


37 (5) 全断面積 $A = \frac{3\sqrt{3}}{2} a^2$.

$\sigma = \frac{P}{A} = \frac{2P}{3\sqrt{3}a^2}$, 

$\epsilon = \frac{\Delta l}{l} = \frac{\sigma_1}{E_1} = \frac{\sigma_2}{E_2} = \frac{1}{\frac{\pi d^2}{4} (1 - \frac{E_2}{E_1}) + \frac{3\sqrt{3}a^2}{2} \frac{E_2}{E_1}} \frac{P}{E_1}$

$E = \frac{\sigma}{\epsilon} = \frac{P}{\frac{3\sqrt{3}}{2} a^2} \frac{\pi d^2}{4} (1 - \frac{E_2}{E_1}) + \frac{3\sqrt{3}}{2} a^2 \frac{E_2}{E_1} E_1$

$= \left\{ \frac{2}{3\sqrt{3}} \left(\frac{d}{a}\right)^2 \left(1 - \frac{E_2}{E_1}\right) + \frac{E_2}{E_1} \right\} E_1$

$= \left\{ \frac{2}{3\sqrt{3}} \left(\frac{d}{a}\right)^2 (E_1 - E_2) + E_2 \right\}$

38 (1)

母材の断面積 $A_m = wt - n\pi r^2$.

鉄線の全断面積 $A_f = n\pi r^2$

$\sigma_f A_f + \sigma_m A_m = P$

$\frac{\sigma_f}{E_f} l = \frac{\sigma_m}{E_m} l$

$\therefore \sigma_f \left(A_f + \frac{E_m}{E_f} A_m \right) = P, \quad \sigma_f = \frac{E_f P}{E_f A_f + E_m A_m}$

$\therefore \sigma_f = \frac{E_f P}{E_f n\pi r^2 + E_m (wt - n\pi r^2)}$

$\sigma_m = \frac{E_m}{E_f} \sigma_f = \frac{E_m P}{E_f n\pi r^2 + E_m (wt - n\pi r^2)}$

(2)

$\sigma = \frac{P}{A} = \frac{P}{wt}$

$\epsilon = \frac{\sigma_f}{E_f} = \frac{\sigma_m}{E_m} = \frac{P}{E_f n\pi r^2 + E_m (wt - n\pi r^2)}$

$E = \frac{\sigma}{\epsilon} = E_f \frac{n\pi r^2}{wt} + E_m \left(1 - \frac{n\pi r^2}{wt} \right)$

(3) $\sigma_{f0} n\pi r^2 + \sigma_{m0} (wt - n\pi r^2) < P$