Chapter Introduction

1.9

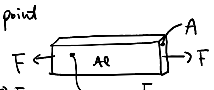
Strength(강도) : A property (물성, 성질) of a <u>material</u>

Al, Steel ...

↳ ① Melting temp: ___

② Strength : 200~300 MPa

Stress (응력) : A state property (상태 성질) at a specific point within a body



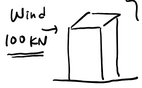
$\sigma = \frac{F}{A}$

1.10 Uncertainty (불확실성)

Design factor, $n_d = \frac{\text{loss of function parameter}}{\text{max. allowable parameter}} > 1$

ex 1-1 max. load on buidg has uncertainty of ±20%

load in failure has uncertainty of ±15%

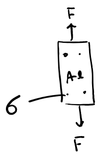


$n_d = \frac{\frac{1}{1-0.15}}{\frac{1}{1+0.2}} = 1.4$ ← > 1, ← < 1 } $n_d > 1$

1.11 factor of safety

$n_d = \frac{\text{loss of function stress}}{\text{allowable stress}} = \frac{S}{\sigma \text{ (or } \tau)} > 1$ (S: Strength, σ: stress)

$= \frac{S}{\sigma}$ or $\frac{S}{\tau}$



S = 250 MPa

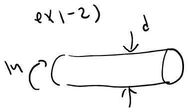
σ > S, then it fails.

$n_d = \frac{S}{\sigma}$

$\sigma = \frac{250}{n_d} = 1.5$ (← 1.5)

ex) $n_d = \frac{250 \text{ MPa}}{\sigma < 250}$

ex 1-2)



M = 100 N.m, $\sigma = -\frac{M \cdot y}{I} = -\frac{16M}{\pi d^3}$ ✓

S = 170 MPa, $n_d = 2.5$

Find out d ?

$n_d = \frac{S}{\sigma} = \frac{170}{\frac{16M}{\pi d^3}}$ ← 100 N.m, ← ? → $d = \left(\frac{16 M n_d}{S \pi}\right)^{\frac{1}{3}}$

= <u>21.11 mm</u>