SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

19EET304/ IOT FOR ELECTRICAL SCIENCES

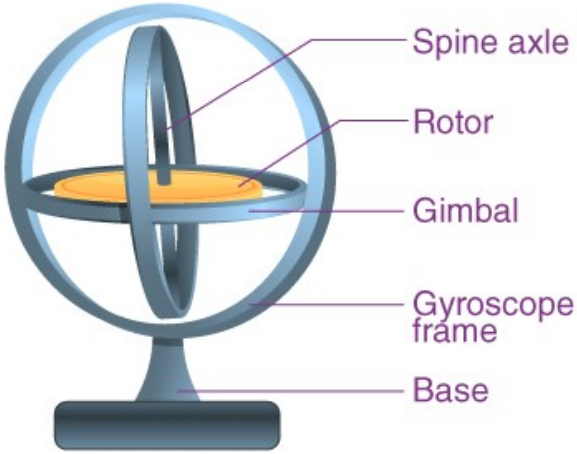
III YEAR VI SEM

UNIT 4 – ACTIVATION DEVICES

TOPIC 4– Accelerometer and Gyroscope types

Gyroscope

The device has a spinning disc mounted on the base so that it can move freely in more than one direction so that the orientation is maintained irrespective of the movement in the base.



Gyroscope

Parts of Gyroscope

- Spin axis
- Gimbal
- Rotor
- Gyroscope frame

Design of Gyroscope

•A gyroscope can be considered a massive rotor fixed on the supporting rings known as the gimbals.

•The central rotor is isolated from the external torques with the help of frictionless bearings that are present in the gimbals. The spin axis is defined by the axle of the spinning wheel.

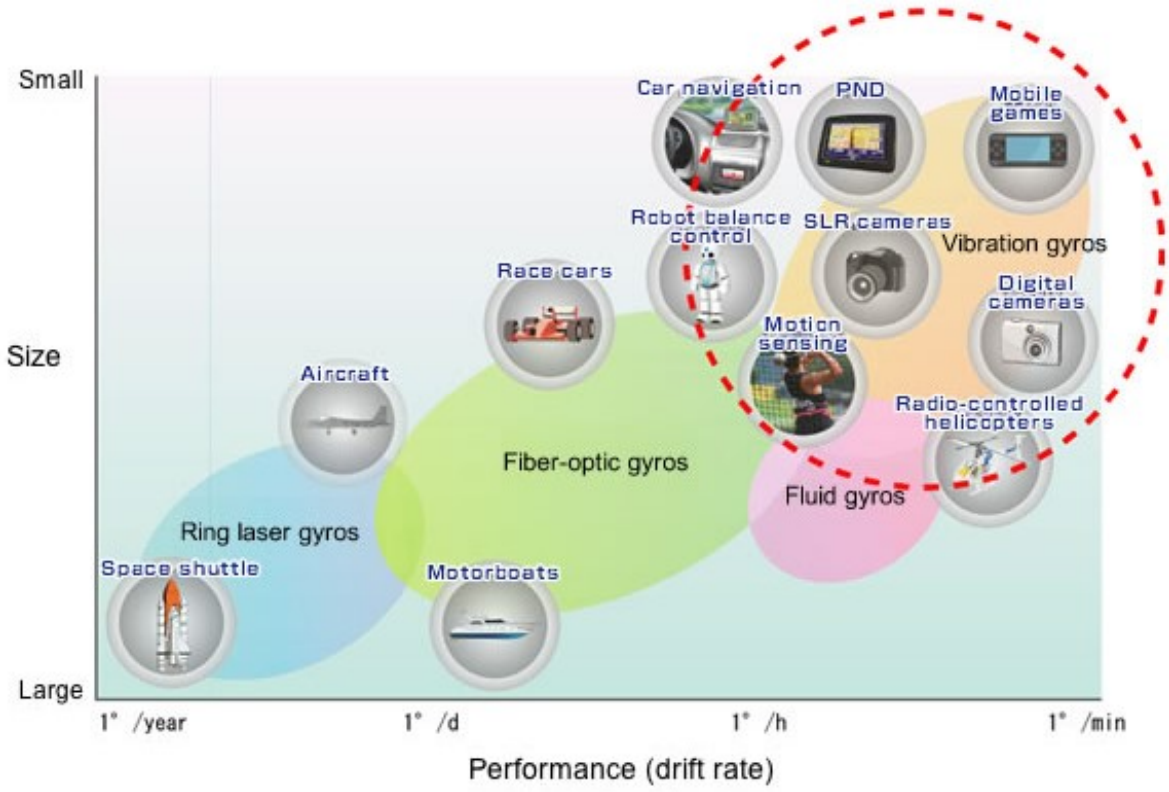
•The rotor has exceptional stability at high speeds as it maintains the high-speed rotation axis at the central rotor. The rotor has three degrees of rotational freedom.

Types of Gyroscopes

The following are the three types of gyroscopes:

- Mechanical gyroscope
- Optical gyroscope
- Gas-bearing gyroscope

Gyroscope-Types



Miniature, high-accuracy vibration gyro sensors are indipensable.

Mechanical Gyroscope

•The working principle of the mechanical gyroscope is based on the conservation of angular momentum.

•This is also one of the most commonly known gyroscopes. The mechanical gyroscope is dependent on the ball bearing to spin.

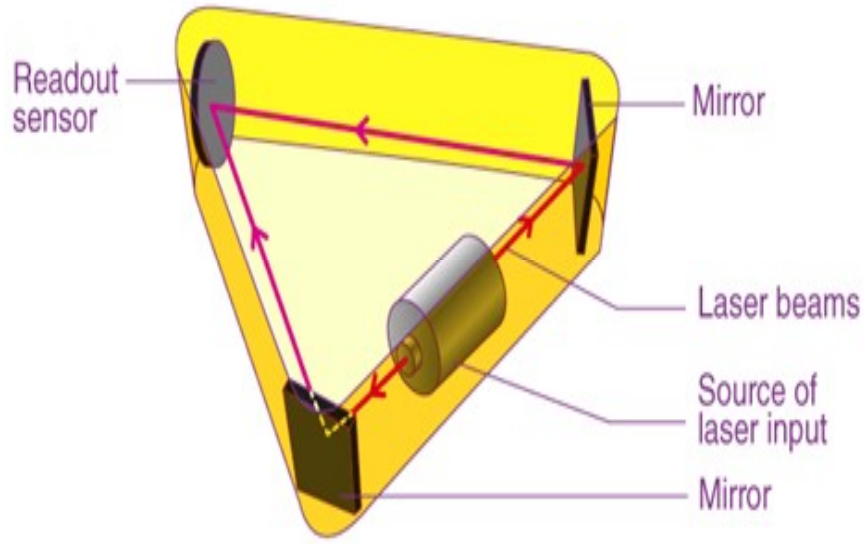
•These gyroscopes are replaced with modern forms of gyroscopes as they are noisier.

• They find applications in the navigation of large aircraft and missile guidance.

Optical Gyroscopes

These gyroscopes are dependent on the ball bearing or the rotating wheel. They are also not based on the conservation of angular momentum.

Optical gyroscopes use two optic fibre coils spun in different orientations. Since there is no movement in the optical gyroscopes, these are considered to be durable and find applications in modern spacecraft and rockets



Gas-Bearing Gyroscopes

•In a gas-bearing gyroscope, the friction between the moving parts is reduced by suspending the rotor with the help of pressurized gas.

•NASA used a gas-bearing gyroscope in the development of the Hubble telescope. Compared to the other gyroscopes, gas-bearing is quieter and more accurate.

Applications of Gyroscope

•Gyroscopes find applications in the compasses of boats, spacecraft, and aeroplanes. The aeroplane's orientation and pitch are determined against the steady spin of the gyroscope.

•In spacecraft, the desired target's navigation is done with a gyroscope's help. The spinning centre of the gyroscope is used as the orientation point.

•The stabilization of the large boats and satellites is done with the help of massive gyroscopes.

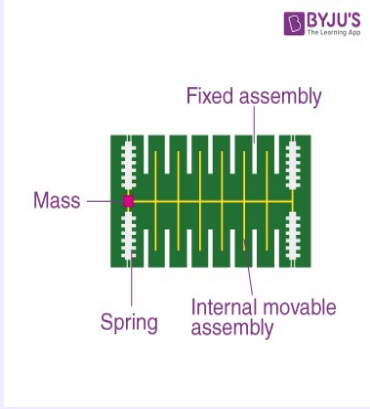
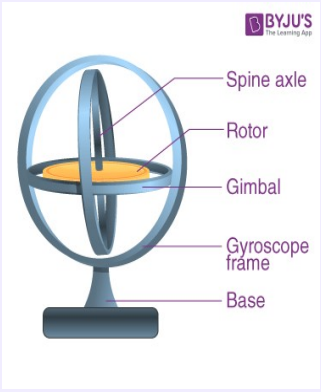
•Gyroscopes are used in gyrotheodolites to maintain the direction in tunnel mining.

•Gyroscopes and accelerometers are used in the design of smartphones providing excellent motion sensing.

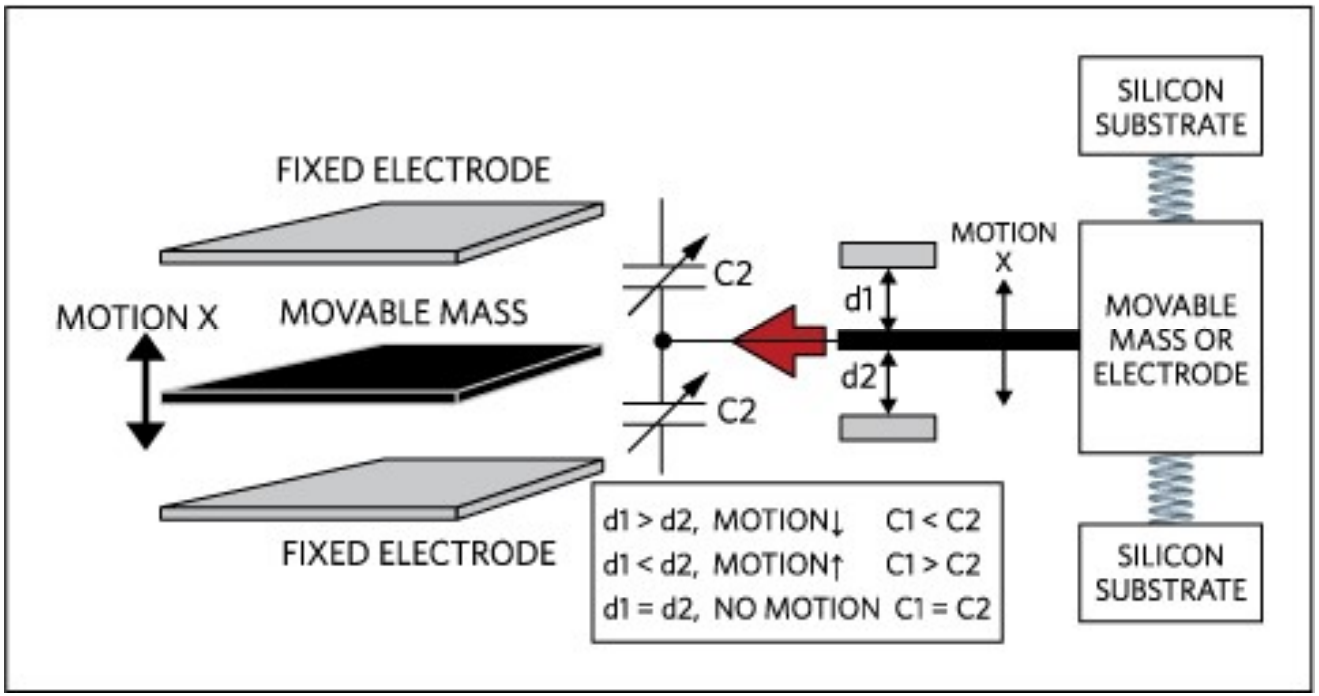
Difference between Accelerometer and Gyroscope

•An accelerometer is an instrument used to measure acceleration and detect vibrations. The other way of defining an accelerometer is an electromechanical device that measures forces due to acceleration.

Difference between Accelerometer and Gyroscope

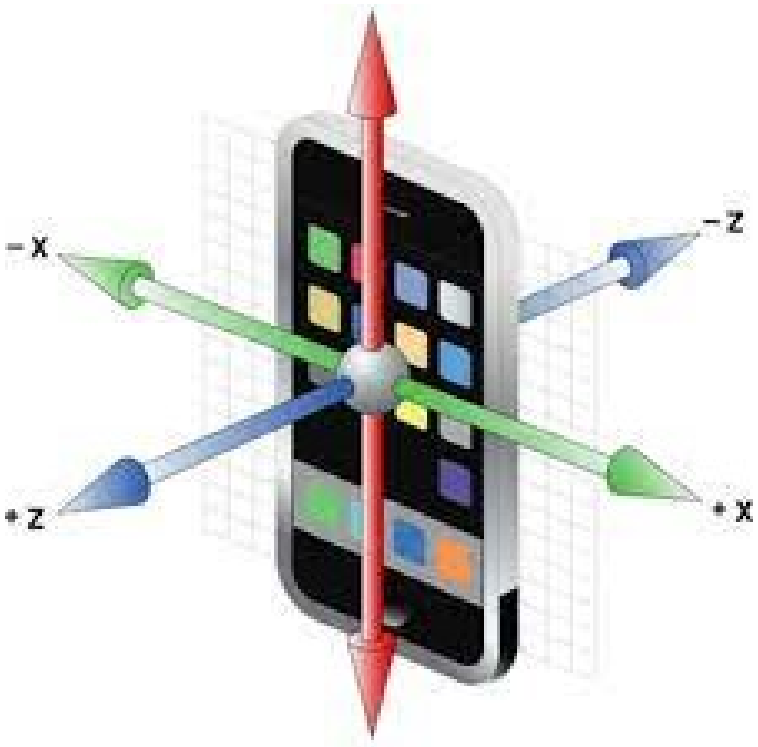
Accelerometer	Gyroscope
It is used for measuring the linear movement and for the detection of tilt	It is used for the measurement of all types of rotation but fails in the identification of movement
The signal-to-noise ratio is lower	The signal-to-noise ratio is higher
This cannot be used for the measurement of angular velocity	This can be used for the measurement of angular velocity
It is used for sensing axis orientation	It is used for sensing angular orientation
	

Acceleration associated with a single moving mass

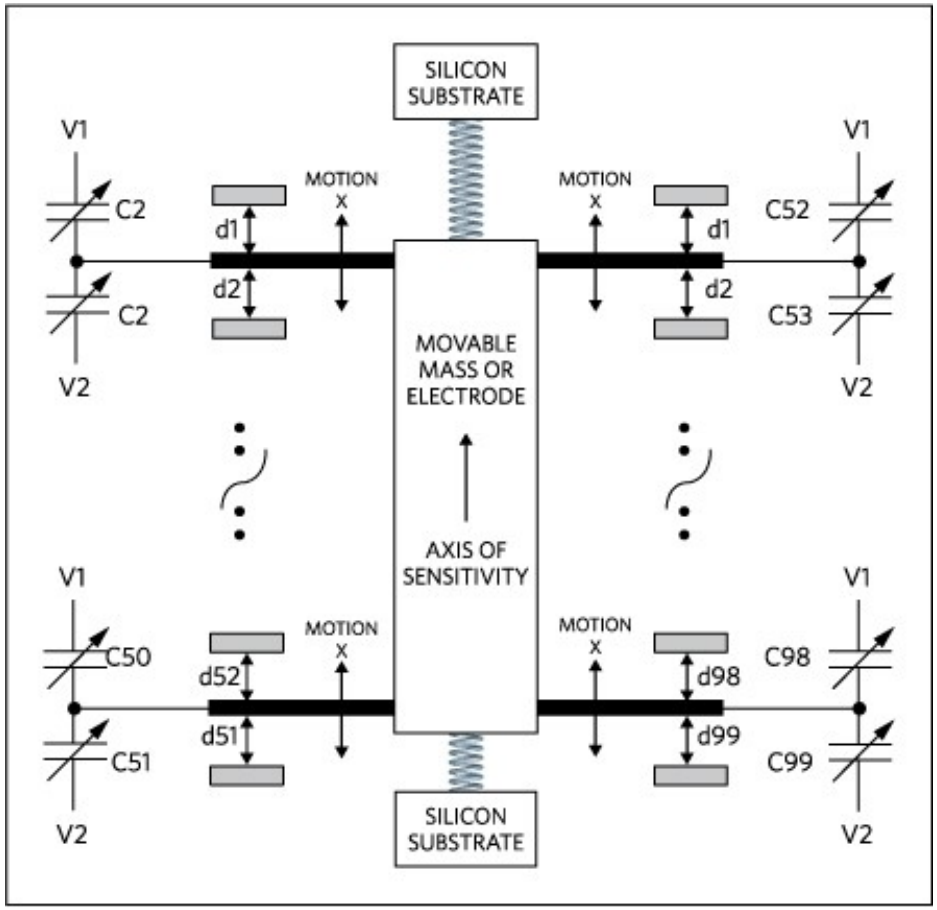


ASSESSMENT - 1

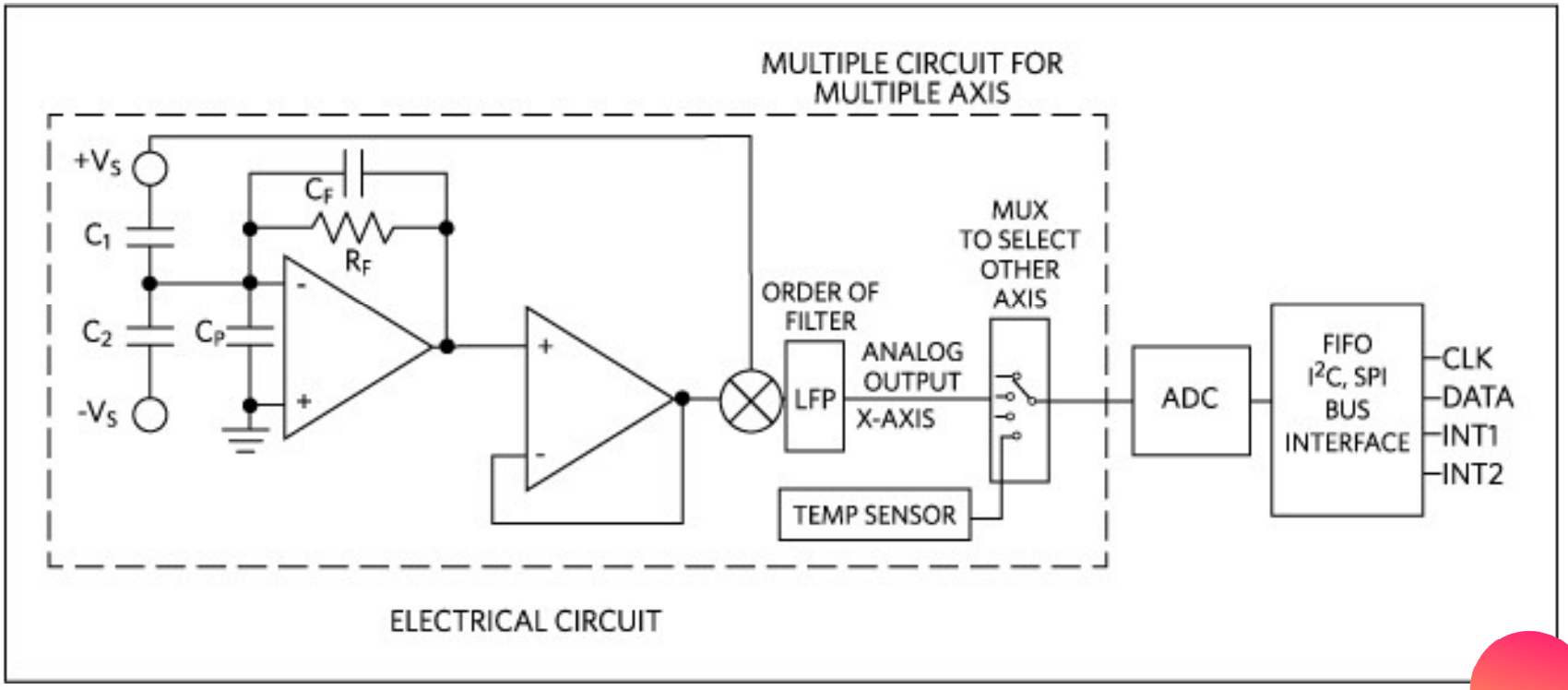
Imagine the Process



Acceleration associated with multiple moving masses



Electrical circuit of an accelerometer



Applications of Gyroscope Sensor

It is used in any application where angular velocity, angle sensing, and control mechanisms are needed to be measured.

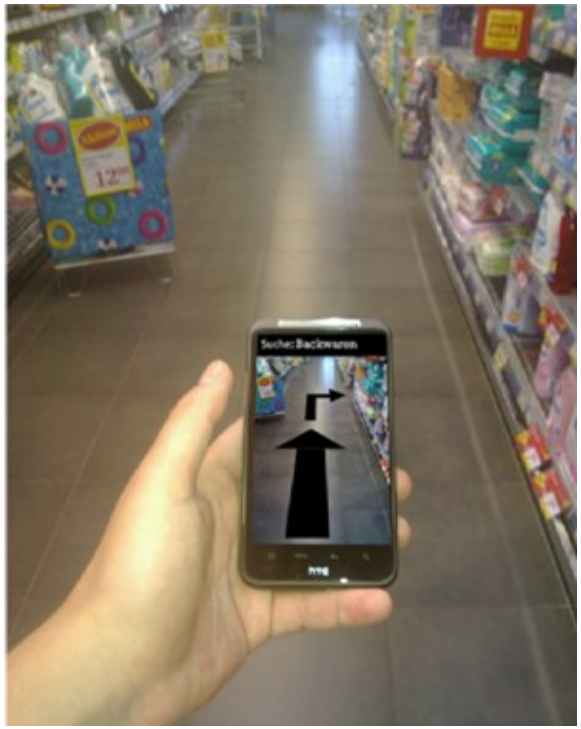
•**Sensing Angular Velocity** It can be used to sense the rate of change of angular motion in moving bodies. This can be used for detecting athletic movement.

•**Sensing Angles** The angles can also be detected using the gyroscope sensor. This application is used in car navigation and game controllers.

•**Sensing Control Mechanism** We can also use a gyroscopic sensor to detect vibration due to various external factors. We can use this application for camera-shake control and vehicle control.

ASSESSMENT – 2

Find the Process



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Thank You