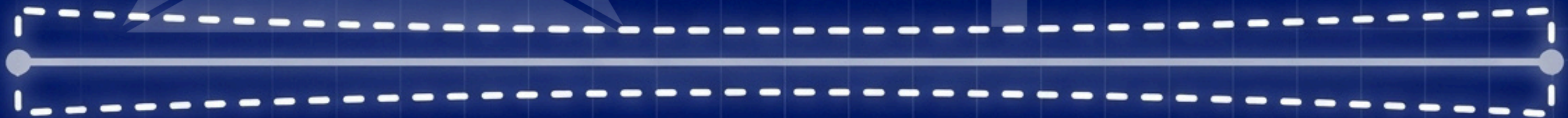
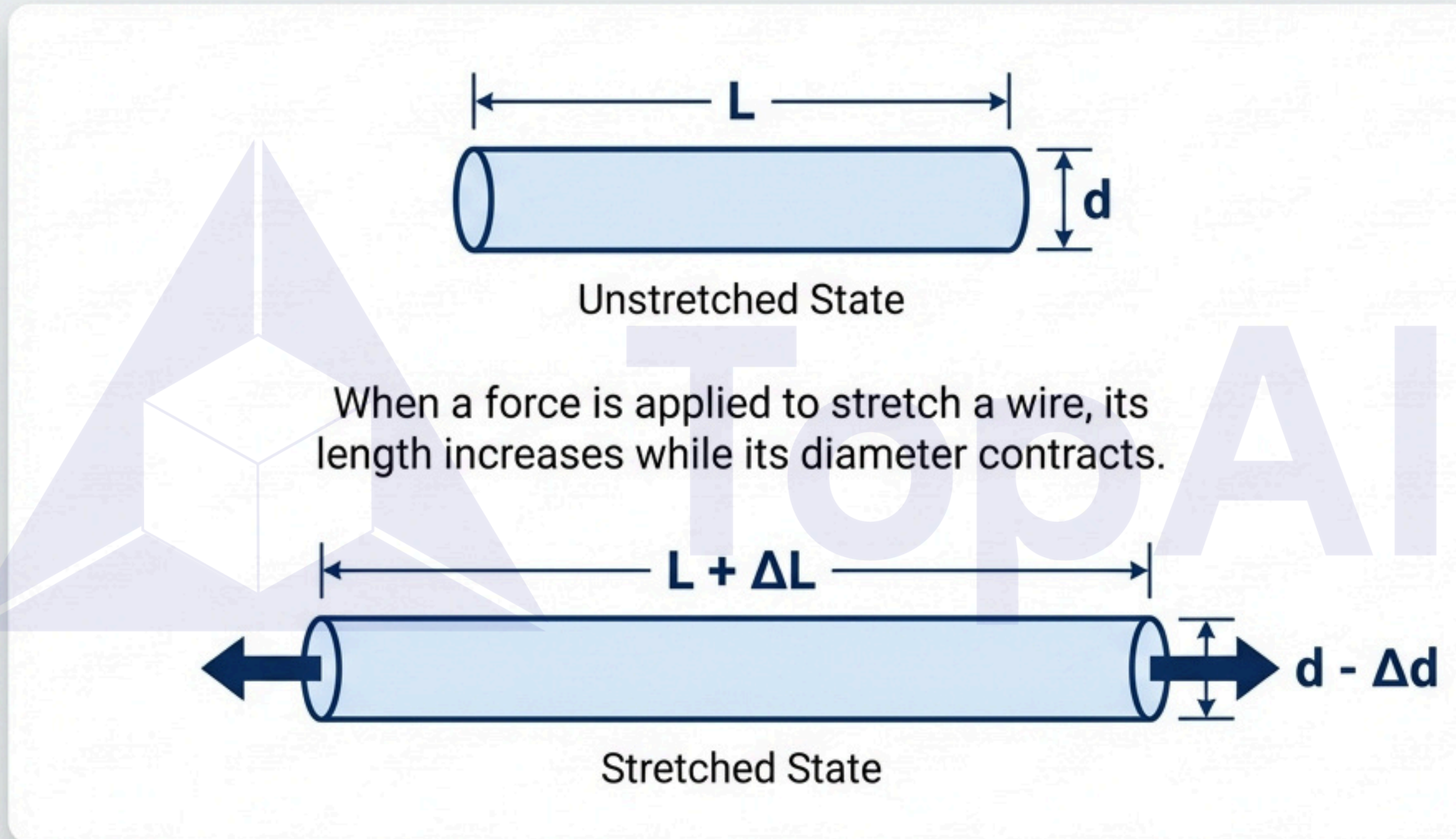


Poisson's Ratio

Dimensional changes in stretched wires



The Anatomy of a Stretched Wire



Key Idea Panel

The volume remains structurally connected; pulling it longer forces the sides to draw inward.

Defining the Two Strains



Longitudinal Strain

Strain in the direction of the stretched wire.



Change in length
(Change in length / Original length)



Lateral Strain

Strain perpendicular to the applied force.

$$\frac{\Delta d}{d}$$

(Contraction of diameter
(Contraction of diameter / Original diameter))

Key Distinction: Lateral strain is always perpendicular to the applied force.



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The Core Formula

Poisson's Ratio = Lateral Strain ÷ Longitudinal Strain

Lateral Strain ($\Delta d / d$)

Longitudinal Strain ($\Delta L / L$)

$$= \frac{\Delta d}{\Delta L} \times \frac{L}{d}$$

Simon Poisson observed that within the elastic limit, lateral strain is directly proportional to longitudinal strain.

Properties of Poisson's Ratio



Pure Number

Because it is a ratio of two strains (which themselves are ratios of identical units), Poisson's ratio is a pure number. It is dimensionless and has no units.



Nature of Material

It depends only on the nature of the material itself. It does not change based on the length, thickness, or specific shape of the wire.



Warning: Do not assign units like meters or Pascals to Poisson's ratio in your calculations!

Typical Values

Steels
0.28 — 0.30

Aluminium Alloys
~ 0.33

Notice that the values are pure numbers, typically hovering around 0.3 for common structural metals.

Chapter 8.5.4 Revision Recap

- ✓ Pulling a wire increases length ($+\Delta L$) but contracts diameter ($-\Delta d$).
- ✓ Longitudinal strain: Strain along the wire ($\Delta L/L$).
- ✓ Lateral strain: Strain perpendicular to applied force ($\Delta d/d$).
- ✓ Poisson's Ratio = Lateral Strain / Longitudinal Strain.
- ✓ It is dimensionless and depends only on the nature of the material.
- ✓ Values given: Steels (0.28–0.30), Aluminium alloys (~ 0.33).

Memory Cue

*L.a.t. comes before L.o.n.
in the dictionary, and
Lateral goes over
Longitudinal in the
formula.*


$$\frac{\text{Lateral}}{\text{Longitudinal}}$$



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