A PRESENTATION ON STRESSES & STRAINS

Prepared by
BALRAJ HOODA
LECTURER
Mechanical Engineering Department
Ganga Institute of Technology & Management, Kablana
Jhajjar (Haryana)

Strength of materials- Strength of materials is the science which deals with the relations between externally applied loads and their internal effect on bodies force acting on a body.

LOADS- The external force acting on a body are called loads.

Types of load - According to the effect produced on the body.

1. Tensile load
2. Compressive load
3. Shearing load
4. Bending load
5. Twisting load

Stress -Resistance offered by a body per unit area is known as stress .It is denoted by sigma.

$$\sigma = \frac{Load}{Area}$$

$$\text{SI Unit} = \frac{N}{m^2}$$

Tensile stress-When an axial pull is applied on the cross-sectional area of a body the induced is known as tensile stress.

Compressive stress-When an axial push is applied on the cross-sectional area of body the stress induced is known as compressive stress.

Shear Stress-When two equal and opposite forces are applied tangentially to the cross-sectional area of body is known as tangential stress. The shear stress is also known as tangential stress.

Strain-The ratio of change in dimension of the body to the original dimension of the body is called as strain.

$$\text{Strain} = \frac{Change\ in\ dimension}{Original\ dimension}$$

SI Unit= It is unit less

Types of strains-

1.Tensile strain

2.Compressive strain

3.Shear strain

4.Volumetric strain

1.Tensile strain-When two equal and opposite axial tensile forces at its ends , it creats elongation in its length.

2. Compressive strain-When a member is subjected to equal and opposite axial compressive force at its ends it decrease its length.

3.Shear strain-The ratio of angular deformation to original length along the force is termed as shear strain.

4.Volumetric strain-The ratio between change in volume and the original volume is known as volumetric strain or bulk strain.

Elasticity-This property by virtue of which certain materials show elastic behavior , returns back to their original position after the removal of external forces is called elasticity.

Plasticity-The body which does not returns back to their original position after the removal of external forces is called plasticity.

Various types of elastic constants-

1. Young's modulus of elasticity
2. Modulus of rigidity
3. Bulk modulus

1.Young’s modulus of elasticity-The ratio between tensile stress and tensile strain or the ratio between compressive stress and compressive strain is called as young's modulus of elasticity. This is denoted by(E).

$$E = \frac{\sigma}{\epsilon}$$

2.Modulus of rigidity-The ratio of shear stress and shear strain is known as modulus of rigidity . This is denoted by (G).

$$G = \frac{\tau}{\Phi}$$

3.Bulk modulus-The ratio of normal stress and volumetric strain is known as bulk modulus.It is denoted by(K).

$$K = \frac{\sigma}{e_v}$$

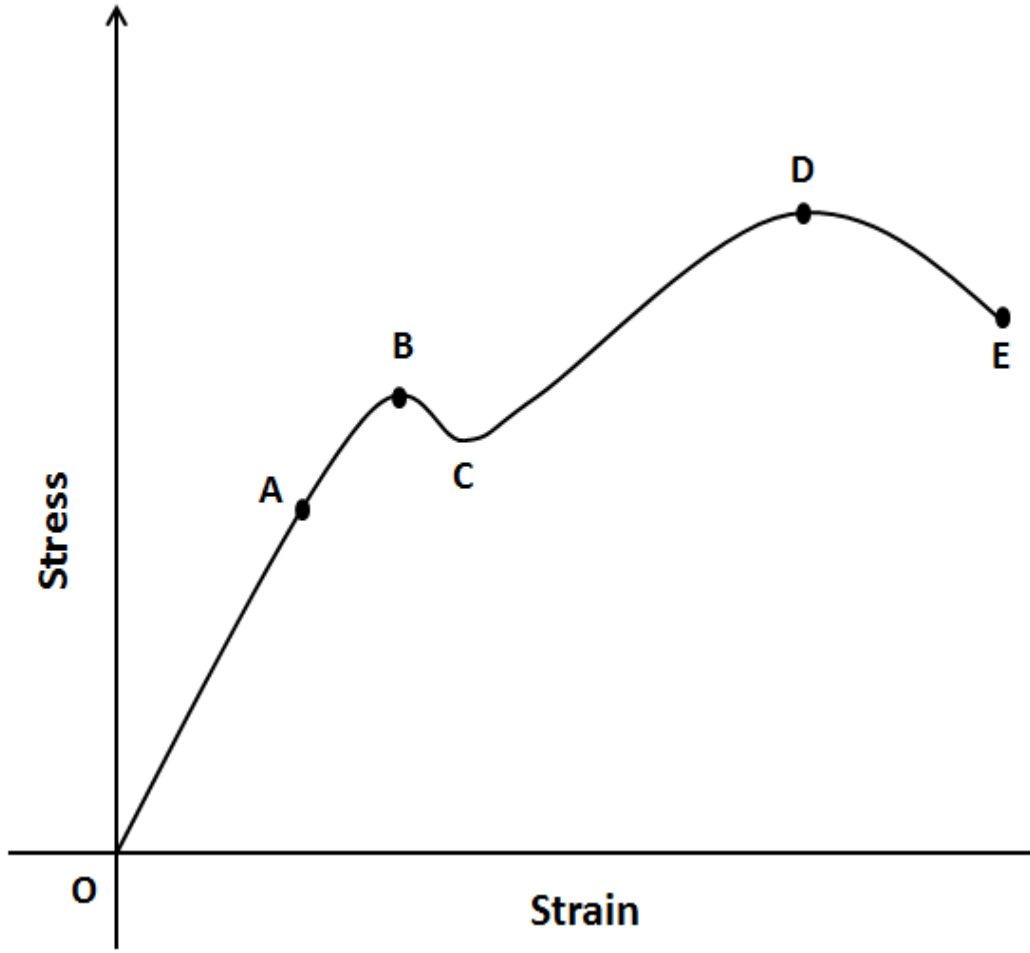
Hooke's law-According to this law stress is directly proportional to strain within the elastic limit.

$$\sigma \propto \varepsilon$$

$$\sigma = E\varepsilon$$

$$E = \frac{\sigma}{\varepsilon}$$

Stress-strain curve for mild steel material-



OA : Proportional limit
A : Elastic limit
B : Yield stress point/upper yield stress point
C : Lower yield stress point
D : Ultimate stress point
E : Breaking or rupture point

A . Proportional limit-In diagram O to A is straight line which represents the stress is proportional to strain . It obeys hooke"S law up to point A and it is known as proportional limit.

B. Upper yield stress –If the material is stressed point B, the plastic stage will reach. On the removal of the load the material will not be able to recover its original size and shape. A little consideration will show that beyond point B.

D. Ultimate stress-At point D the specimen regains some strength and higher values of streses are required for higher strains.

E. Breaking stress-At point e a neck is formed then a little consideration will show that the stress necessary to break away the specimen. The stress corresponding to point E is known as breaking stress.

Thank You