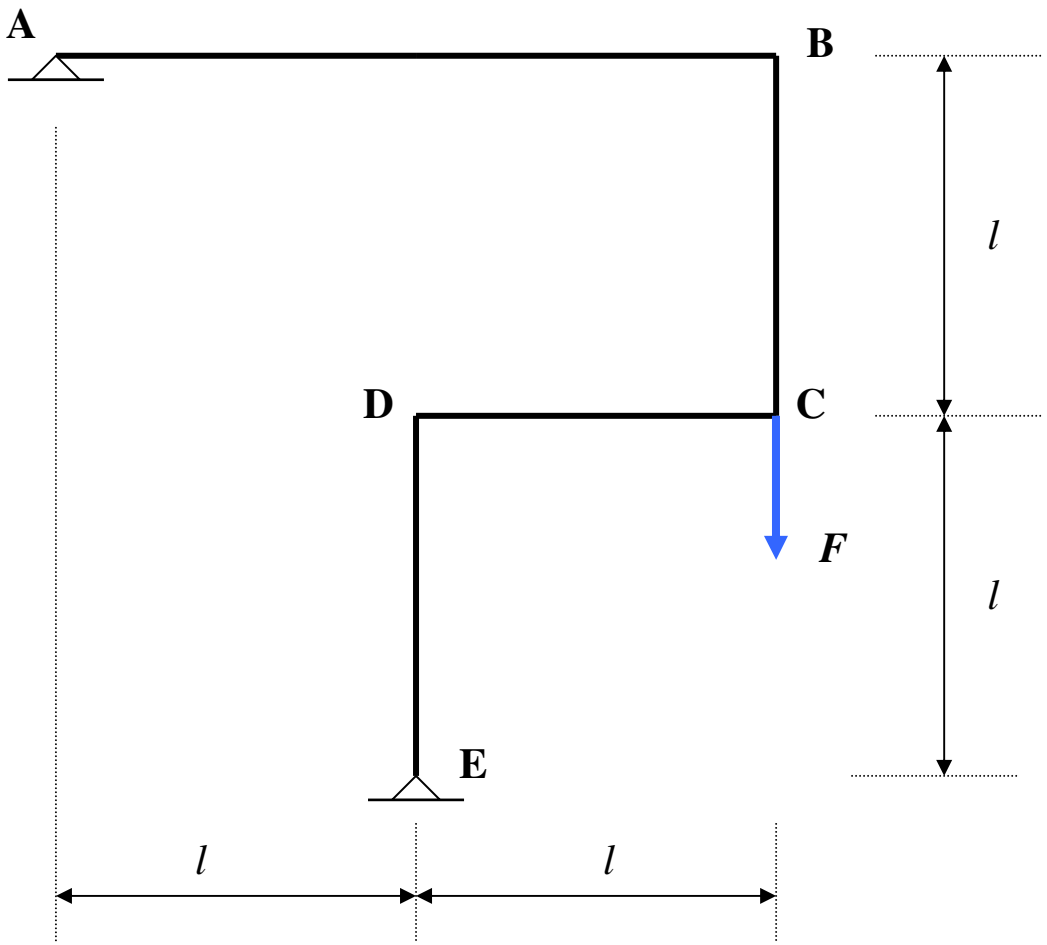
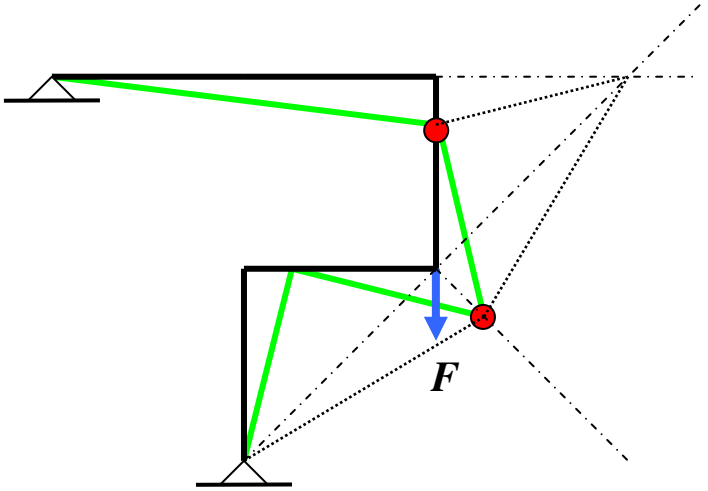
FIND THE COLLAPSE LOAD F_p

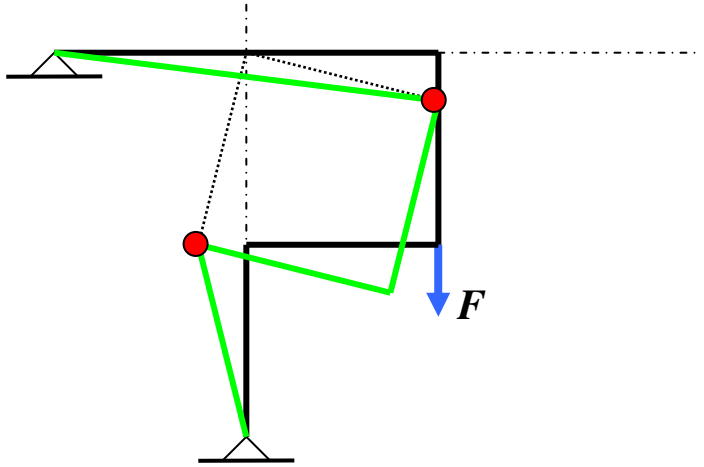


Analysis :

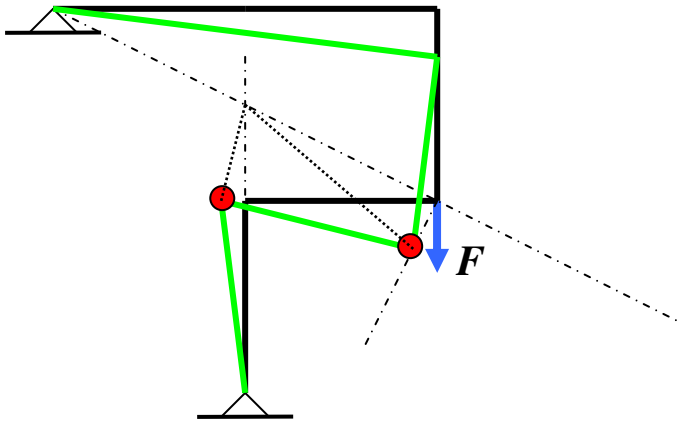
- Static indeterminate $n = 1$
- Max 2 hinges for a mechanism
- 3 possible positions for hinges (B,C,D)
- 3 possible failure mechanisms



1



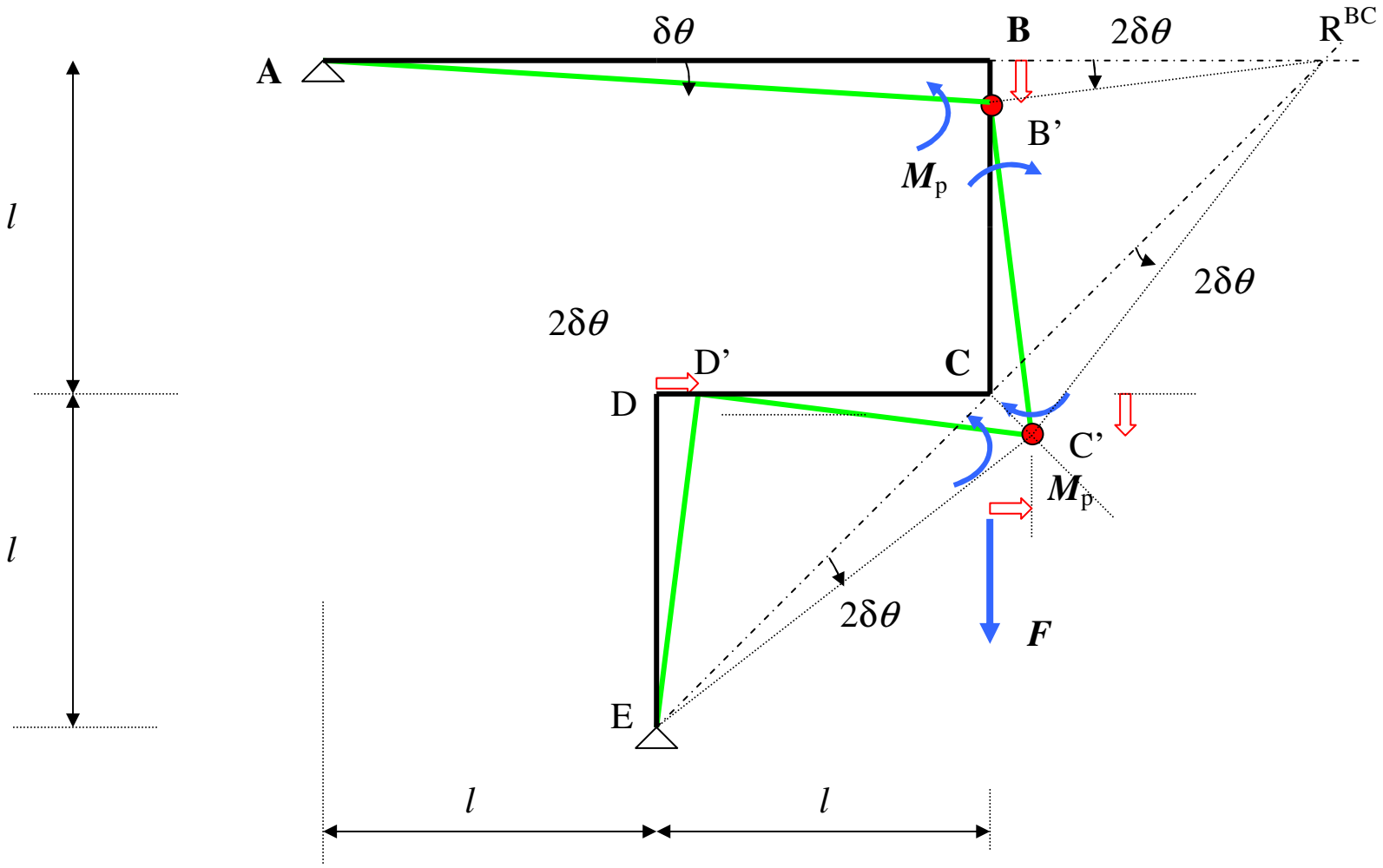
2



3

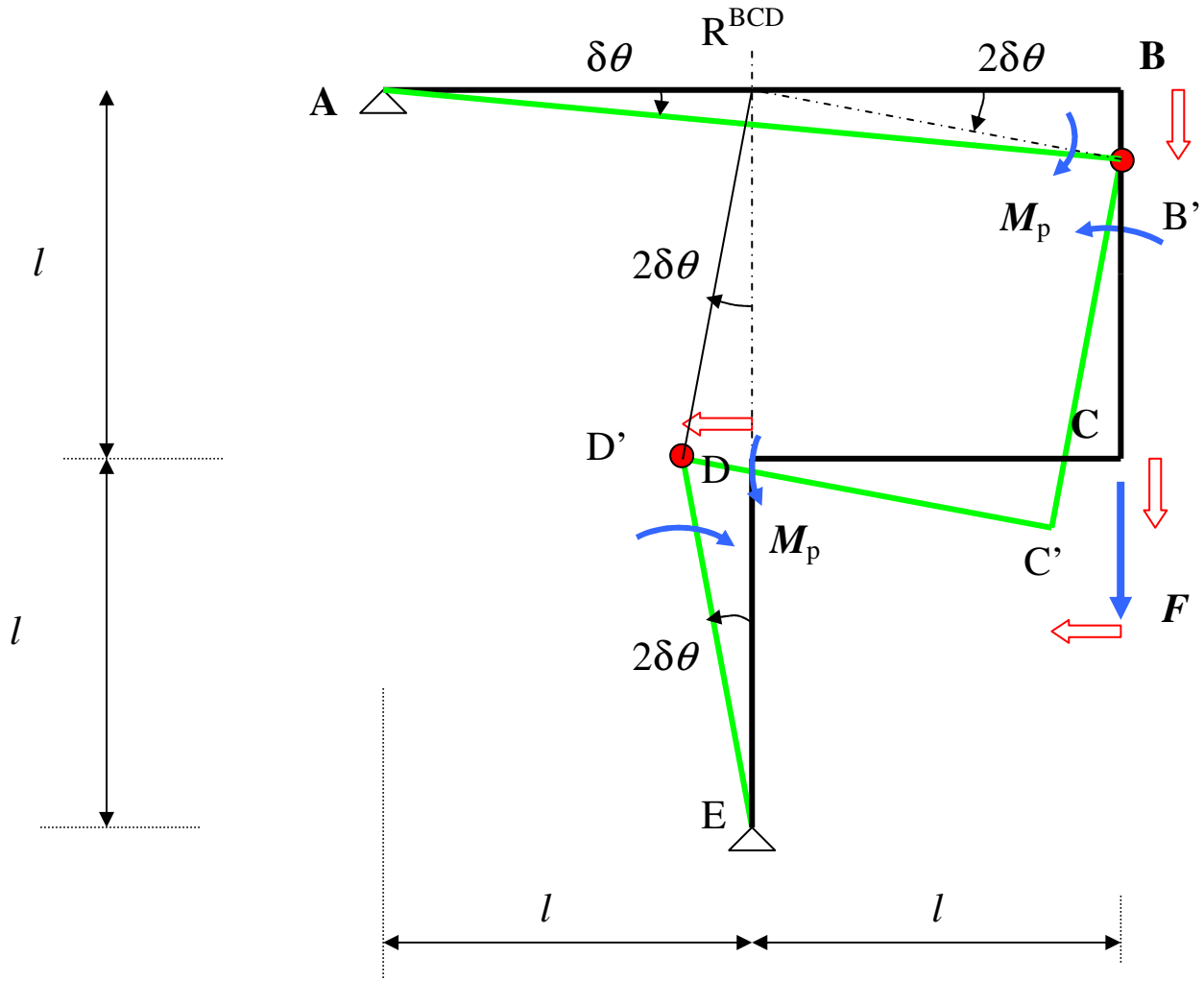
TU Delft

Mechanism 1

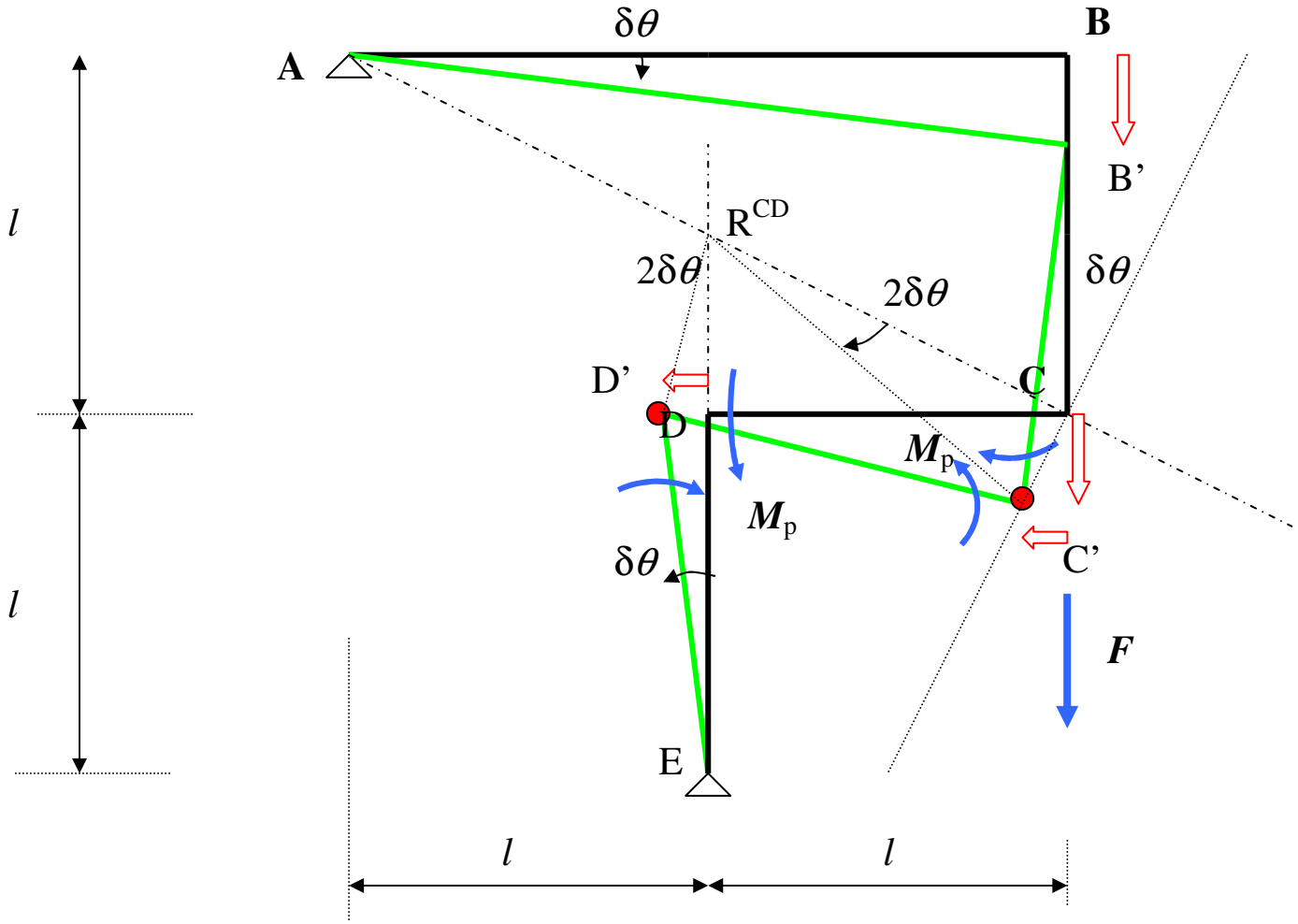


TU Delft

Mechanism 2



Mechanism 3



TU Delft

Virtual work

Mechanism 1

$$\delta A = -M_p \times \delta\theta - M_p \times 2\delta\theta - M_p \times 2\delta\theta - M_p \times 2\delta\theta + F \times 2\delta\theta \times l = 0$$

$$F_{p\text{-}1} = \frac{7M_p}{2l}$$

Mechanism 2

$$\delta A = +M_p \times \delta\theta - M_p \times 2\delta\theta - M_p \times 2\delta\theta - M_p \times 2\delta\theta + F \times 2\delta\theta \times l = 0$$

$$F_{p\text{-}2} = \frac{5M_p}{2l}$$

Mechanism 3

$$\delta A = +M_p \times \delta\theta - M_p \times 2\delta\theta - M_p \times 2\delta\theta - M_p \times \delta\theta + F \times 2\delta\theta \times l = 0$$

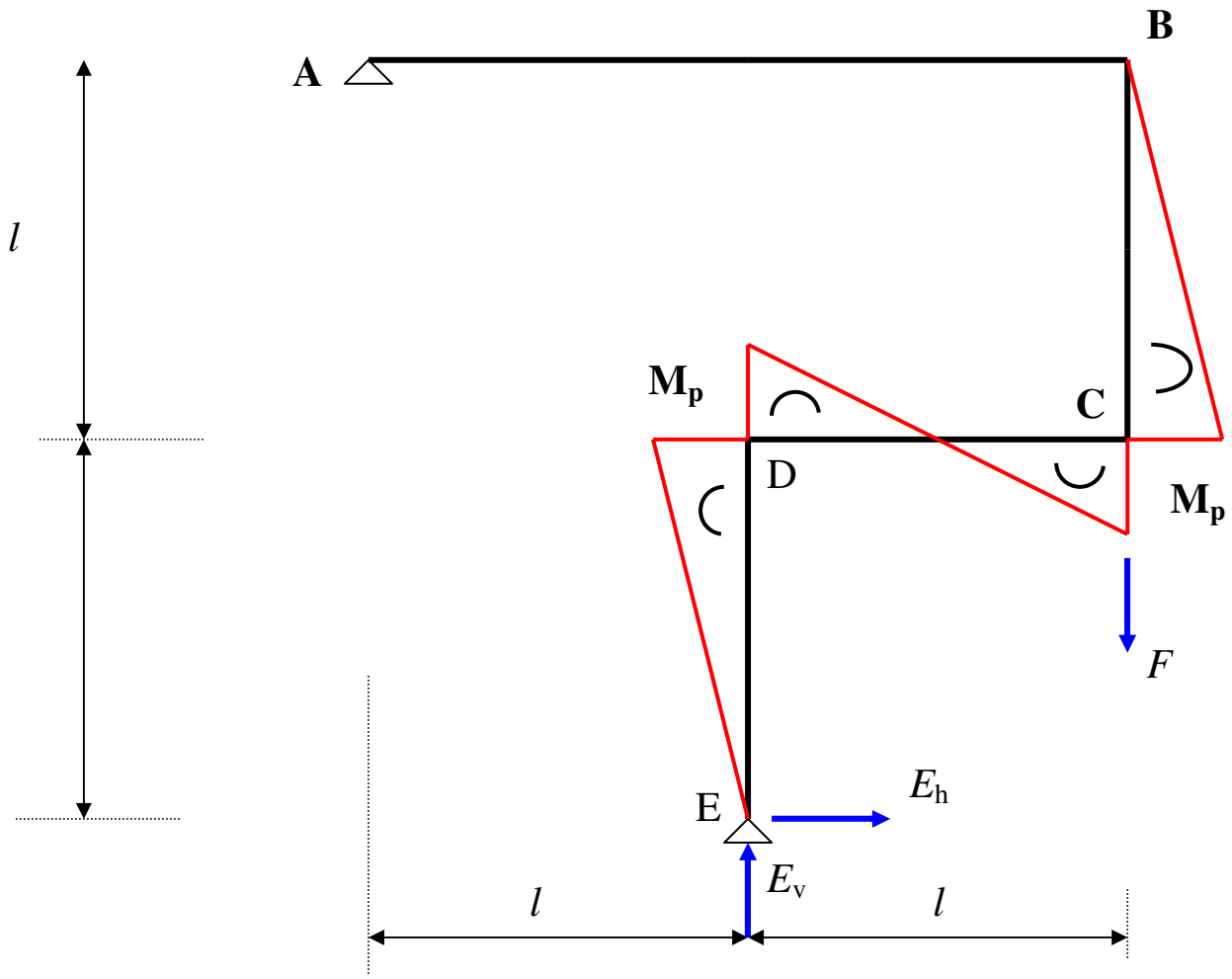
$$F_{p\text{-}3} = \frac{2M_p}{l}$$

COLLAPSE LOAD

TU Delft

MOMENT DISTRIBUTION MECHANISM 3

$$F_p = \frac{2M_p}{l}$$



Find the moment at **B** ?

1 Horizontal reaction at E:

$$\sum T|D = 0 \quad \Rightarrow \quad E_h \times l = M_p \quad \Rightarrow \quad E_h = \frac{M_p}{l} = \tfrac{1}{2} F_p$$

2 Find the vertical reaction at E with sum of moments around A:

$$\sum T|A = 0 \quad \Rightarrow \quad E_v \times l + E_h \times 2l - F_p \times 2l = 0$$

$$E_v = F_p$$

3 Find the moment at B:

$$A_v = 0 \quad \Rightarrow \quad M_B = 0$$