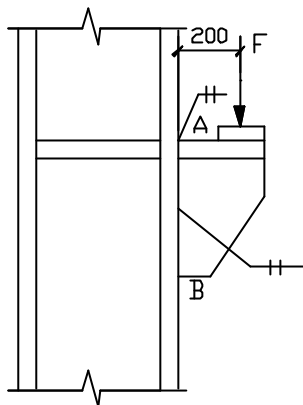
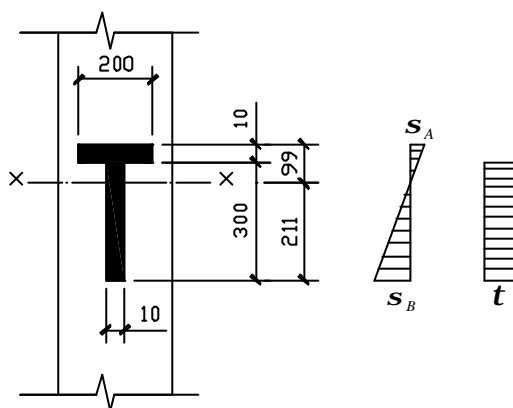


【题目】试验算如图所示牛腿与柱连接的对接焊缝的强度。荷载设计值 $F = 220\text{kN}$ 。钢材 Q235 - A · F, 焊条 E4303 型, 手工焊, 无引弧板, 焊缝质量三级 (假定剪力全部由腹板上的焊缝承受)。



【解答】

1. 确定对接焊缝计算截面的几何特性



(1) 计算中和轴的位置 (对水平焊缝的形心位置取矩)

$$y_A = \frac{(30-1) \times 1 \times 15.5}{(30-1) \times 1 + (20-1) \times 1} + 0.5 = 9.9\text{cm}$$

$$y_B = 31 - 9.9 = 21.1\text{cm}$$

(2) 焊缝计算截面的几何特性

全部焊缝计算截面的惯性矩

$$\begin{aligned} I_w &= \frac{1}{12} \times 1 \times (30-1)^3 + (30-1) \times 1 \times 6.1^2 + (20-1) \times 1 \times 9.4^2 \\ &= 4790\text{cm}^4 \end{aligned}$$

全部焊缝计算截面的抵抗矩

$$W_w^A = \frac{I_w}{y_A} = \frac{4790}{9.9} = 484\text{cm}^3$$

$$W_w^B = \frac{I_w}{y_B} = \frac{4790}{21.1} = 227 \text{ cm}^3$$

腹板焊缝计算截面的面积

$$A_w^w = (30 - 1) \times 1 = 29 \text{ cm}^2$$

2. 验算焊缝强度

(1) A点

$$s_A = \frac{M}{W_w^A} = \frac{220 \times 20 \times 10^4}{484 \times 10^3} = 90.9 \text{ N/mm}^2 < f_t^w = 185 \text{ N/mm}^2 \text{ (满足)}$$

(2) B点

$$s_B = \frac{M}{W_w^B} = \frac{220 \times 40 \times 10^4}{227 \times 10^3} = 193.8 \text{ N/mm}^2$$

$$t = \frac{F}{A_w^w} = \frac{220 \times 10^3}{29 \times 10^2} = 75.9 \text{ N/mm}^2$$

折算应力

$$\begin{aligned} \sqrt{s^2 + 3t^2} &= \sqrt{193.8^2 + 3 \times 75.9^2} = 234.2 \text{ N/mm}^2 < 1.1 f_c^w = 1.1 \times 215 \\ &= 236.5 \text{ N/mm}^2 \text{ (满足)} \end{aligned}$$