

Answers Problems 8

8.1

$$(1) T = \frac{\pi r_0^3 \sigma_{yp}}{2}$$

$$(2) \sigma_x = \frac{R}{2h} P, \quad \sigma_y = \frac{R}{h} P, \quad \tau_{xy} = 0, \quad \varepsilon_x = \frac{RP}{2Eh}(1-2\nu), \quad \varepsilon_y = \frac{RP}{2Eh}(2-\nu), \quad \gamma_{xy} = 0$$

$$\varepsilon_2 = \varepsilon_x, \quad \varepsilon_1 = \varepsilon_y, \quad \gamma_1 = -(1+\nu) \frac{RP}{2Eh}$$

$$(3) h = \frac{\sqrt{3}RP}{2\sigma_{yp}} S$$

8.2

(1) 510 MPa

(2) $\sigma_1 = 22.7$ MPa, $\sigma_2 = -9.7$ MPa, $\tau_1 = 15.7$ MPa

(3) 3.63 kN

8.3

(1) 1.01 GPa

$$(2) \sigma_1 = \frac{290}{d^2} \text{ [kPa]}, \quad \sigma_2 = -\frac{36}{d^2} \text{ [kPa]}$$

(3) 1.1 m

8.4

(1) 1.45 MPa

(2) 2.7 mm

8.5

$$(1) \sigma_x = \frac{40F}{\pi d^2}, \quad \sigma_y = 0, \quad \tau_{xy} = \frac{4F}{\pi d^2}$$

$$(2) \sigma_1 = \frac{4F}{\pi d^2} (5 + \sqrt{26}), \quad \sigma_2 = \frac{4F}{\pi d^2} (5 - \sqrt{26})$$

$$(3) d = 2 \sqrt{\frac{\sqrt{103}SF_0}{\pi\sigma_p}}$$

8.6

$$(1) \frac{16\sqrt{3}T_0}{\pi D^3}$$

$$(2) \frac{16T_0}{5\pi D^3}$$

8.7

(1) Bending moment: $3FR$, torsional moment: $6FR$, tensile force: 0

$$(2) \sigma_x = \frac{12F}{\pi R^2}, \quad \sigma_y = 0, \quad \tau_{xy} = \frac{12F}{\pi R^2}$$

$$(3) \sigma_1 = \frac{6(1+\sqrt{5})F}{\pi R^2}, \quad \sigma_2 = \frac{6(1-\sqrt{5})F}{\pi R^2}$$

$$(4) \sigma_{eq} = \frac{24F}{\pi R^2}$$

$$(5) \sigma_1 = \frac{12F}{\pi R^2}, \quad \sigma_2 = -\frac{12F}{\pi R^2}$$

8.8

$$(1) \frac{2F_0}{\pi R^2}$$

$$(2) F_1 = \frac{1}{2\sqrt{3}} F_0$$

$$(3) F_a = \frac{F_0}{4}$$

$$(4) P_0 = \frac{2F_0}{25\sqrt{3}\pi SR^2} = \frac{2\sqrt{3}}{75} \frac{F_0}{\pi SR^2}$$

8.9

$$(1) T = \frac{\pi D^3}{16\sqrt{3}} \sigma_{pl}$$

$$(2) \sigma_x = \frac{128F}{\pi D^2}, \quad \sigma_y = 0, \quad \tau_{xy} = \frac{64F}{\pi D^2}$$

$$(3) \sigma_1 = \frac{64F}{\pi D^2} (1+\sqrt{2}), \quad \sigma_2 = \frac{64F}{\pi D^2} (1-\sqrt{2})$$

$$(4) F = \frac{\pi D^2}{64\sqrt{7}} \sigma_{pl}$$

$$(5) h = \frac{\sqrt{3}}{4} \frac{PdS}{\sigma_{pl}}$$

8.10

$$(1) \frac{F_0}{ah}$$

$$(2) F_1 = \frac{\sqrt{13}}{13} F_0$$

$$(3) T = \frac{\sqrt{3}\pi F_0 a^2}{6h}$$

8.11

$$(1) \frac{8\sqrt{3}F}{\pi R^2}$$

$$(2) F_1 = \frac{4\sqrt{39}}{13} F$$

$$(3) \quad h = \frac{25\pi PR^3 S}{4F}$$

8.12

$$(1) \quad \frac{16\sqrt{3}T_0}{\pi D^3}$$

$$(2) \quad \frac{\sqrt{21}}{48} \frac{F}{T_0} \frac{\pi D^3 S}{d}$$