

The strain gauge is an example of a passive transducer that uses the variation in electrical resistance in wires to sense the strain produced by a force on the wires.

It is well known that stress (force/unit area) and strain (elongation or compression/unit length) in a member or portion of any object under pressure is directly related to the modulus of elasticity.

Since strain can be measured more easily by using variable resistance transducers, it is a common practice to measure strain instead of stress, to serve as an index of pressure. Such transducers are popularly known as strain gauges.

If a metal conductor is stretched or compressed, its resistance changes on account of the fact that both the length and diameter of the conductor changes. Also, there is a change in the value of the resistivity of the conductor when subjected to strain, a property called the *piezo-resistive effect*. Therefore, resistance strain gauges are also known as *piezo resistive gauges*.

Many detectors and transducers, c.g. load cells, torque meters, pressure gauges, temperature sensors, etc. employ strain gauges as secondary transducers.

When a gauge is subjected to a positive stress, its length increases while its area of cross-section decreases. Since the resistance of a conductor is directly proportional to its length and inversely proportional to its area of cross-section, the resistance of the gauge increases with positive strain. The resistance

2. **Bonded Resistance Wire Strain Gauges** A metallic bonded strain gauge is shown in Fig. 13.4.

A fine wire element about 25 μm (0.025 in.) or less in diameter is looped back and forth on a carrier (base) or mounting plate, which is usually cemented to the member undergoing stress. The grid of fine wire is cemented on a carrier which may be a thin sheet of paper, bakelite, or teflon. The wire is covered on the top with a thin material, so that it is not damaged mechanically. The spreading of the wire permits uniform distribution of stress. The carrier is then bonded or cemented to the member being studied. This permits a good transfer of strain from carrier to wire.

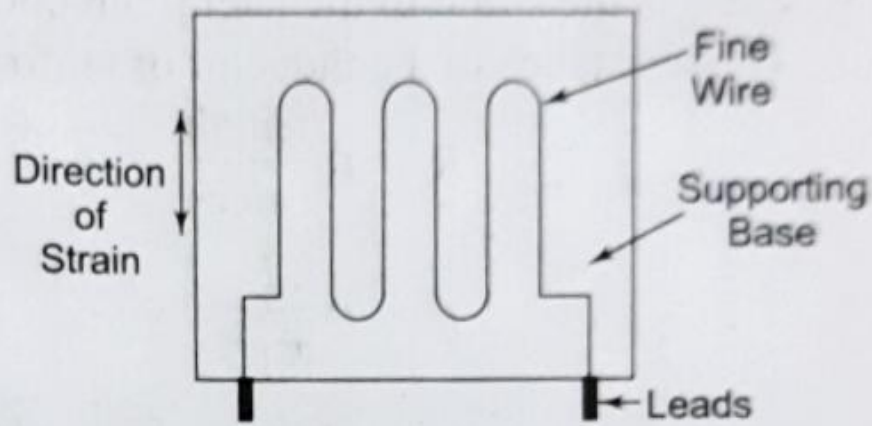


Fig. 13.4 Bonded resistance wire strain gauge

A tensile stress tends to elongate the wire and thereby increase its length and decrease its cross-sectional area. The combined effect is an increase in resistance, as seen from the following equation

$$R = \frac{\rho \times l}{A}$$

where ρ = the specific resistance of the material in Ωm
 l = the length of the conductor in m
 A = the area of the conductor in m^2