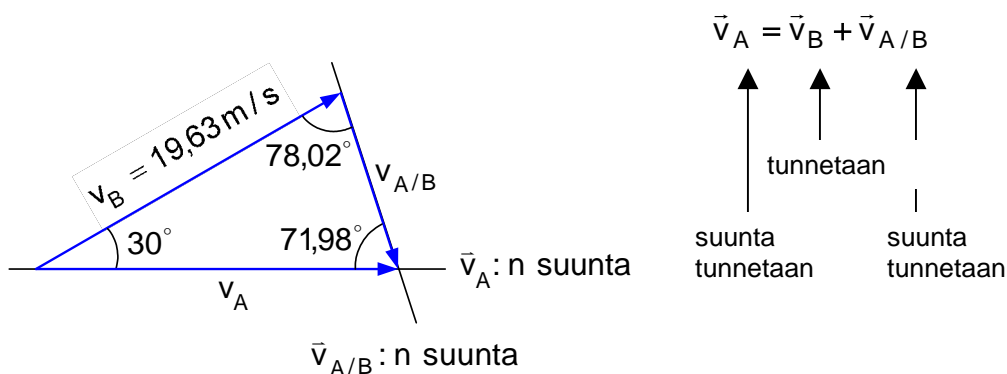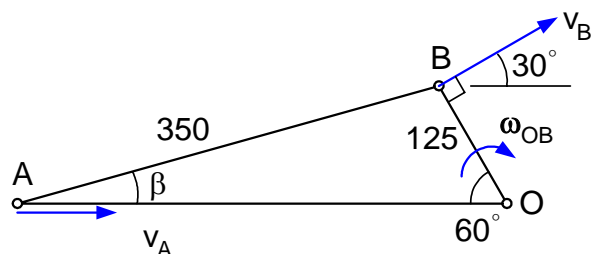5.14 Kuvan mukaisessa mäntämekanismissa kammen OB pyörimisnopeus on 1500 r/min myötäpäivään ja kulma $\theta = 60°$. Määritä männän A nopeus, kiertokangen pisteen G nopeus ja kiertokangen kulmanopeus. $OB = 125\,mm$, $BG = 100\,mm$ ja $AG = 250\,mm$.

Ratkaisu:

$$\frac{\sin\beta}{125\,mm} = \frac{\sin 60°}{350\,mm} \qquad \Rightarrow \qquad \beta = 18{,}02° \qquad \omega_{OB} = 1500\frac{2\pi}{60\,s} = 157{,}08\frac{1}{s}$$

$$v_B = OB \cdot \omega_{OB} = 0{,}125\,m \cdot 157{,}08\frac{1}{s}$$

$$\Rightarrow \qquad v_B = 19{,}63\frac{m}{s}$$

$$\vec{v}_A = \vec{v}_B + \vec{v}_{A/B}$$

tunnetaan

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$\vec{v}_{A/B} \perp AB \qquad 90° - \beta = 71{,}98° \qquad\qquad \vec{v}_A \;\rightarrow\qquad \vec{v}_B \perp OB$

$$\frac{\sin 78{,}02°}{v_A} = \frac{\sin 71{,}98°}{19{,}63\,m/s} \qquad \Rightarrow \qquad v_A = 20{,}19\frac{m}{s} \;\rightarrow$$

$$\frac{\sin 30°}{v_{A/B}} = \frac{\sin 71{,}98°}{19{,}63\,m/s} \qquad \Rightarrow \qquad v_{A/B} = 10{,}32\frac{m}{s}$$

$$\omega_{AB} = \frac{v_{A/B}}{AB} = \frac{10{,}32}{0{,}35}\frac{1}{s} \qquad \Rightarrow \qquad \omega_{AB} = 29{,}49\frac{1}{s} \quad \text{vastapäivään}$$

$$\vec{v}_G = \vec{v}_B + \vec{v}_{G/B}$$

tunnetaan

tunnetaan
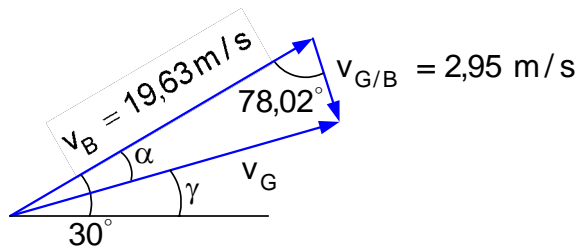
$$v_{G/B} = \omega_{AB} \cdot BG = 29{,}49\,\frac{1}{s} \cdot 0{,}1m = 2{,}95\,\frac{m}{s} \qquad \vec{v}_{G/B} \perp GB$$

$$v_G^2 = (19{,}63^2 + 2{,}95^2 - 2 \cdot 19{,}63 \cdot 2{,}95 \cdot \cos 78{,}02^\circ) \qquad \Rightarrow \qquad v_G = 19{,}24\,\frac{m}{s}$$

$$\frac{\sin\alpha}{2{,}95\,m/s} = \frac{\sin 78{,}02^\circ}{19{,}24\,m/s} \qquad \Rightarrow \qquad \alpha = 8{,}63^\circ \qquad \Rightarrow \qquad \gamma = 21{,}37^\circ$$