Measurement of Strain

Strain gauges are devices used to measure the dimensional changes of components under test. Strain gauges are used in a number of applications, some of them have been listed below:

1. Strain gauges are used in force measuring devices such as strain gauge load cell.
2. Strain gauge are used in measurement of vibration / acceleration such as strain gauge accelerometer.
3. Strain gauges along with diaphragm are used in the measurement of pressure.

Some important terms have been explained below:

Strain

Strain is the relative change in dimensions, that is, change in length of given original length.

Strain = change in length/original length = mm/mm (dimensionless).

Strain Gauges

When a metallic conductor is stretched or compressed, its resistance changes due to a change in the length and diameter (cross section) of the conductor.Hence a strain gauge is a measurement transducer used to measure strain (that is, relative changes in dimension). It is a transducer because it converts information about relative change in dimension to a change in resistance.

Positive Strain

When a strain gauge (metallic conductor) is subjected to tension, it is said to be positively strained. That is, when the strain gauge is subjected to positive strain (tension), its length increases and its area of cross section decreases. As the resistance of a conductor is proportional to its length and inversely proportional to its area of cross section, the resistance of the strain gauge increases with the positive strain.

Negative Strain.

When a strain gauge (metallic Conductor) is subjected to compression , it is said to negatively strained. that is, when the strain gauge is subjected to negative strain (compression), its length decreases and its area of cross section increases. As the resistance of the conductor is proportional to its length and inversely proportional to its area of cross section, the resistance of the strain gauge decreases with negative strain.

Piezoresistivity

There will be a change in resistivity of a conductor when it is strained and this property is called as piezoresistivity.

Poisson's Ratio

Poisson's Ratio = lateral strain, that is, the relative change in dimension in the cross section / Longitudinal strain, that is the relative change in dimension in the length.

$$= (dD/D)/(dL/L)$$

where, D=Diameter: L=Length

Gauge Factor (Strain Sensitivity Factor)

The fractional change in resistance due to unit change in length (unit strain) is called as gauge factor.

Gauge Factor, $F = (dR/R)/(dL/L)$

Where, R = Resistance, L=Length

The magnitude of the strain gauge factor indicates the sensitivity of the strain gauge. the high gauge factor implies that there will be a large change in resistance for a given strain input.

Source:

http://instrumentationandcontrollers.blogspot.in/2010/11/measurement-of-strain.html