

Formula Sheet

Stresses: $\sigma = \frac{P}{A}$ $\sigma = \frac{M \cdot c}{I}$ $\tau = \frac{T \cdot c}{J}$

Unsymmetric bending: $\sigma = \frac{P}{A} + \frac{-M_z y}{I_z} + \frac{-M_y z}{I_y}$ $\tan \phi = \frac{I_z}{I_y} \tan \theta$

Shear stress: $\tau = \frac{VQ}{It}$ $q = \tau \cdot t = \frac{VQ}{I}$

Thin-walled pressure vessel: $\sigma_1 = \frac{Pr}{t}$ $\sigma_2 = \frac{Pr}{2t}$

Stress Transformation:

$$\sigma_{x'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta$$

$$\tan 2\theta_p = \frac{2 \cdot \tau_{xy}}{(\sigma_x - \sigma_y)}$$

$$\tau_{x'y'} = -\frac{\sigma_x - \sigma_y}{2} \sin 2\theta + \tau_{xy} \cos 2\theta$$

$$\tan 2\theta_s = -\frac{(\sigma_x - \sigma_y)}{2 \cdot \tau_{xy}}$$

$$\tau_{\max} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$\sigma_{\text{avg}} = \frac{\sigma_x + \sigma_y}{2}$$

$$\sigma_{1,2} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

Beam Design: $S_{\text{req}} = \frac{|M|_{\max}}{\sigma_{\text{all}}}$ $r_m = \frac{V_{\max}}{A_{web}}$, where $A_{web} = d \cdot t_{web}$

Yield Criteria:

Von Mises (Distortion Energy): $\sigma_x^2 - \sigma_x \sigma_y + \sigma_y^2 < \sigma_Y^2$

Tresca (Maximal Shear Stress): $| \sigma_x | < \sigma_Y$ and $| \sigma_y | < \sigma_Y$
or $| \sigma_x - \sigma_y | < \sigma_Y$

Strain Gauge Transformation: $\epsilon(\theta) = \epsilon_x \cos^2 \theta + \epsilon_y \sin^2 \theta + \gamma_{xy} \sin \theta \cos \theta$

Generalized Hook's Law:

$$\epsilon_x = \frac{1}{E} [\sigma_x - \nu(\sigma_y + \sigma_z)]$$

$$\gamma_{xy} = \frac{1}{G} \tau_{xy}, \quad \gamma_{yz} = \frac{1}{G} \tau_{yz}, \quad \gamma_{zx} = \frac{1}{G} \tau_{zx}$$

$$\epsilon_y = \frac{1}{E} [\sigma_y - \nu(\sigma_x + \sigma_z)]$$

$$G = \frac{E}{2(1+\nu)}$$

$$\epsilon_z = \frac{1}{E} [\sigma_z - \nu(\sigma_x + \sigma_y)]$$

Plane Stress: $\sigma_x = \frac{E}{(1-\nu^2)} [\epsilon_x + \nu \epsilon_y]$

Mechanical Engineering Formulas Cheat Sheet

Liying Dong



Mechanical Engineering Formulas Cheat Sheet:

The Academic Discourse of Mechanical Engineering Thi Ngoc Phuong Le, Minh Man Pham, Michael Barlow, 2023-03-15
This volume examines rhetorical conventions employed in mechanical engineering research to understand the knowledge making principles of the discipline as well as their expression within the research article. In particular, the study analyses the organisational patterns of mechanical engineering research articles using Swales's conceptualisation of moves and steps. In addition, the research identifies the phraseology associated with specific moves and steps. The study draws on a corpus of 120 mechanical engineering research articles equally distributed across two sub-disciplines: mechanical systems and thermal fluids engineering. Three research traditions: experimental, theoretical, and mixed methods, and two publication periods: 2002-2006 and 2012-2016. It adopts an integrated methodology intertwining various approaches and perspectives, including corpus linguistics, move analysis, discourse analysis, and interviews, to address two main strands of research enquiry: i) What are the properties of the rhetorical structures in terms of range, frequency, and length for each section of mechanical engineering research articles? ii) What effect does sub-discipline, research tradition, and publication date have on the rhetorical structure of research articles?
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