

模块三 习题答案

1、解： $\sigma_1 = 400 + \sigma_3 = 500 \text{ kPa}$ $\sin \phi = \frac{\sigma_1 - \sigma_3}{\sigma_1 + \sigma_3} = 0.67$ $\phi = 41.81^\circ$

2、解： (1) $\tau_{\max} = \frac{\sigma_1 - \sigma_3}{2} = 250 \text{ kPa}$ $\alpha_{\tau_{\max}} = 45^\circ$

(2) 设与大主应力的夹角为 α

$$\alpha = 90^\circ - 30^\circ = 60^\circ \quad \sigma = \frac{1}{2}(\sigma_1 + \sigma_3) + \frac{1}{2}(\sigma_1 - \sigma_3)\cos 2\alpha = 325 \text{ kPa}$$

$$\tau = \frac{1}{2}(\sigma_1 - \sigma_3)\sin 2\alpha = 216 \text{ kPa}$$

3、解： ① 绘制 $\sigma - \tau_f$ 曲线，量得 $\phi = 26.6^\circ$ $c = 17.7 \text{ kPa}$

② $\sigma = 220 \text{ kPa}$ 时， $\tau_f = \sigma \tan \phi + c = \sigma \tan 26.6^\circ + 17.7 = 126.6 \text{ kPa} > \tau = 100 \text{ kPa}$

$\therefore$ 该平面内未发生剪切破坏。

4、解： 已知 $\sigma_3 = 160 \text{ kPa}$ $\phi = 35^\circ$ $c = 12 \text{ kPa}$ 剪切破坏时的最大主应力 σ_{1f} 可

按本判别式计算：

$$\begin{aligned} \sigma_{1f} &= \sigma_3 \tan^2 \left(45^\circ + \frac{\phi}{2} \right) + 2c \cdot \tan \left(45^\circ + \frac{\phi}{2} \right) = 160 \tan^2 62.5^\circ + 2 \times 12 \times \tan 62.5^\circ \\ &= 635.9 \text{ kPa} \end{aligned}$$

5、解： ① $\tau_f = \sigma \tan \phi$ $200 = 300 \tan \phi$ $\phi = 32.5^\circ$

② $\alpha_f = 45^\circ + \frac{\phi}{2} = 61.25^\circ$

③ $\alpha_f = 61.25^\circ$ $300 = \frac{1}{2}(\sigma_1 + \sigma_3) + \frac{1}{2}(\sigma_1 - \sigma_3)\cos (2 \times 61.25^\circ)$

$$200 = \frac{1}{2}(\sigma_1 - \sigma_3)\sin 122.5^\circ \quad \sigma_1 = 591.73 \text{ kPa} \quad \sigma_3 = 163 \text{ kPa}$$

6、解： 查表 3-7 得： $\eta_b = 0.3$ $\eta_d = 1.6$ $f_a = 260.58 \text{ kPa}$