

Chapter Introduction

1.9

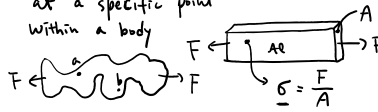
Strength (강도): A property of a material

Al, Steel, ...

① Making temp: —

② Strength: 200~250 MPa

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



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 building has uncertainty of $\pm 20\%$
 in failure has uncertainty of $\pm 15\%$

Wind 100 kN

Diagram of a building with a wind load of 100 kN.

$$n_d = \frac{\frac{1}{1-0.15}}{\frac{1}{1+0.2}} = 1.4$$

$\left. \begin{array}{l} \leftarrow > 1 \\ \leftarrow < 1 \end{array} \right\} \textcircled{n_d > 1}$

1.11 factor of safety

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

Diagram of a rectangular block with area A and thickness t , subjected to tensile forces F . The stress is labeled as σ .

$S = 250 \text{ MPa}$

$\sigma > S$, then it fails.

$$n_d = \frac{S}{\sigma} \quad \text{or} \quad n_d = \frac{250 \text{ MPa}}{\sigma < 250}$$

ex 1-2)

Diagram of a cylindrical shaft of diameter d subjected to a bending moment M .

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

$S = 170 \text{ MPa}$, $n_d = 2.5$

Find out d ?

$$n_d = \frac{S}{\sigma} = \frac{170}{\frac{16M}{\pi d^3}} = 2.5 \rightarrow d = \left(\frac{16M n_d}{S \pi} \right)^{\frac{1}{3}} = 21.11 \text{ mm}$$