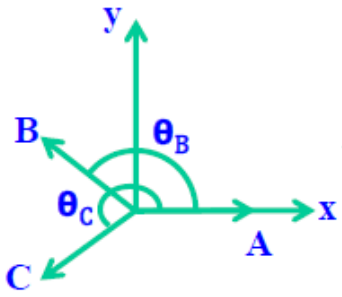
Tutorial on Strain Gages

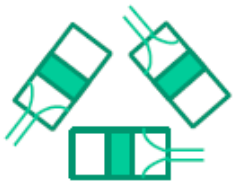
1. Consider a long cantilever beam of 20 mm width with a thickness of 3 mm. Load acting on this stainless steel beam (poisson's ratio of 0.285) is 300 gms at the free end. Strain gage is located at a distance of 200 mm from the free end. For a gage factor of 2.2, calculate the change in resistance, if the resistance of strain gage is 120 Ω. Youngs Modulus of stainless steel is 200 GPa.

   If this strain gage is made as one arm of the wheatstone bridge, then find sensitivity of Wheatstone bridge and overall sensitivity. Power density of the strain gage is 0.012 W/m^2 for a strain gage area of 4 mm × 3 mm. Ratio of $\frac{R_2}{R_1} = r = 5.$ What is the change in voltage observed by a balanced Wheatstone Bridge.

   If the above strain gage is used in a biaxial strain field where $\frac{\varepsilon_t}{\varepsilon_a} = 1$, then what is the deviation between actual axial strain and apparent axial strain for a transverse sensitivity factor of this strain gage being 4.4% (as given by the supplier).

2. A rectangular strain gauge rosette is composed of strain gauges oriented at relative angles of 0, 45, and 90 degrees, as shown in Figure. The rosette is used to measure strain on an aluminum structural member (E = 69 MPa, poisson's ratio of 0.334). The measured values of strain are 20000 $\mu\varepsilon$ (zero deg), 5000 $\mu\varepsilon$ (45 degree) and 10000 $\mu\varepsilon$ (90 degree).
3. Consider a delta rosette whose configuration is as given below





$\theta_A = 0^\circ$

$\theta_B = 120^\circ$

$\theta_C = 240^\circ$

Determine the normal stresses, shear stress, principal stresses and direction of principal stresses in terms of the measured shear strains