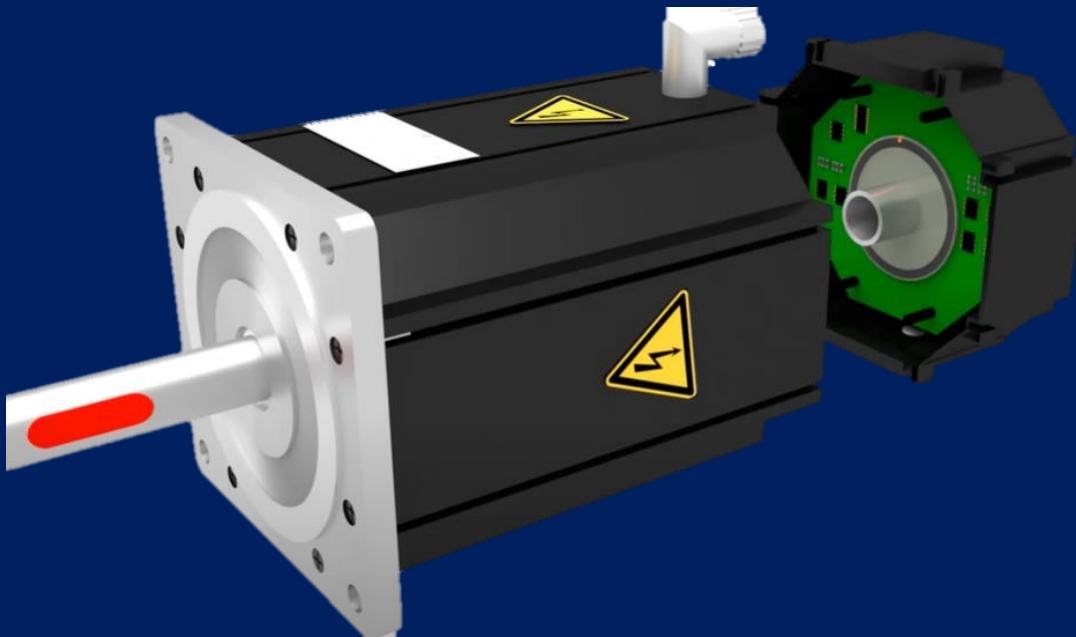
MOTORS

SERVO MOTORS



MOTORS

SERVO MOTORS



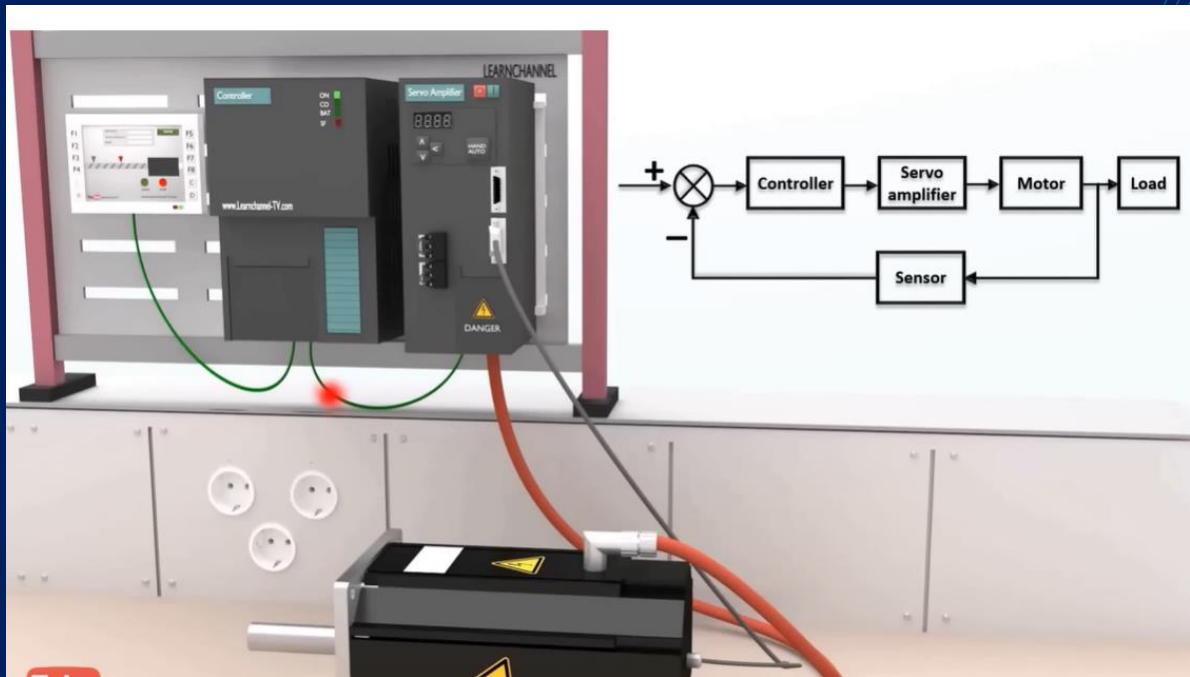
International **ROBOTICS** Club

September 2024



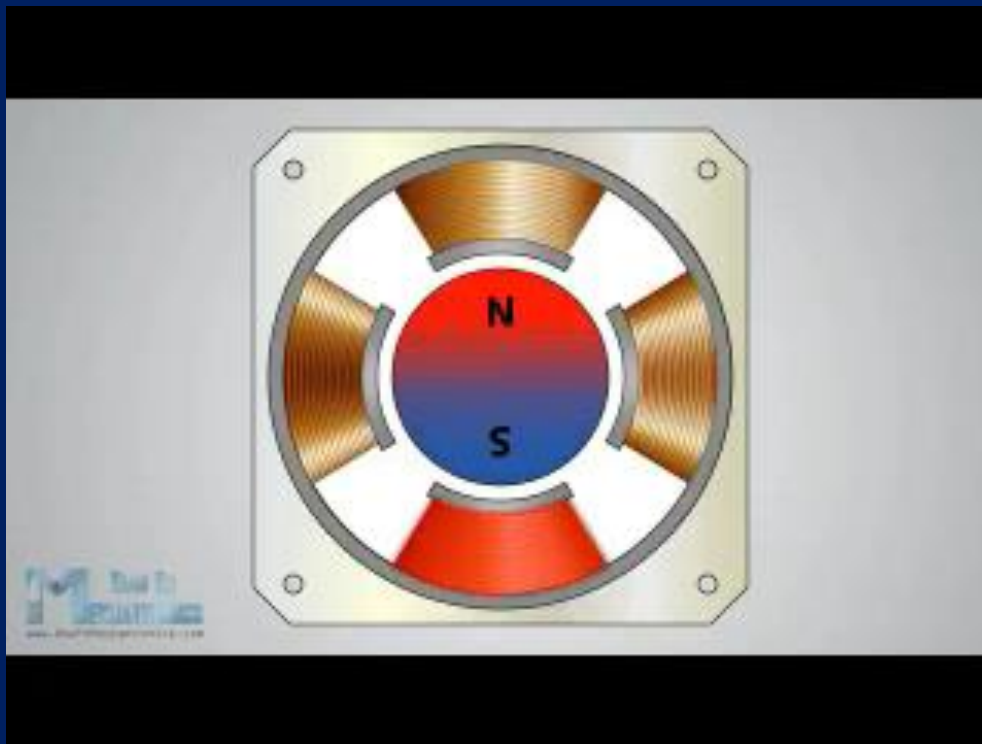
MOTORS

SERVO MOTORS



MOTORS

STEPPER MOTORS



SENSORS

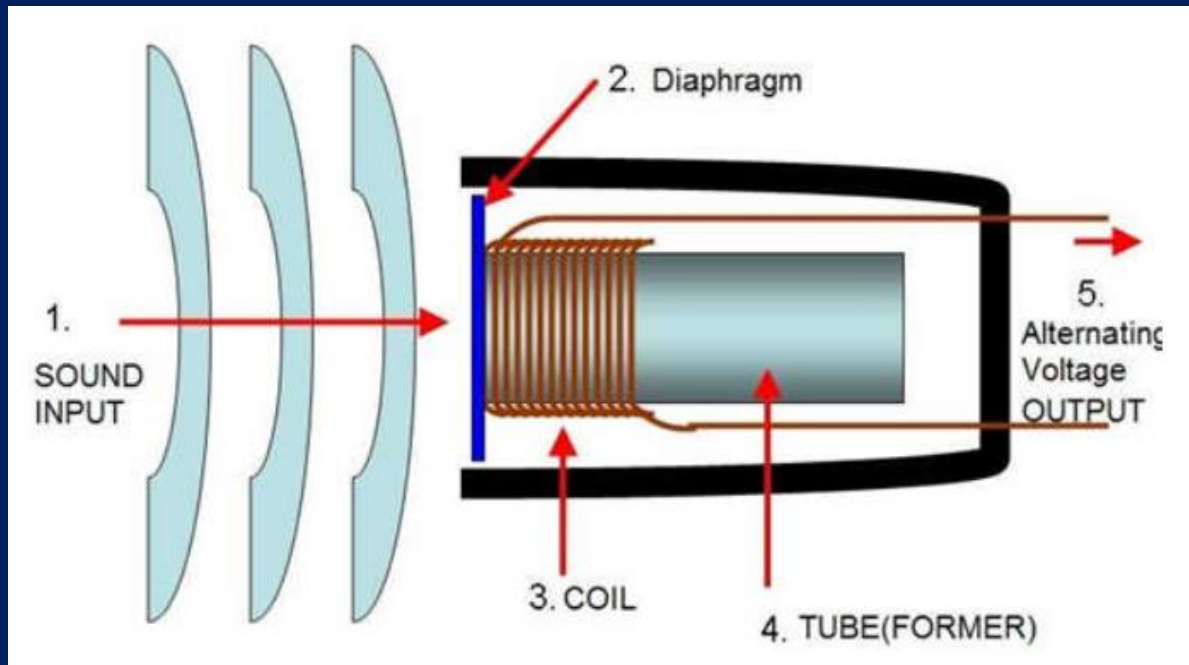
LIGHT SENSORS

- Photovoltaic cells: applied when changing solar radiation energy to electrical.
- Photoresistors: are used to adjust their resistance by changing light intensities.



SENSORS

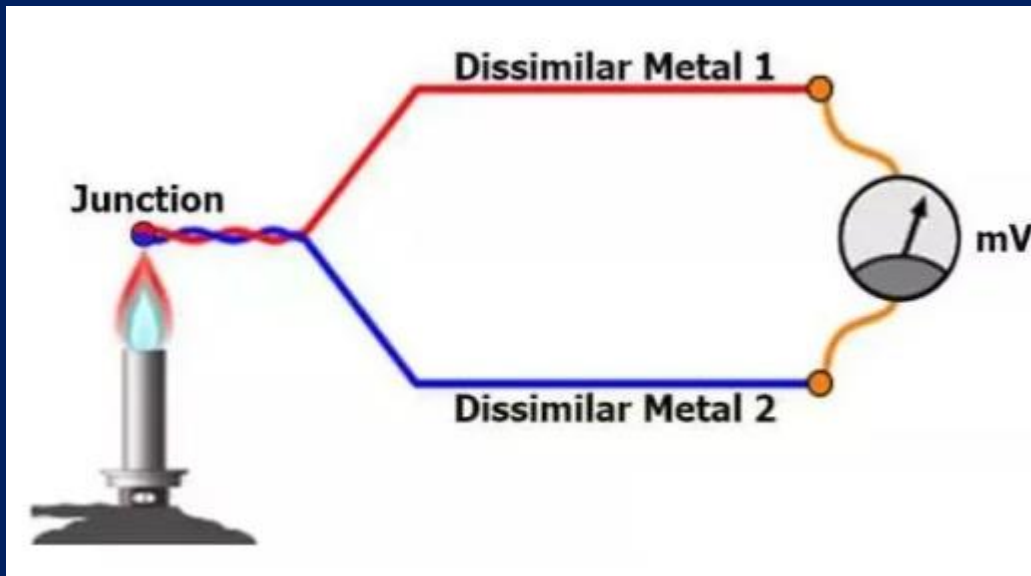
SOUND SENSOR



SENSORS

TEMPERATURE SENSOR

- Thermocouple



SENSORS

TEMPERATURE SENSOR

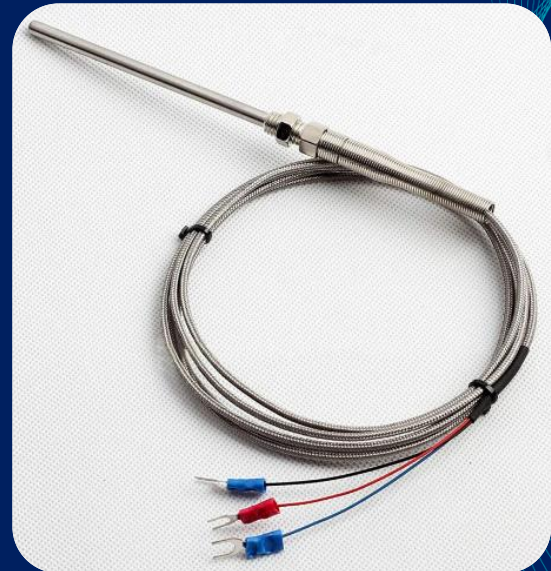
- Thermistor
- ceramics or polymers



SENSORS

TEMPERATURE SENSOR

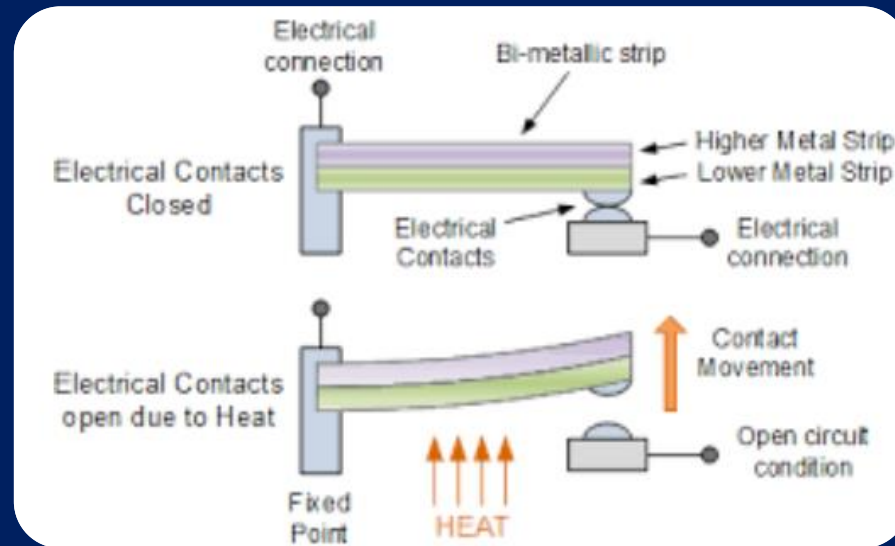
- RTD (Resistive Temperature Detector)
- platinum, copper or nickel



SENSORS

TEMPERATURE SENSOR

- Thermostat



SENSORS

CONTACT SENSOR



International **ROBOTICS** Club

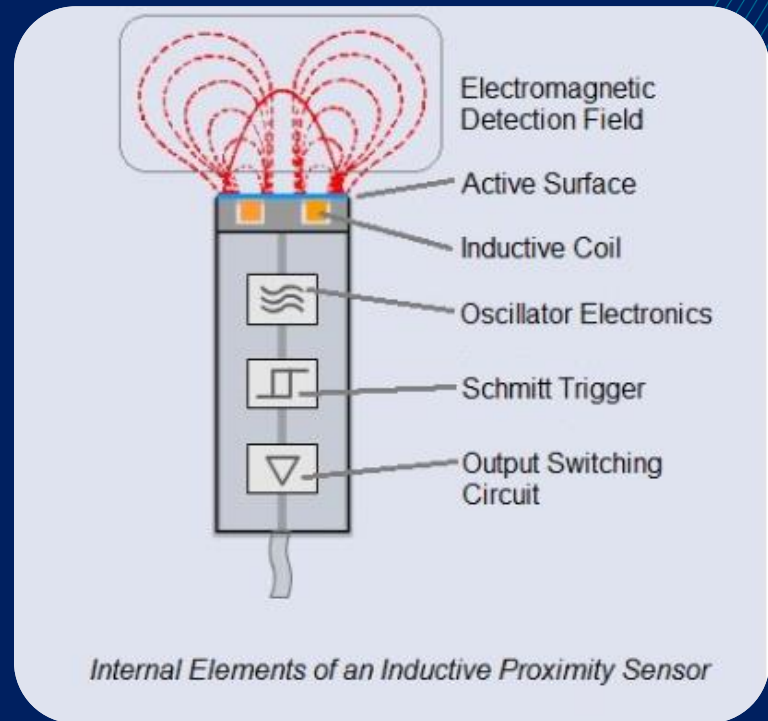
September 2024



SENSORS

PROXIMITY SENSOR

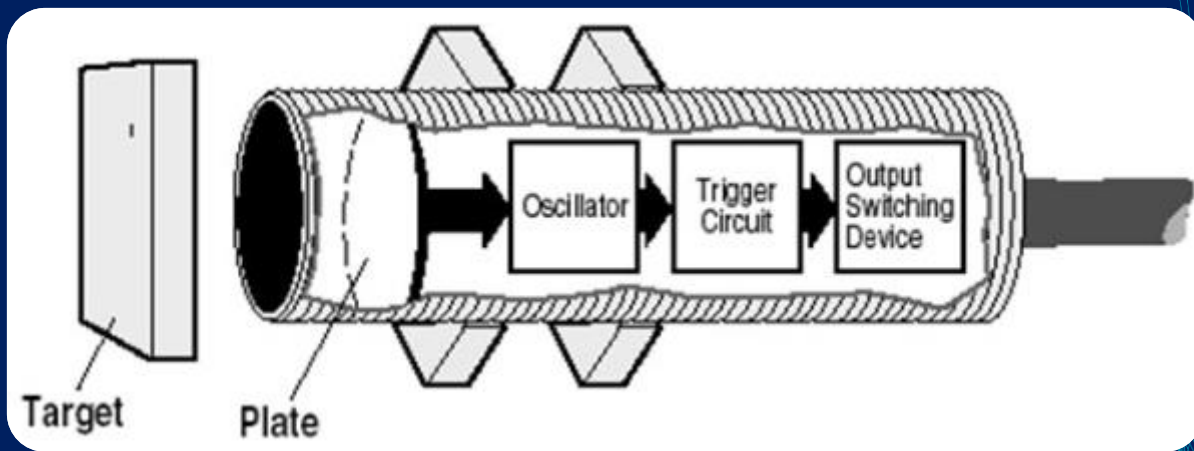
- Inductive Proximity Sensors



SENSORS

PROXIMITY SENSOR

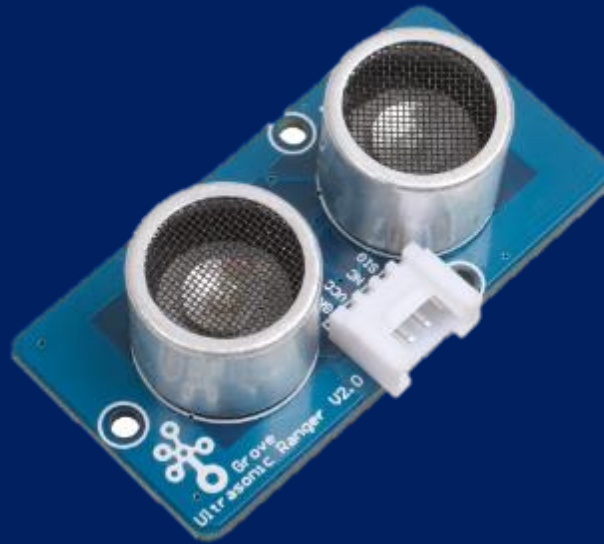
- Capacitive Proximity Sensors



SENSORS

PROXIMITY SENSOR

- Ultrasonic Proximity Sensors



SENSORS

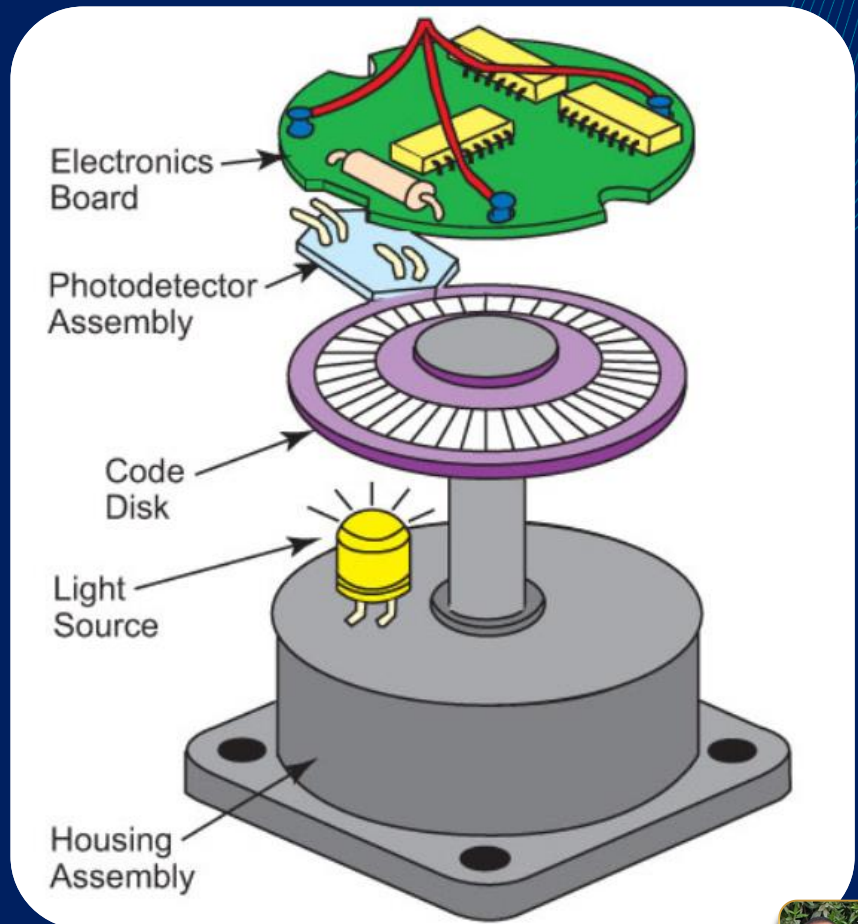
PROXIMITY SENSOR

- IR Proximity Sensor



SENSORS

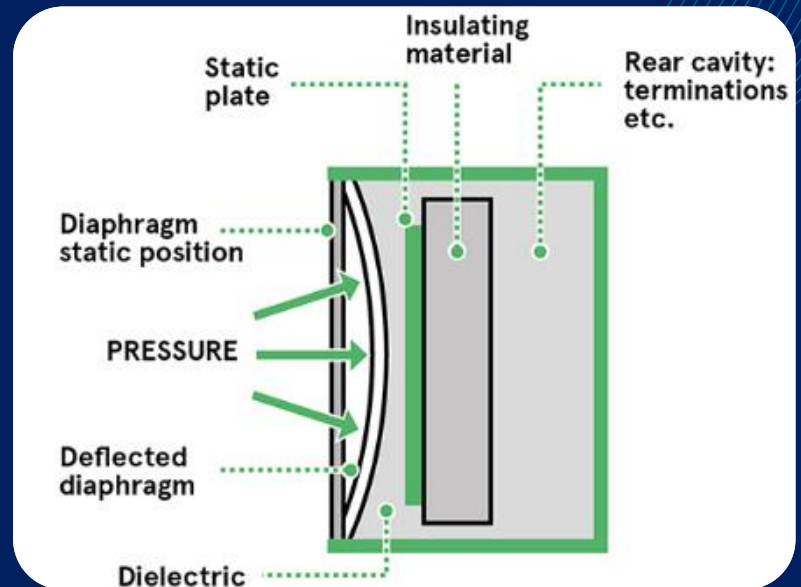
ENCODERS



SENSORS

PRESSURE SENSORS

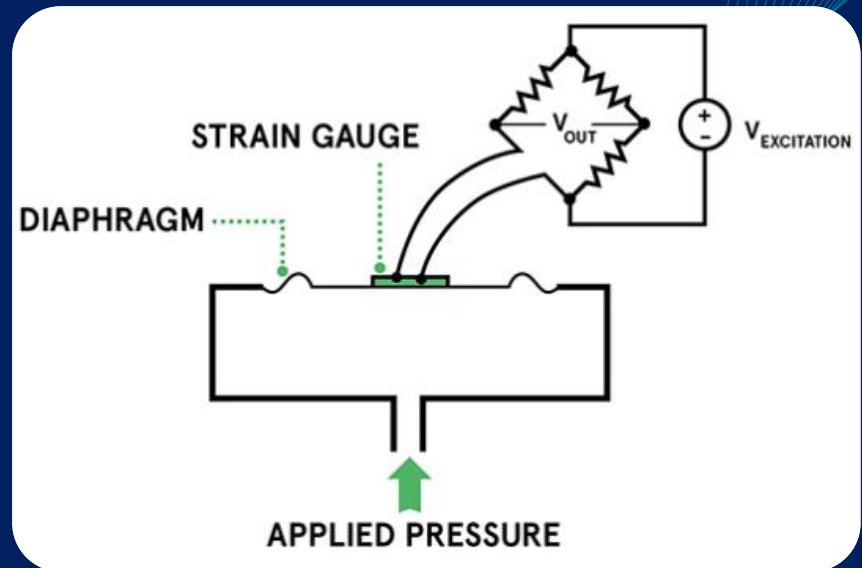
- Capacitive pressure sensors



SENSORS

PRESSURE SENSORS

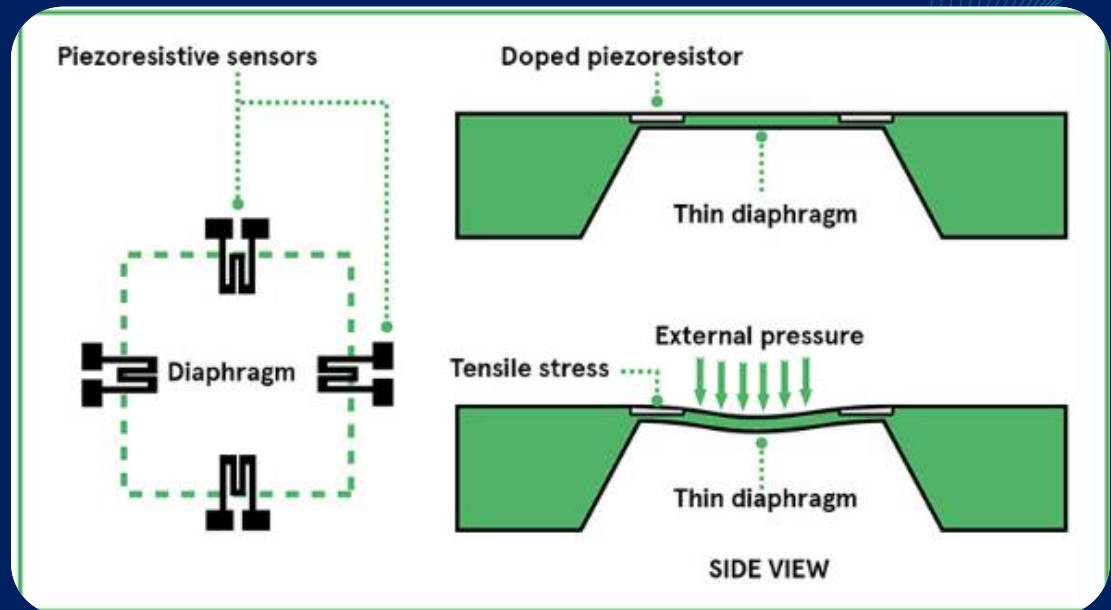
- Strain-gauge pressure sensors



SENSORS

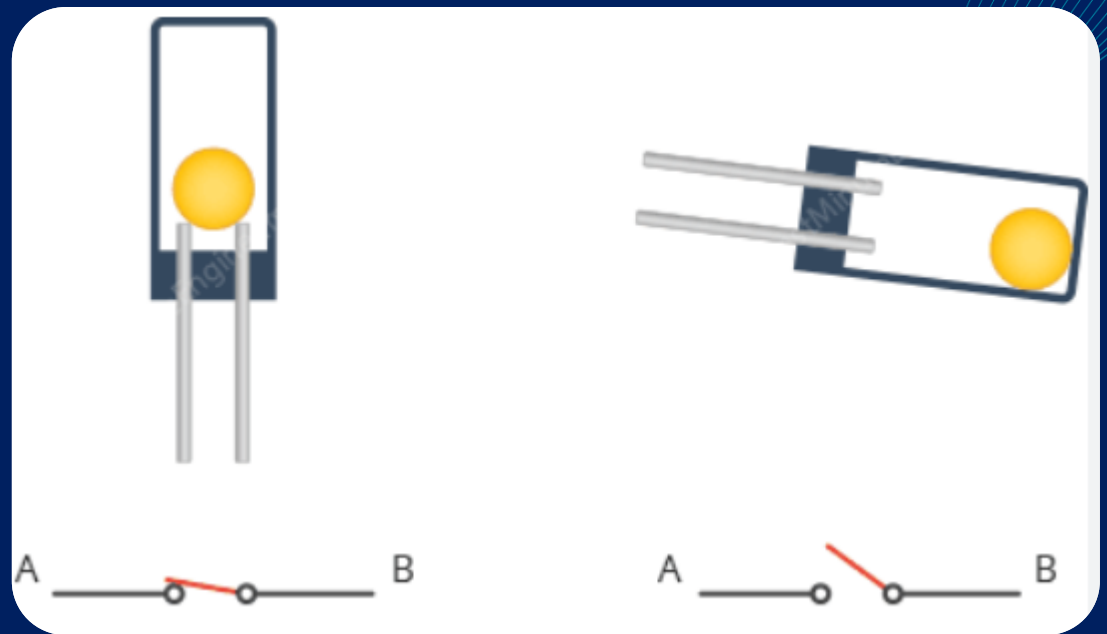
PRESSURE SENSORS

- Piezoresistive pressure sensors



SENSORS

TILT SENSORS

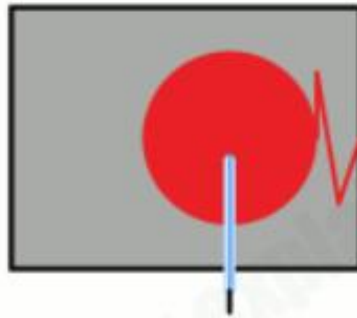


SENSORS

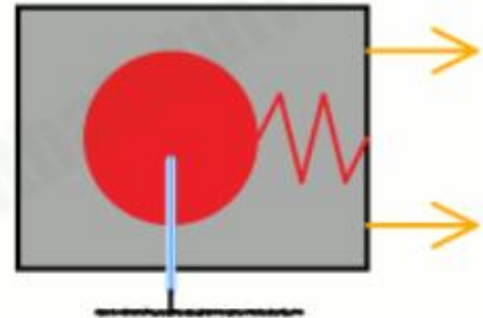
ACCELERATION SENSOR

Mechanical accelerometer

2. Mass takes time to move



1. Mass suspended
inside box



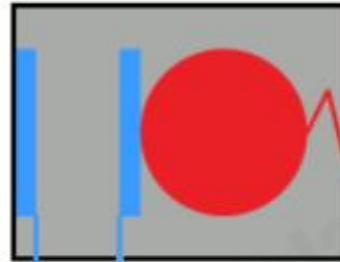
3. Pen leaves trace
on paper



SENSORS

ACCELERATION SENSOR

Capacitive accelerometer



1. Mass presses capacitor plate



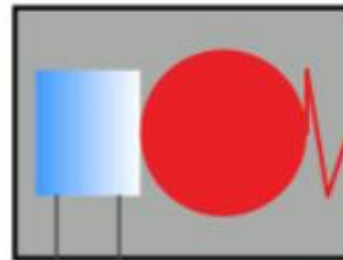
2. Mass closes plates, changing capacitance



SENSORS

ACCELERATION SENSOR

Piezoelectric accelerometer



1. Mass presses against crystal

2. Mass squeezes crystal



3. Squeezed crystal generates voltage



LEVERS





International **ROBOTICS**
Club

**Thank
you**





Co-Founder & Club Host
Dr. Mohamed El Mezewdy
00201011762939

International



ROBOTICS
Club



Club Founder
Dr. Mahmoud Bahgat
00966568654916
00201094932932



Monthly ZOOM Meeting



Every 3rd Monday of the month

7 pm Egy

7 pm KSA

8 pm UAE