Dry Friction

Mechanical Engineering

Why friction is an inequality, and what changes when sliding starts.

Friction takes whatever value equilibrium demands, up to a limit set by the normal force.

$$F \le \mu_s N \cdot \text{sliding: } F = \mu_k N \cdot \tan \varphi = \mu_s$$

$\mu_s = 0.3$, $N = 100$ N → **F can reach 30 N**
Then it slips.

Applied push of 20 N → **Friction is 20 N**
Not 30 N.

Slope at angle φ → **Slip is impending**
$\tan \varphi = \mu_s$.

THE COMMON MISTAKE

× **Writing $F = \mu N$ from the start**

✓ **$F = \mu N$ only at impending slip**

Below the limit friction equals whatever the other forces demand. Using μN too early gives a body that is not in equilibrium.

Coulomb friction ignores contact area, speed and lubrication. Real values scatter widely; use measured data.