



SNS COLLEGE OF TECHNOLOGY
An Autonomous Institution
Coimbatore-35



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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

IIYEAR/ III SEMESTER

19ECT201 Electrical Engineering and Instrumentation

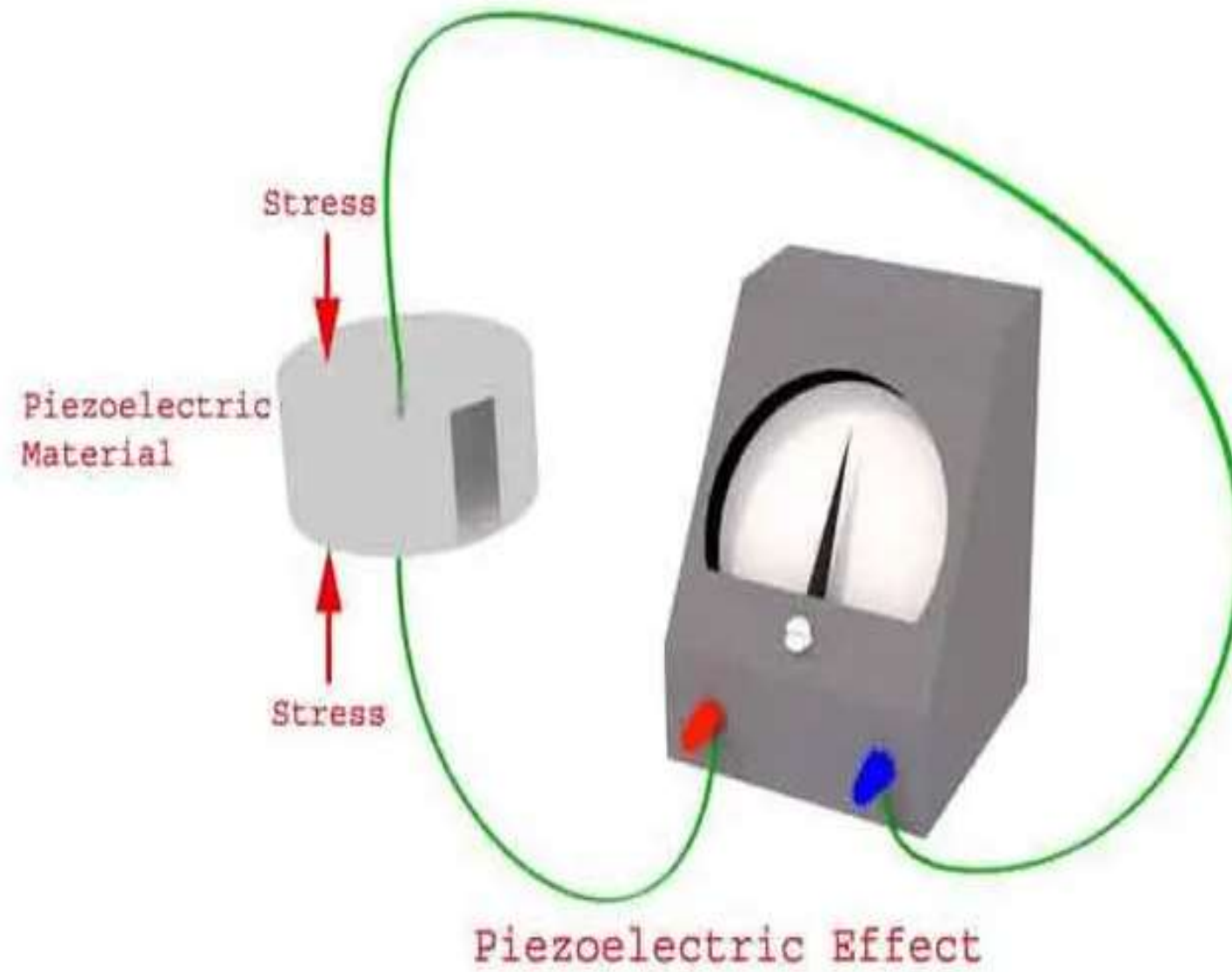
**TOPIC -VARIABLE CAPACITIVE TRANSDUCER- PIEZO
ELECTRIC TRANSDUCER**



PIEZO ELECTRIC TRANSDUCER

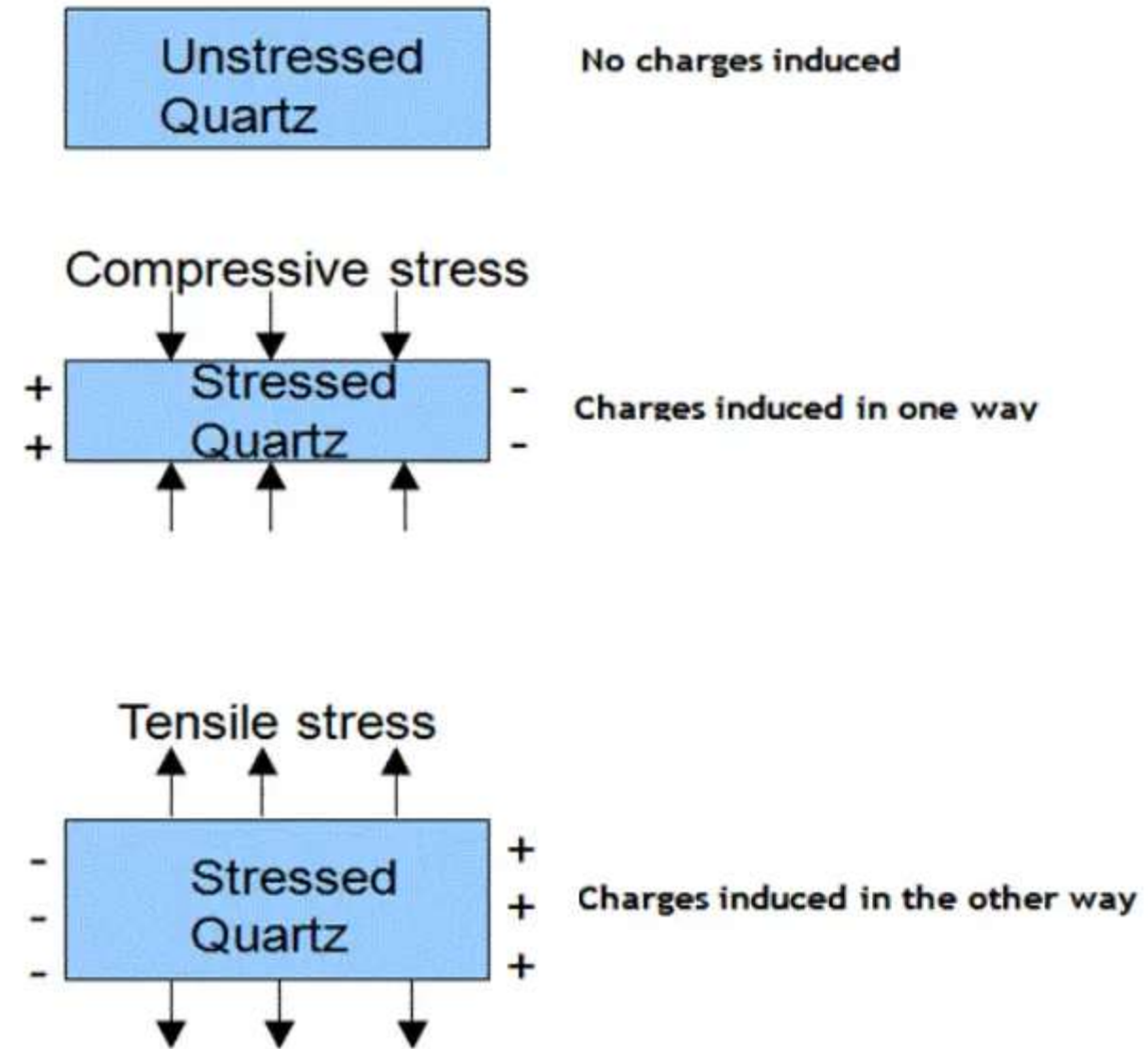


- A piezoelectric transducer (also known as a piezoelectric sensor) is a device that uses the piezoelectric effect to measure changes in acceleration, pressure, strain, temperature or force by converting this energy into an electrical charge
- A [transducer](#) can be anything that converts one form of energy to another. The piezoelectric **material** is one kind of transducers. When we squeeze this piezoelectric material or apply any force or pressure, the transducer converts this energy into voltage. This [voltage](#) is a function of the force or pressure applied to it.
- The electric voltage produced by a piezoelectric transducer can be easily measured by the voltage [measuring instruments](#). Since this voltage will be a function of the force or pressure applied to it, we can infer what the force/pressure was by the voltage reading. In this way, physical quantities like mechanical stress or force can be measured directly by using a piezoelectric transducer.





- A piezoelectric transducer consists of quartz crystal
- The quartz crystal has the unique property of generating electrical polarity when mechanical stress applied to it along a certain plane. Basically, There are two types of stress. One is compressive stress and the other is tensile stress.





- When there is unstressed quartz no charges induce on it.
- In the case of compressive stress, positive charges are induced on one side and negative charges are induced in the opposite side. The crystal size gets thinner and longer due to compressive stress.
- In the case of tensile stress, charges are induced in reverse as compare to compressive stress and quartz crystal gets shorter and fatter.
- A piezoelectric transducer is based on the principle of the piezoelectric effect. The word piezoelectric is derived from the Greek word piezen, which means to squeeze or press.
- The piezoelectric effect states that when mechanical stress or forces are applied on quartz crystal, produce electrical charges on the quartz crystal surface. The piezoelectric effect is discovered by Pierre and Jacques Curie. The rate of charge produced will be proportional to the rate of change of mechanical stress applied to it. Higher will be stress higher will be voltage.



APPLICATIONS



- In microphones, the sound pressure is converted into an electric signal and this signal is ultimately amplified to produce a louder sound.
- Automobile seat belts lock in response to a rapid deceleration is also done using a piezoelectric material.
- It is also used in medical diagnostics.
- It is used in electric lighter used in kitchens. The pressure made on piezoelectric sensor creates an electric signal which ultimately causes the flash to fire up.
- They are used for studying high-speed shock waves and blast waves.
- Used in infertility treatment.
- Used in Inkjet printers
- It is also used in restaurants or airports where when a person steps near the door and the door opens automatically. In this, the concept used is when a person is near the door pressure is exerted person weight on the sensors due to which the electric effect is produced and the door opens automatically



Advantages&drawbacks



The advantages of piezoelectric transducers are:

No need for an external force

Easy to handle and use as it has small dimensions

High-frequency response it means the parameters change very rapidly

The disadvantages of piezoelectric transducers are:

It is not suitable for measurement in static condition

It is affected by temperatures

The output is low so some external circuit is attached to it

It is very difficult to give the desired shape to this material and also desired strength