H

Hooke's Law

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Definition

Robert Hooke, a British physicist in the mid-1600s (UCMP, 2006), recognized a linear relationship between the weight of an object suspended from a conventional coil spring and the distance the spring deflected, provided that the object did not stretch the spring beyond its elastic range. Objects of different weights deflected the spring different distances that were proportional to the objects' weights, and the spring's deflection was uniformly distributed along its deformed length. The constant of proportionality for a spring is known as the spring constant, which is the stiffness of the spring over its elastic range. Hooke realized that his discovery was widely applicable to objects made from many materials that have become known generally as "deformable bodies" that have elastic ranges of response to loads or stresses. Thus, Hooke's law is the basis for the theory of elasticity.

The load-deflection concept from a spring experiment can be applied to a solid, uniform, right circular bar or a rock core sample; in its simplest form, a load applied axially to a bar or core sample results in a change in its length that is proportional to the magnitude of the load. The change in length (Δl) divided by the initial length (l_o) is the definition of strain (ε_x). Since the bar or core sample has a cross-sectional area, the load can be converted to an axial stress (σ_x). Stress applied to the bar or core sample divided by the strain it produces is the modulus of elasticity (E) for the bar or rock material. The load applied axially to the bar or core sample also results in a change in its diameter. The ratio of the change in diameter to the change in length is a material property known as Poisson's ratio (v). The relationship between stress and strain in the elastic range is the basis for the elastic properties of most common materials and is important in engineering geology.

Cross-References

- ▶ Modulus of Elasticity
- ▶ Poisson's Ratio
- ▶ Strain
- ▶ Stress

References

UCMP (2006) Robert Hooke (1635–1703). University of California Berkeley Museum of Paleontology. http://www.ucmp.berkeley.edu/history/hooke.html. Accessed April 2016

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