

ELASTIC COMPLIANCE AND STIFFNESS CONSTANTS



- Hookes law states that for sufficiently small deformations the strain is directly proportional to the stress
- The strain components are linear functions of the stress components
- The stress components are linear of the strain components
- The quantities s_{11} S_{12} - elastic compliance constants or elastic constants

- C_{11} c_{12} – elastic stiffness constants or moduli of elasticity
- The s 's have the dimensions of [area]/ [force] or [volume] / [energy]
- The c 's have the dimensions of [force]/[area] or [energy] / [volume]

Elastic Energy Density:

- The 36 constants may be reduced in number by several considerations
- The elastic energy density U is a quadratic function of the strains

- In approximation of hooke's law we write

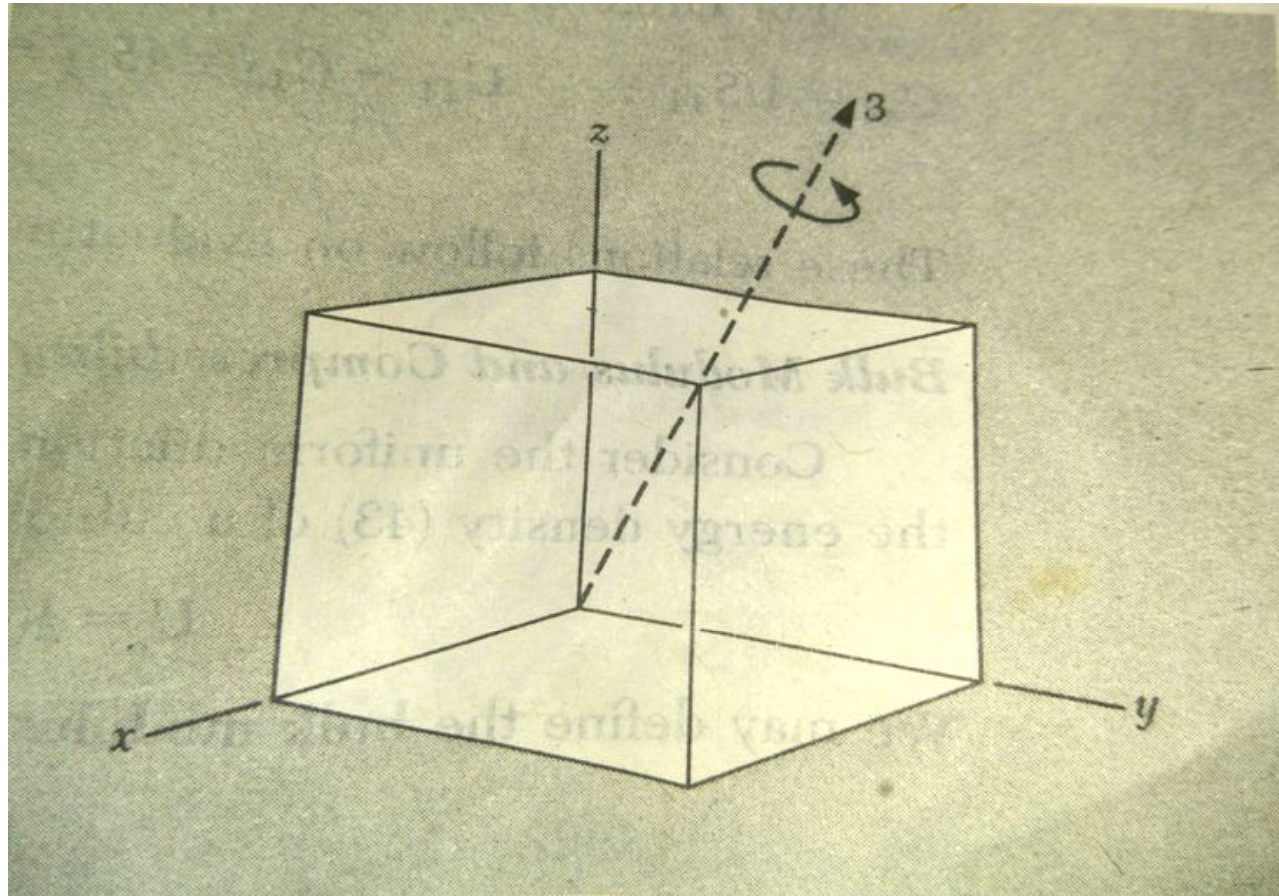
$$U = 1/2 \sum \sum C_{\lambda\mu} e_{\lambda} e_{\mu}$$

- The stress components from derivative of U with respect to the associated strain component
- The stress X_x applied to one face of a unit cube the opposite face being held at rest
- The 36 elastic stiffness constants are reduced to 21

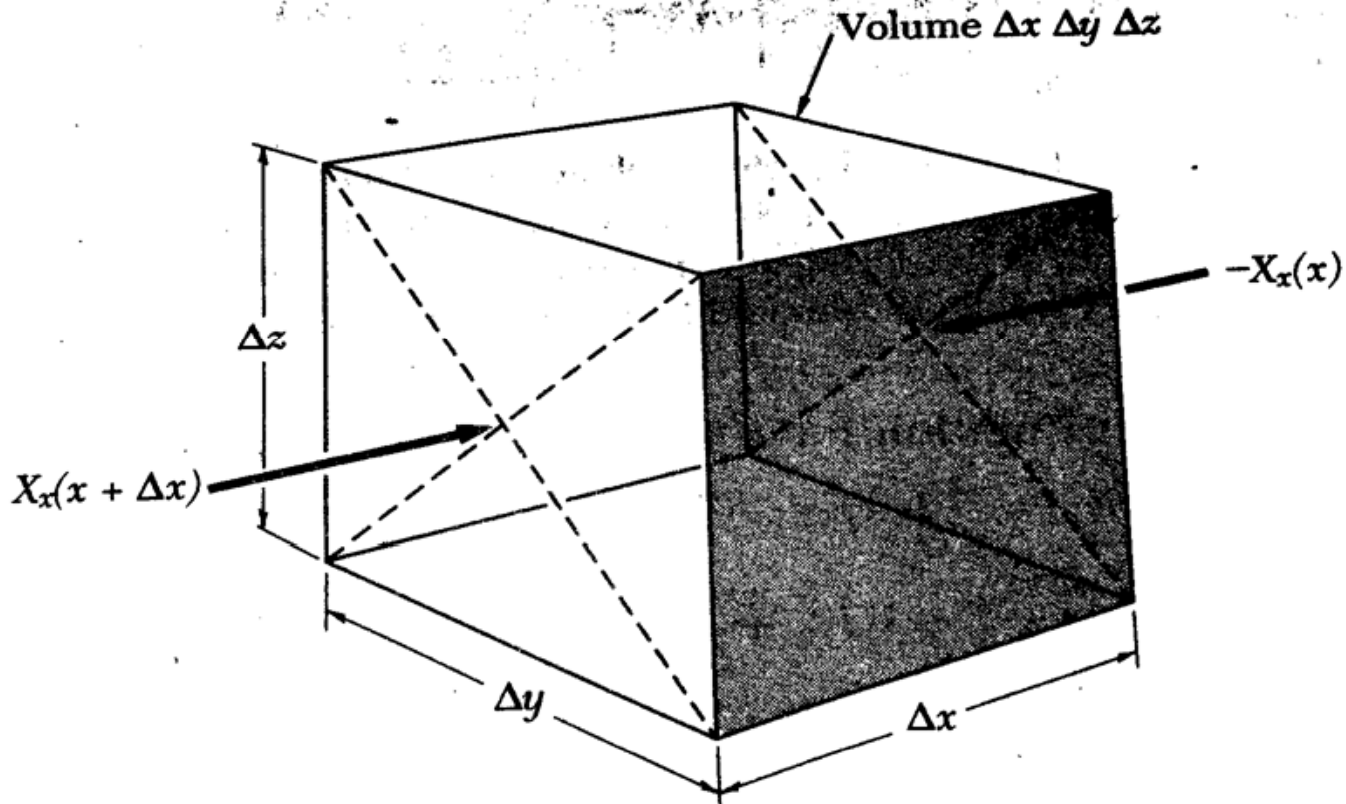
Elastic Stiffness Constants Of Cubic Crystals:

- The number of independent elastic stiffness constants is reduced further if the crystal possesses symmetry elements
- The cubic crystal there are only 3 independent stiffness constants
- The minimum symmetry requirement for a cubic structure is the existence of four three-fold rotation axes
- The axes are in the $[111]$ and equivalent directions
- The effect of rotation of about $2\pi/3$ about these four axes is to interchange the x, y, z

- A rotation will change the sign of the term because $e_{xy} = -e_{yx}$



Bulk modulus & compressibility:





thank you