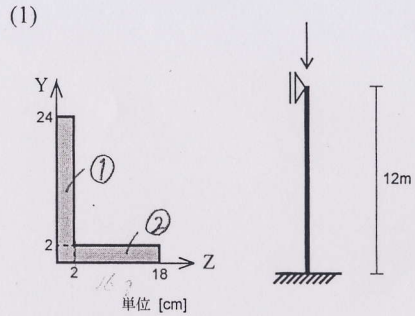


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第7回 練習問題 実施日2016/11/30			

問. (1), (2)の断面形状について断面積 $A$ , 断面左下を原点とした図心位置 $(Z_0, Y_0)$ , 図心を通る軸に関する断面2次モーメント $I_z, I_y$ , 断面相乗モーメント $I_{zy}$ を求めなさい。これらの値を用いて主断面2次モーメント $I_1, I_2$  (ただし $I_1 > I_2$ ) を求めなさい。また、鉛直荷重を受ける各構造物の座屈長さ $L_k$ , 座屈荷重 $P_{cr}$ , 座屈応力度 $\sigma_{cr}$ を求めなさい。ただし、ヤング係数 $E$ の値を $2.1 \times 10^6 \text{ kgf/cm}^2$ とし、解答はkgf, cmを用い、有効数字3桁で答えよ。



$$(Z_1, Y_1) = (Z_1 - Z_0, Y_1 - Y_0)$$

$$(Z_2, Y_2) = (Z_2 - Z_0, Y_2 - Y_0)$$

$$A_1 = 48 \quad A_2 = 32 \quad A = 80$$

$$Y_1 = 12 \quad Y_2 = 1$$

$$Z_1 = 1 \quad Z_2 = 10$$

$$S_z = 12 \times 48 + 32 \times 1 = 608$$

$$Y_0 = 7.6 = \frac{S_z}{A}$$

$$S_y = 48 \times 1 + 32 \times 10 = 368$$

$$Z_0 = 4.6 = \frac{S_y}{A}$$

$$I_z = (2 \times 24^3)/12 + 48 \times (12 - 7.6)^2$$

$$+ (16 \times 2^3)/12 + 32 \times (1 - 7.6)^2$$

$$= 3233.28 + 1404.587 = 4637.867$$

$$I_y = (24 \times 2^3)/12 + 48 \times (4.6 - 1)^2$$

$$+ (2 \times 16^3)/12 + 32 \times (4.6 - 10)^2$$

$$= 638.08 + 1615.787 = 2253.867$$

$$I_1 = 3445.867 + 2243.636$$

$$= 5689.503$$

$$I_2 = 3445.867 - 2243.636$$

$$= 1202.231$$

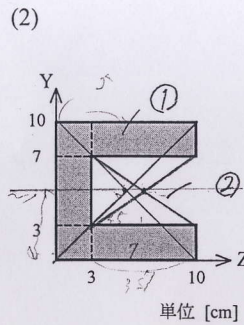
$$L_k = 0.7 \times 1200 = 840$$

$$P_{cr} = \frac{\pi^2 \times E \times I}{L_k^2} = 35314.120$$

$$O_{cr} = \frac{35314.120}{80} A = 80 \text{ cm}^2, Y_0 = 7.60 \text{ cm}, Z_0 = 4.60 \text{ cm}, I_1 = 4640 \text{ cm}^4$$

$$= 441.426 \quad I_y = 2250 \text{ cm}^4, I_{zy} = 1900 \text{ cm}^4, I_1 = 5690 \text{ cm}^4, I_2 = 1200 \text{ cm}^4$$

$$L_k = 840 \text{ cm}, P_{cr} = 35300 \text{ kgf/cm}^2, \sigma_{cr} = 441 \text{ kgf/cm}^2$$



$$A_1 = 100 \quad A_2 = 28 \quad A = 72$$

$$Y_1 = 5 \quad Y_2 = 5$$

$$Z_1 = 5 \quad Z_2 = 6.5$$

$$S_z = 100 \times 5 - 28 \times 5 = 360$$

$$Y_0 = 5.00$$

$$S_y = 100 \times 5 - 28 \times 6.5 = 318$$

$$Z_0 = 4.417$$

$$I_z = 10^4/12 - (7 \times 4^3)/12 + 0 = 796$$

$$I_y = 10^4/12 + 100(5 - 4.417)^2 - (4 \times 7^3)/12 - 28 \times (4.417 - 6.5)^2$$

$$= 631.5$$

$$I_{zy} = 100 \times (5 - 5) \times (5 - 4.417) - 28 \times (6.5 - 4.417) \times (5 - 5)$$

$$= 0$$

$$C = (796 + 631.499)/2 = 713.75$$

$$R = \sqrt{(796 - 631.499)^2/4 + 0^2} = 82.25$$

$$I_1 = 796 (C + R)$$

$$I_2 = 631.5 (C - R)$$

$$L_k = 0.5 \times 1500 = 750$$

$$P_{cr} = 23268.57$$

$$O_{cr} = 23268.57 / 72 = 323.174$$

$$A = 72.0 \text{ cm}^2, Y_0 = 5.00 \text{ cm}, Z_0 = 4.42 \text{ cm}, I_1 = 796 \text{ cm}^4$$

$$I_y = 632 \text{ cm}^4, I_{zy} = 0 \text{ cm}^4, I_1 = 796 \text{ cm}^4, I_2 = 632 \text{ cm}^4$$

$$L_k = 750 \text{ cm}, P_{cr} = 23300 \text{ kgf/cm}^2, \sigma_{cr} = 323 \text{ kgf/cm}^2$$