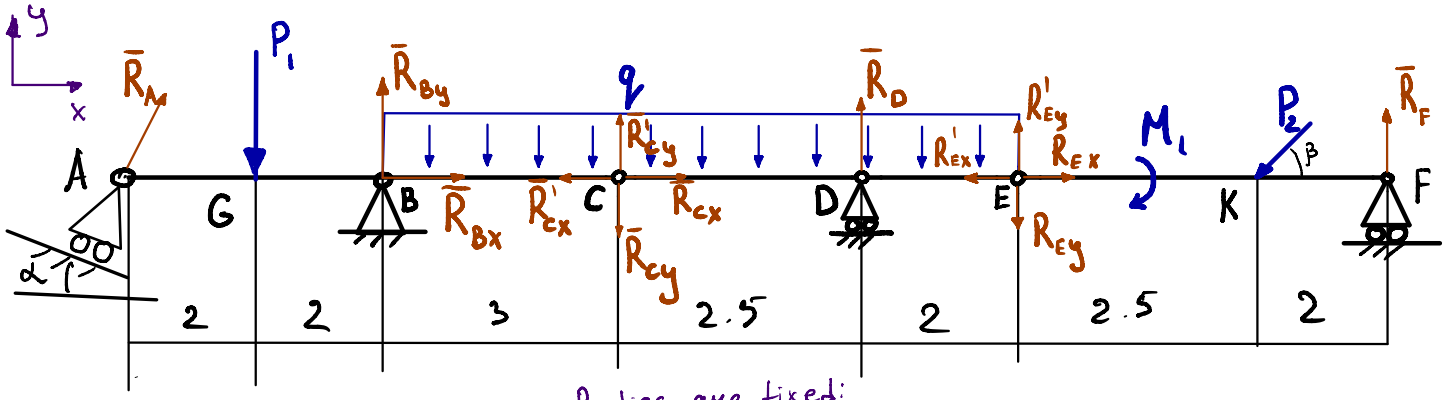


RO: 3 rigid bodies : AC, CE, EF.

Method: statics

Bodies are fixed:

AC: A-roller support R_A

B- support R_{Bx}, R_{By}

C-pin R'_{cx}, R'_{cy}

CE: C-pin R_{cx}, R_{cy}

D- roller support R_D

E-pin R'_{Ex}, R'_{Ey}

EF: E-pin R_{Ex}, R_{Ey}

F-roller support R_F

Force analysis:

AC: $R_A \to R_A \cos\alpha$, $R_A \to R_A \sin\alpha$

$\bar{R}'_{cy} = -\bar{R}_{cy}$; $\bar{R}'_{cx} = -\bar{R}_{cx}$

$\bar{R}'_{Ey} = -\bar{R}_{Ey}$; $\bar{R}'_{Ex} = -\bar{R}_{Ex}$

Solution:

AC:
$$\begin{cases} x: R_A \cos\alpha + R_{Bx} - R'_{cx} = 0 \\ y: R_A \sin\alpha + R_{By} + R'_{cy} - q \cdot BC - P_1 = 0 \\ M_A: -P_1 \cdot AG + R_{By} \cdot AB - q \cdot BC \cdot \left(AB + \frac{BC}{2}\right) + R'_{cy} \cdot AC = 0 \end{cases}$$

CE:
$$\begin{cases} x: R_{cx} - R'_{Ex} = 0 \\ y: -R_{cy} + R'_{Ey} + R_D - q \cdot CE = 0 \\ M_E: -R_D \cdot DE + q \cdot CE \cdot \frac{CE}{2} + R_{cy} \cdot CE = 0 \end{cases}$$

EF:
$$\begin{cases} x: R_{Ex} - P_2 \cdot \cos\beta = 0 \\ y: -R_{Ey} - P_2 \sin\beta + R_F = 0 \\ M_E: -P_2 \cdot (\sin\beta) \cdot EK - M_1 + R_F \cdot EF = 0 \end{cases}$$

EF:

$R_{Ex} = P_2 \cdot \cos\beta = 9$

$R_F = \dfrac{P_2 \cdot \sin\beta \cdot EK + M_1}{EF} = 16.66$

$R_{Ey} = R_F - P_2 \sin\beta = P_2 \cdot \sin\beta \left(\frac{EK}{EF} - 1\right) + \frac{M_1}{EF} = 1.0718$

CE:

$R_{cx} = R'_{Ex} = P_2 \cdot \cos\beta = 9$

$R_{cy} = R'_{Ey} + R_D - q \cdot CE = R_D - 5.228$

$-R_D \cdot DE + q \cdot \frac{CE^2}{2} + R_D \cdot CE - 5.228 \cdot \overset{-25.5}{CE} = 0$

$R_D = 3.74$

$R_{cy} = -1.487$

AC: $R_A \cdot \cos\alpha + R_{Bx} - 9 = 0$

$R_A \sin\alpha + R_{By} - 1.487 - 1.4 \cdot 3 \cdot 5.5 - 1.487 \cdot 7 = 0$

$R_{By} = \dfrac{P_1 \cdot AG + q \cdot BC\left(AB + \frac{BC}{2}\right) - R'_{cy} \cdot AC}{AB}$

$R_{By} = 14.38$

$R_A = 4.68$

$R_{Bx} = 9 - R_A \cdot \cos\alpha = 5.69.$

Answer:

$R_A = 4.68$

$R_{Bx} = 5.69$

$R_{By} = 14.38$

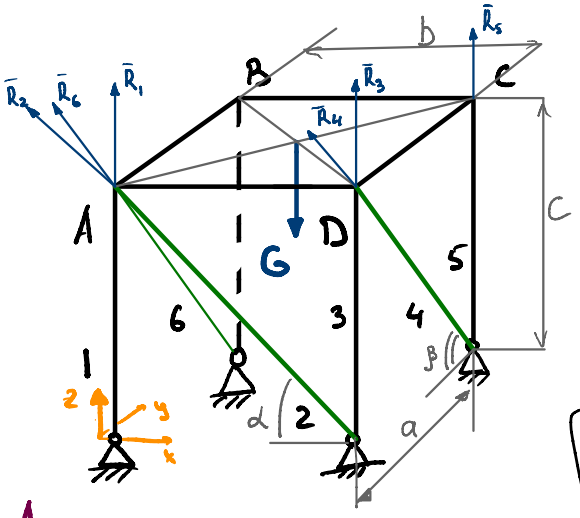
$R_{cx} = 9$

$R_{cy} = -1.487$

$R_D = 3.74$

$R_{ex} = 9.0$ $R_{ey} = 1.072$

$R_f = 16.66$



RO: 1 rigid body ABCD, 1-6 rods.

Method: statics

Body is fixed: A – rod 1 R_1, rod 2 R_2, rod 6 R_6; B – rod 3 R_3, rod 4 R_4; C – rod 5 R_5

Force analysis:

$R_2 \rightarrow$ x: $R_2 \cdot \cos\alpha$, z: $R_2 \cdot \sin\alpha$

$R_6 \rightarrow$ y: $-R_6 \cdot \cos\beta$, z: $R_6 \cdot \sin\beta$

$R_4 \rightarrow$ y: $-R_4 \cdot \cos\beta$, z: $R_4 \cdot \sin\beta$

Solution:

$$\begin{cases} x: & -R_2 \cdot \cos\alpha + P = 0 \\ y: & -R_6 \cdot \cos\beta - R_4 \cdot \cos\beta = 0 \\ z: & R_6 \cdot \sin\beta + R_4 \cdot \sin\beta + R_2 \cdot \sin\alpha + R_1 + R_3 + R_5 - G = 0 \\ M_{Ax}: & R_5 \cdot a - G \cdot \frac{a}{2} = 0 \\ M_{Ay}: & -(R_5 \cdot b + R_3 \cdot b + R_4 \cdot b \sin\beta) + G \cdot \frac{b}{2} = 0 \\ M_{Az}: & -R_4 \cdot \cos\beta \, b - P \cdot a = 0 \end{cases}$$

Answer:

$R_1 = -37.(6)$

$R_2 = 38.005848$

$R_3 = 23.(3)$

$R_4 = -35.43382$

$R_5 = 9.0$

$R_6 = 35.4338$