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Strength S, S_y, S_u
- inherent property of the object
- geometry, material

Stress
- property of object
- state and location
- σ, τ → shear stress
- ↳ normal

Factor of Safety

The yield strength of hot rolled steel is 220 Mpa.

Design Factor

$$n_d = \frac{\text{loss-of-function param}}{\text{max allowable param}}$$

If the load that will cause failure is between 90 and 110 lbs and you'd like a design factor of 2, what is the max allowable load?

A. 45 lbs
B. 50 lbs
C. 55 lbs

Factor of Safety

$$n_d = \frac{\text{yield strength}}{\text{max stress}} = \frac{S_y}{\sigma_{max}}$$

Table A-17 (Preferred Sizes)

See the "Preferred Sizes" Wikipedia page. Link is on the resources tab of the course website.

A square cross section rod is loaded axially with a static load of 1000±10 lbs. The strength of the material is 25 kpsi and the desired design factor is 4. Determine the minimum width of the square cross section. Then select a preferred fractional inch size from Table A-17 and report the factor of safety.

$$\sigma_{max} = \frac{P_{max}}{A} = \frac{P_{max}}{w^2}$$

$$n_d = \frac{S}{\sigma_{max}} \Rightarrow \sigma_{max} = \frac{S}{n_d}$$

$$w^2 \sigma_{max} = P_{max}$$

$$w^2 = \frac{P_{max}\, n_d}{S}$$

$$w = \sqrt{\frac{P_{max}\, n_d}{S}}$$

$$W = \sqrt{\frac{(1010\ \text{lbs})(4)}{(25E3\ \text{psi})}}$$

$$W = 0.40\ldots''$$

$$\frac{7}{16.} \Rightarrow 0.4375''$$

Factor of Safety

$$W_n = 0.4375''$$

$$n_d = \frac{S}{\sigma_{max}} = \boxed{\frac{S\, W_n^2}{P_{max}}}$$