

$$\underline{F}_{G_6}^a = -m_6 \underline{a}_{G_6} = -8.1 (-28.82 \underline{i} + 162.3 \underline{j}) = (233.442 \underline{i} - 1314.63 \underline{j}) \text{ N}$$

$$\underline{T}_{G_6}^a = -\frac{1}{12} m_6 |AB|^2 \cdot \alpha_6 \underline{k} = -\frac{1}{12} (8.1) (0.45)^2 (-219.2 \underline{k}) = (29.96 \underline{k}) \text{ Nm}$$


$$\underline{W}_6 = -8.1 \cdot (9.81 \underline{j}) = -79.46 \underline{j} \text{ N}$$

6 nolu vize

$$\sum M_A = 0 \quad (7)$$

$$\begin{aligned} & -(F_{56} \cos 6.6)(0.45 \cos 7.34) - (F_{56} \sin 6.6)(0.45 \sin 7.34) \\ & + 233.442 (0.225 \cos 7.34) + (1314.63 + 79.46) (0.225 \sin 7.34) \\ & + 29.96 = 0 \end{aligned}$$

$$- 0.44996 F_{56} + 122.1276 = 0$$

$F_{56} = 271.42 \text{ N}$  $= F_{45}$

$$\rightarrow \sum F_x = 0$$

$$F_{16x} + 233.442 - 271.42 \cos 6.6 = 0$$

$F_{16x} = 36.18 \text{ N}$ \rightarrow

$$\uparrow \sum F_y = 0$$


$$F_{16y} - 1314.63 - 79.46 + 271.42 \sin 6.6 = 0$$

$F_{16y} = 1362.9 \text{ N}$ \uparrow

4 nolu uzuv

$$\rightarrow \sum F_x = 0$$

$$271.42 \cos 6.6 - F_{34} \cos 16.78 = 0$$

$F_{34} = 281.6 \text{ N}$  $= F_{23} = F_{12}$

2 nolu uzuv

$$\sum M_E = 0$$

$$T_2 - (281.6 \cos 16.78)(0.45 \sin 60) - (281.6 \sin 16.78)(0.45 \cos 60) = 0$$

$$T_2 = 123.36 \text{ Nm}$$

$T_2 = 123.36 \text{ Nm}$ \leftarrow

$$|OE| = 0.45 \text{ m} \quad |AB| = 0.45 \text{ m}$$

$$|ED| = 1.35 \text{ m} \quad |BC| = 0.375 \text{ m}$$

$$\omega_2 = 26.18 \text{ rad/s} \quad (2)$$

$$\theta_2 = 60^\circ \quad (3)$$

$$\theta_3 = 343.22^\circ$$

$$\theta_5 = 353.4^\circ$$

$$\theta_6 = 262.66^\circ$$

$$\underline{OE} + \underline{ED} = \underline{OD} \quad (1) \quad (2)$$

$$\underline{AB} + \underline{BC} = \underline{AC} \quad (2) \quad (2)$$

$$\left. \begin{aligned} 0.45 \cos \theta_2 + 1.35 \cos \theta_3 &= OD \\ 0.45 \sin \theta_2 + 1.35 \sin \theta_3 &= 0 \end{aligned} \right\} \begin{aligned} -0.45 \omega_2 \sin \theta_2 - 1.35 \omega_3 \sin \theta_3 &= \frac{v}{4} \\ 0.45 \omega_2 \cos \theta_2 + 1.35 \omega_3 \cos \theta_3 &= 0 \end{aligned}$$

$$\left. \begin{aligned} 0.45 \cos \theta_6 + 0.375 \cos \theta_5 &= S_{AC} \\ 0.45 \sin \theta_6 + 0.375 \sin \theta_5 &= -0.49 \end{aligned} \right\} \begin{aligned} -0.45 \omega_6 \sin \theta_6 - 0.375 \omega_5 \sin \theta_5 &= \frac{v}{4} \\ 0.45 \omega_6 \cos \theta_6 + 0.375 \omega_5 \cos \theta_5 &= 0 \end{aligned}$$

$$\omega_3 = \frac{-0.45 \cos \theta_2}{1.35 \cos \theta_3} \omega_2 \Rightarrow \boxed{\omega_3 = -0.174 \omega_2} \quad \checkmark$$

$$\omega_5 = -\frac{0.45 \cos \theta_6}{0.375 \cos \theta_5} \omega_6 \Rightarrow \boxed{\omega_5 = 0.1543 \omega_6} \quad \checkmark$$

$$\begin{aligned} * -0.45 \omega_2 \sin 60 - 1.35 (-0.174 \omega_2) \sin 343.22 &= -0.45 \omega_6 \sin 262.66 \\ &- 0.375 (0.1543 \omega_6) \sin 353.4 \end{aligned}$$

$$-0.4575 \omega_2 = 0.453 \omega_6$$

$$\boxed{\omega_6 = -26.44 \text{ rad/s}} \quad (2)$$

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$$\underline{\underline{r}}_{G_6} = \underline{\underline{OA}} + \underline{\underline{AG_6}} \quad (3)$$

$$\underline{\underline{r}}_{G_6} = 0.975 \underline{\underline{i}} + 0.64 \underline{\underline{j}} + 0.225 (\cos \theta_6 \underline{\underline{i}} + \sin \theta_6 \underline{\underline{j}})$$

$$\underline{\underline{v}}_{G_6} = 0.225 (-\omega_6 \sin \theta_6 \underline{\underline{i}} + \omega_6 \cos \theta_6 \underline{\underline{j}})$$

$$\underline{\underline{a}}_{G_6} = 0.225 \left[(-\alpha_6 \sin \theta_6 - \omega_6^2 \cos \theta_6) \underline{\underline{i}} + (\alpha_6 \cos \theta_6 - \omega_6^2 \sin \theta_6) \underline{\underline{j}} \right]$$

$$\underline{\underline{v}}_{G_6} = (-5.9 \underline{\underline{i}} + 0.76 \underline{\underline{j}}) \text{ m/s} \quad (4) \quad \Downarrow$$

$$\underline{\underline{a}}_{G_6} = (-28.82 \underline{\underline{i}} + 162.3 \underline{\underline{j}}) \text{ m/s}^2$$

$$\begin{aligned} \underline{\underline{F}}_{G_6}^a &= -m_6 \underline{\underline{a}}_{G_6} \Rightarrow m_6 = 8.1 \text{ kg} \\ &= -8.1 \times (-28.82 \underline{\underline{i}} + 162.3 \underline{\underline{j}}) \\ &= (233.442 \underline{\underline{i}} - 1314.63 \underline{\underline{j}}) \text{ N} \end{aligned}$$

$$\underline{\underline{T}}_{G_6}^a = -\frac{1}{12} 8.1 \cdot (0.45)^2 \cdot (-219.2) = (29.96 \underline{\underline{k}}) \text{ Nm}$$

$$\underline{\underline{T}}_2 \underline{\underline{\omega}}_2 + \underline{\underline{T}}_{G_6}^a = \underline{\underline{\omega}}_6 + \underline{\underline{F}}_{G_6}^a \cdot \underline{\underline{v}}_{G_6} = 0$$

$$T_2 \cdot 26.18 + (29.94 \cdot 26.44) + (233.442 \underline{\underline{i}} - 1314.63 \underline{\underline{j}}) \cdot (-5.9 \underline{\underline{i}} + 0.76 \underline{\underline{j}}) = 0$$

~~$T_2 = 121.03 \text{ Nm}$~~
 123.336 Nm (1)

2)

$$m_1 \underline{e}_1 = 5 \times 0.5 \times 10^{-3} \underline{i} = (2.5 \times 10^{-3} \underline{i}) \text{ kg m} \quad (1) \quad (5)$$

$$m_2 \underline{e}_2 = 4 \times 0.8 \times 10^{-3} (\cos 100 \underline{i} + \sin 100 \underline{j}) \quad (1)$$

$$= (-0.555 \underline{i} + 3.15 \underline{j}) \times 10^{-3} \text{ kg m}$$

$$m_3 \underline{e}_3 = 3 \times 0.6 \times 10^{-3} (\cos 175 \underline{i} + \sin 175 \underline{j}) \quad (1)$$

$$= (-1.793 \underline{i} + 0.157 \underline{j}) \times 10^{-3} \text{ kg m}$$

$$m_4 \underline{e}_4 = 6 \times 0.8 \times 10^{-3} (\cos 270 \underline{i} + \sin 270 \underline{j}) \quad (1)$$

$$= (-4.8 \times 10^{-3} \underline{j}) \text{ kg m}$$

$$m_L \underline{e}_L = m_L e_L (\cos \theta_L \underline{i} + \sin \theta_L \underline{j})$$

$$m_R \underline{e}_R = m_R e_R (\cos \theta_R \underline{i} + \sin \theta_R \underline{j})$$

$$\sum \underline{M}_L = 0 \quad (1)$$

$$-(0.2 \underline{k}) \times (2.5 \times 10^{-3} \underline{i}) + (0.4 \underline{k}) \times (-0.555 \underline{i} + 3.15 \underline{j}) \times 10^{-3}$$

$$+ (0.6 \underline{k}) \times (-1.793 \underline{i} + 0.157 \underline{j}) \times 10^{-3} + (0.8 \underline{k}) \times (-4.8 \times 10^{-3} \underline{j})$$

$$+ (0.65 \underline{k}) \times [m_R e_R (\cos \theta_R \underline{i} + \sin \theta_R \underline{j})] = 0$$

$$\underline{i} : (-1.26 - 0.0942 + 3.84) \times 10^{-3} - 0.65 m_R e_R \sin \theta_R = 0$$

$$\underline{j} : (-0.5 - 0.222 - 1.076) \times 10^{-3} + 0.65 m_R e_R \cos \theta_R = 0$$

\downarrow
m_R e_R

$$0.65 m_R e_R \sin \theta_R = 2.4858 \times 10^{-3}$$

$$0.65 m_R e_R \cos \theta_R = 1.798 \times 10^{-3}$$

$$\theta_R = \tan^{-1} \left(\frac{2.4858}{1.798} \right) = 54.4^\circ \quad \boxed{54.12^\circ} \quad (2)$$

$$e_R = 5 \text{ cm} = 0.05 \text{ m}$$

$$m_R = \frac{\cancel{2.4858 \times 10^{-3}} \quad 1.798 \times 10^{-3}}{(0.65)(0.05) \cos 54.4} = \cancel{0.1314 \text{ kg}} \quad 0.0943 \text{ kg} \quad (2)$$

$$\approx \cancel{131 \text{ gram}} \quad 94.393 \text{ gr}$$

$$m_R \underline{e}_R = 0.13 \cdot 0.05 (\cos 54.4 \underline{i} + \sin 54.4 \underline{j})$$

$$= (3.78 \underline{i} + 5.285 \underline{j}) \times 10^{-3} \text{ kgm}$$

$$(2.763 \underline{i} + 3.82 \underline{j})$$

$$m_1 \underline{e}_1 + m_2 \underline{e}_2 + m_3 \underline{e}_3 + m_4 \underline{e}_4 + m_R \underline{e}_R + m_L \underline{e}_L = 0$$

$$m_L \underline{e}_L = (-3.932 \underline{i} + 3.792 \underline{j}) \times 10^{-3} \text{ kgm}$$

$$(-2.915 \underline{i} - 2.327 \underline{j}) \cdot 10^{-3} \text{ kgm}$$

$$\theta_L = \tan^{-1} \left(\frac{3.792}{-3.932} \right) = -43.96^\circ \quad 38.555^\circ$$

$$= 136.04^\circ \quad \boxed{218.599^\circ} \quad (2)$$

$$m_L e_L = \sqrt{(-3.932)^2 + (3.792)^2} \times 10^{-3}$$

$$= 5.46 \times 10^{-3} \text{ kgm} \quad 3.729 \cdot 10^{-3} \text{ kgm}$$

$$m_L = \frac{5.46 \times 10^{-3}}{0.05} = 0.1092 \text{ kg} \quad 0.0745 \text{ kg} \quad (2)$$

$$\approx 109 \text{ gram} \quad 74.55 \text{ gr}$$