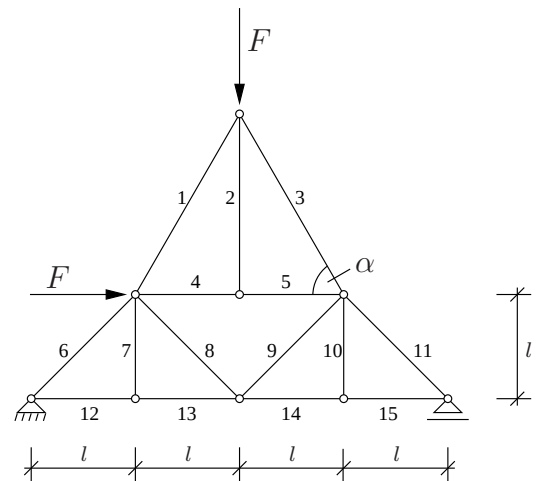


Aufgabe 3

Ein Fachwerk ist durch zwei Einzelkräfte F belastet.

1. Zeigen Sie, dass das System statisch bestimmt ist.
2. Berechnen Sie die Auflagerreaktionen.
3. Kennzeichnen Sie die offensichtlichen Nullstäbe.
4. Berechnen Sie sämtliche Stabkräfte.

Geg.: $F, l, \alpha = 60^\circ$.

**Lösung****1. Statische Bestimmtheit**

$$f = 2k - (a + s) = 2 \cdot 9 - (3 + 15) = 18 - 18 = 0$$

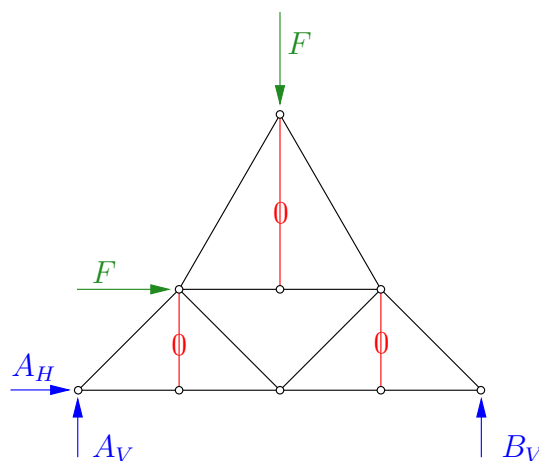
$\Rightarrow$ Das System ist innerlich statisch bestimmt.

2. Auflagerreaktionen

$$\rightarrow \Sigma H : \quad A_H + F = 0 \quad \Rightarrow A_H = -F$$

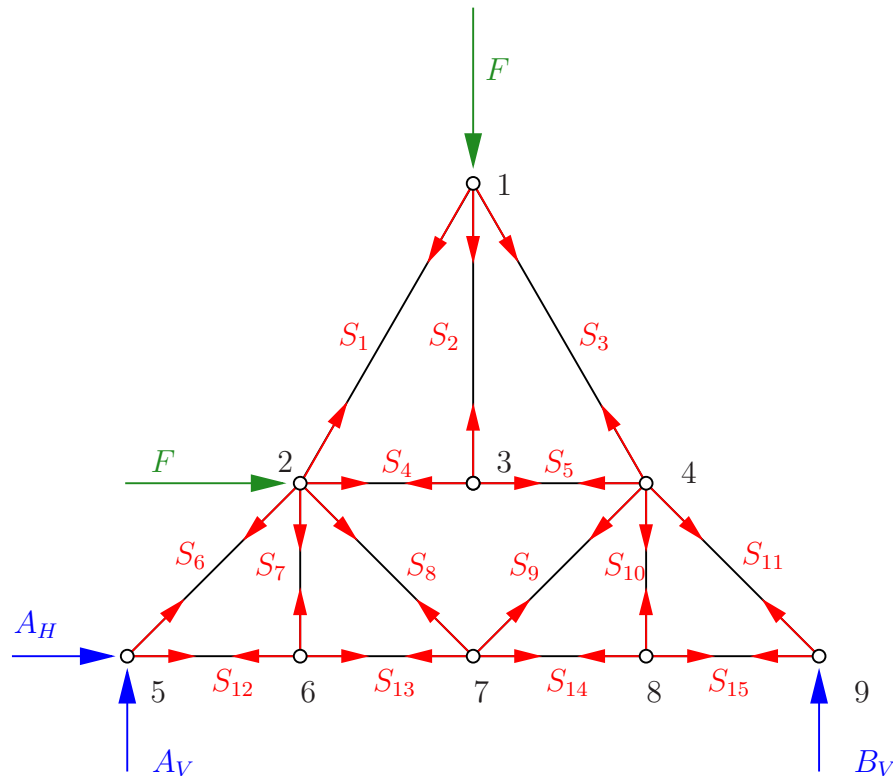
$$\curvearrowright \Sigma M_A : \quad -B_V \cdot 4l + F \cdot 2l + F \cdot l = 0 \quad \Rightarrow B_V = \frac{3}{4}F$$

$$\uparrow \Sigma V : \quad A_V + B_V = F \quad \Rightarrow A_V = \frac{1}{4}F$$

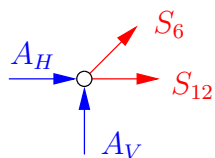
3. Offensichtliche Nullstäbe

4. Stabkräfte

4.1 Freischnitt



4.2 Knotengleichgewichte

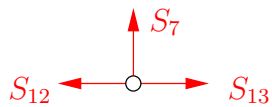


$$\uparrow \Sigma V : \quad \frac{1}{\sqrt{2}}S_6 + \frac{1}{4} = 0$$

$$\rightarrow S_6 = -\frac{\sqrt{2}}{4}F$$

$$\rightarrow \Sigma H : \quad S_{12} + \frac{1}{\sqrt{2}}S_6 - F = 0$$

$$\rightarrow S_{12} = \frac{5}{4}F$$

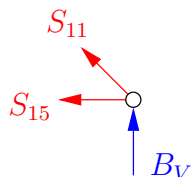


$$\uparrow \Sigma V : \quad S_7 = 0$$

$$\rightarrow S_7 = 0$$

$$\rightarrow \Sigma H : \quad S_{13} = S_{12}$$

$$\rightarrow S_{13} = \frac{5}{4}F$$

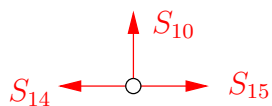


$$\uparrow \Sigma V : \quad \frac{1}{\sqrt{2}}S_{11} + \frac{3}{4}F = 0$$

$$\rightarrow S_{11} = -\frac{3\sqrt{2}}{4}F$$

$$\rightarrow \Sigma H : \quad -S_{15} - \frac{1}{\sqrt{2}}S_{11} = 0$$

$$\rightarrow S_{15} = \frac{3}{4}F$$

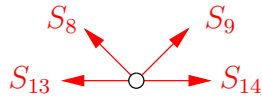


$$\uparrow \Sigma V : \quad S_{10} = 0$$

$$\rightarrow S_{10} = 0$$

$$\rightarrow \Sigma H : \quad S_{14} = S_{15}$$

$$\rightarrow S_{14} = \frac{3}{4}F$$



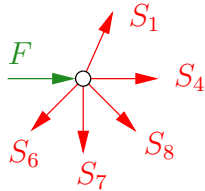
$$\uparrow \Sigma V : \frac{1}{\sqrt{2}}S_9 + \frac{1}{\sqrt{2}}S_8 = 0$$

$$\rightarrow S_9 = -S_8$$

$$\rightarrow \Sigma H : S_{14} - S_{13} + \frac{1}{\sqrt{2}}S_9 - \frac{1}{\sqrt{2}}S_8 = 0$$

$$\rightarrow S_8 = -\frac{\sqrt{2}}{4}F$$

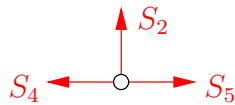
$$\rightarrow S_9 = \frac{\sqrt{2}}{4}F$$



$$\uparrow \Sigma V : \frac{\sqrt{3}}{2}S_1 - S_7 - \frac{1}{\sqrt{2}}S_8 - \frac{1}{\sqrt{2}}S_6 = 0$$

$$\rightarrow S_1 = -\frac{1}{\sqrt{3}}F$$

$$\rightarrow \Sigma H : S_4 + F + \frac{1}{2}S_1 + \frac{1}{\sqrt{2}}S_8 - \frac{1}{\sqrt{2}}S_6 = 0 \rightarrow S_4 = F \left(\frac{1}{2\sqrt{3}} - 1 \right)$$

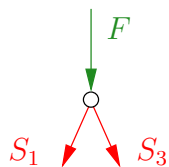


$$\uparrow \Sigma V : S_2 = 0$$

$$\rightarrow S_2 = 0$$

$$\rightarrow \Sigma H : S_4 = S_5$$

$$\rightarrow S_5 = F \left(\frac{1}{2\sqrt{3}} - 1 \right)$$



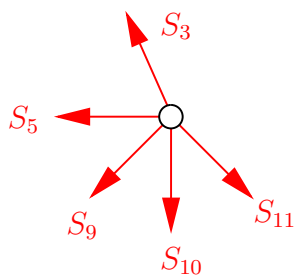
$$\uparrow \Sigma V : -F - \frac{\sqrt{3}}{2}S_1 - \frac{\sqrt{3}}{2}S_3 = 0$$

$$\rightarrow S_3 = -\frac{1}{\sqrt{3}}F$$

$$\rightarrow \Sigma H : \frac{1}{2}S_3 - \frac{1}{2}S_1 = 0$$

$$\frac{1}{2} \cdot \left(-\frac{1}{\sqrt{3}}F \right) - \frac{1}{2} \left(-\frac{1}{\sqrt{3}}F \right) = 0 \quad \checkmark$$

Probe:



$$\uparrow \Sigma V : \frac{\sqrt{3}}{2}S_3 - \frac{1}{\sqrt{2}}S_{11} - \frac{1}{\sqrt{2}}S_9 - S_{10} = 0$$

$$-\frac{1}{2}F + \frac{3}{4}F - \frac{1}{4}F - 0 = 0$$

$$0 = 0$$

✓

$$\rightarrow \Sigma H : -\frac{1}{2}S_3 - S_5 - \frac{1}{\sqrt{2}}S_9 + \frac{1}{\sqrt{2}}S_{11} = 0$$

$$\frac{1}{2\sqrt{3}}F - \frac{1}{2\sqrt{3}}F + F - \frac{1}{4}F - \frac{3}{4}F = 0$$

$$0 = 0$$

✓