

Solution Manual 3rd Ed. Metal Forming: Mechanics and Metallurgy
Chapter 1

Determine the principal stresses for the stress state

$$\sigma_x = \begin{vmatrix} 10 & -3 & 4 \\ -3 & 5 & 2 \\ 4 & 2 & 7 \end{vmatrix}$$

Solution: $I_1 = 10+5+7=32$, $I_2 = -(50+35+70) + 9 + 4 + 16 = -126$, $I_3 = 350 - 48 - 40 - 80 - 63 = 119$; $\sigma^3 - 32\sigma^2 - 126\sigma - 119 = 0$. A trial and error solution gives $\sigma = 13.04$. Factoring out 13.04, $\sigma^2 - 8.96\sigma + 9.16 = 0$. Solving: $\sigma_1 = 13.04$, $\sigma_2 = 7.785$, $\sigma_3 = 1.175$.

1-2 A 5-cm. diameter solid shaft is simultaneously subjected to an axial load of 80 kN and a torque of 400 Nm.

- Determine the principal stresses at the surface assuming elastic behavior.
- Find the largest shear stress.

Solution: a. The shear stress, τ , at a radius, r , is $\tau = \tau_s R / r$ where τ_s is the shear stress at the surface R is the radius of the rod. The torque, T , is given by $T = \int 2\pi r^2 dr = (2\pi \tau_s / R) \int r^3 dr = \pi \tau_s R^3 / 2$. Solving for τ_s , $\tau_s = 2T / (\pi R^3) = 2(400 \text{ N}) / (\pi 0.025^3) = 16 \text{ MPa}$

The axial stress is $.08 \text{ MN} / (\pi 0.025^2) = 4.07 \text{ MPa}$

$$\sigma_1, \sigma_2 = 4.07/2 \pm [(4.07/2)^2 + (16/2)^2]^{1/2} = 1.029, -0.622 \text{ MPa}$$

b. the largest shear stress is $(1.029 + 0.622)/2 = 0.925 \text{ MPa}$

A long thin-wall tube, capped on both ends is subjected to internal pressure. During elastic loading, does the tube length increase, decrease or remain constant?

Solution: Let y = hoop direction, x = axial direction, and z = radial direction. -

$$e_x = e_z = (1/E)[\sigma - \nu(\sigma_3 + \sigma_1)] = (1/E)[\sigma_2 - \nu(2\sigma_2)] = (\sigma_2/E)(1-2\nu)$$

Since $\nu < 1/2$ for metals, $e_x = e_z$ is positive and the tube lengthens.

4 A solid 2-cm. diameter rod is subjected to a tensile force of 40 kN. An identical rod is subjected to a fluid pressure of 35 MPa and then to a tensile force of 40 kN. Which rod experiences the largest shear stress?

Solution: The shear stresses in both are identical because a hydrostatic pressure has no shear component.

1-5 Consider a long thin-wall, 5 cm in diameter tube, with a wall thickness of 0.25 mm that is capped on both ends. Find the three principal stresses when it is loaded under a tensile force of 40 N and an internal pressure of 200 kPa.

Solution: $\sigma_x = PD/4t + F/(\pi Dt) = 12.2 \text{ MPa}$

$$\sigma_y = PD/2t = 2.0 \text{ MPa}$$

$$\sigma_z = 0$$

Metal Forming Solution Manual

Hobart Hurd Willard



Metal Forming Solution Manual:

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Chandra, 2023-05-26 Devices and Circuit Fundamentals is Chapter Outline Learning Objectives Key Terms Figure List Chapter Summary Formulas Answers to Examples Self Exams Glossary of Terms defined *Organic Chemistry, 4e Student Solution Manual and Study Guide* David R. Klein, 2021-01-07 Success in organic chemistry requires mastery in two core aspects fundamental concepts and the skills needed to apply those concepts and solve problems With Organic Chemistry Student Solution Manual and Study Guide 4th Edition students can learn to become proficient at approaching new situations methodically based on a repertoire of skills These skills are vital for successful problem solving in organic chemistry

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Laboratory Manual for the Course in Advanced Quantitative Analysis Hobart Hurd Willard, 1920 Handbook of Metalforming Processes Henry Ericsson Theis, 1999-05-26 Reflecting hands on experience of materials equipment tooling and processes used in the industry this work provides up to date information on flat rolled sheet metal products It addresses the processing and forming of light to medium gauge flat rolled sheet metal illustrating the versatility and myriad uses of this material **Materials** Michael F. Ashby, Hugh Shercliff, David Cebon, 2013-12-03 Materials Engineering Science Processing and Design winner of a 2014 Textbook Excellence Award Texty from The Text and Academic Authors Association is the ultimate materials engineering text and resource for students developing skills and understanding of materials properties and selection for engineering applications Written by world class authors it takes a unique design led approach that is

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