

Topic 9 Deformation of solids

Summary

- Forces on an object can cause tensile deformation (stretching) or compressive deformation (squashing).
- An elastic change occurs when an object returns to its original shape and size when the load is removed from it.
- Hooke's law states extension is proportional to load provided the limit of proportionality is not exceeded.
- The spring constant (force constant) k is the ratio of force to extension.
- Elastic potential energy (strain energy) is energy stored in a body due to change of shape.
- $\text{Strain energy} = \frac{1}{2}ke^2$
- $\text{Tensile strain} = \text{extension/original length}$
- $\text{Tensile stress} = \text{force/cross-sectional area}$
- $\text{Young modulus} = \text{stress/strain}$

Definitions and formulae

- Hooke's law: the extension is proportional to the force provided the limit of proportionality is not exceeded
- The elastic limit is the maximum force that can be applied to a wire such that the wire returns to its original length when the force is removed.
- Spring constant = force per unit extension
- Stress = force per unit area normal to force
- Strain = extension divided by the original length
- The Young modulus = tensile stress/tensile strain
- In elastic deformation the wire returns to its original length when the load is removed.
- In plastic deformation the wire does not return to its original length when the load is removed.
- The area under a force–extension graph is equal to the work done or the strain energy stored in a deformed body.