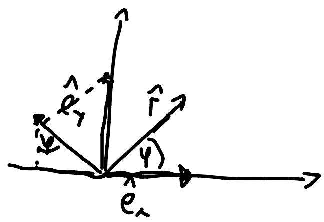
6.2

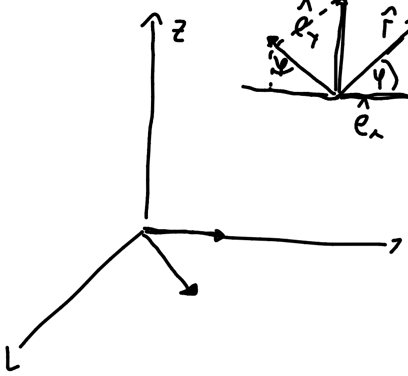
Tuesday, November 22, 2022 5:17 PM

$\varrho(\varphi) = A(\sin\varphi + \cos\varphi)$

$\varphi(t) = \omega t \; ; \; z(t) = 0$

$t_1 = 0 \; , \; t_2 = \frac{3\pi}{4\omega}$





$\hat{e}_\varrho = \cos\varphi\, \hat{e}_x + \sin\varphi\, \hat{e}_y \Rightarrow \dot{\hat{e}}_\varrho = \dot{\varphi}\, \hat{e}_\varphi$

$\hat{e}_\varphi = -\sin\varphi\, \hat{e}_x + \cos\varphi\, \hat{e}_y \Rightarrow \dot{\hat{e}}_\varphi = -\dot{\varphi}\, \hat{e}_\varrho$

$\vec{\varrho}(t) = \varrho\, \hat{e}_\varrho + z\, \hat{e}_z$

$\vec{v}(t) = \dot{\varrho}\, \hat{e}_\varrho + \varrho\dot{\varphi}\, \hat{e}_\varphi + \dot{z}\, \hat{e}_z$

$a(t) = \ddot{\varrho}\, \hat{e}_\varrho + \dot{\varphi}\dot{\varrho}\, \hat{e}_\varphi + \dot{\varrho}\dot{\varphi}\, \hat{e}_\varphi + \varrho\ddot{\varphi}\, \hat{e}_\varphi - \varrho\dot{\varphi}^2 e_\varrho + \ddot{z}\hat{e}_z$

$\Rightarrow a(t) = (\ddot{\varrho} - \varrho\dot{\varphi}^2)\hat{e}_\varrho + (2\dot{\varrho}\dot{\varphi} + \varrho\ddot{\varphi})\hat{e}_\varphi + \ddot{z}\, \hat{e}_z$

$\vec{\varrho}(t) = A(\sin\omega t + \cos\omega t)\hat{e}_\varrho \; ; \; \varphi(t) = \omega t$

$v^2 = A^2\omega^2(1 - 2\sin\omega t \ldots 1 + \ldots) =$

$= 2A^2\omega^2$

$\Rightarrow \vec{v}(t) = A\omega(\cos\omega t - \sin\omega t)\hat{e}_\varrho + A\omega(\sin\omega t + \cos\omega t)\hat{e}_\varphi$

$$\Rightarrow \quad \vec{v}(t) = A\omega(\cos\omega t - \sin\omega t)\hat{e}_\varrho + A\omega(\sin\omega t + \cos\omega t)\hat{e}_\varphi$$

$= 2A^2\omega^2$

$$\vec{a}(t) = -A\omega^2(\sin\omega t + \cos\omega t)\hat{e}_\varrho + A\omega^2(\cos\omega t - \sin\omega t)\hat{e}_\varphi$$
$$+ A\omega^2(-\sin\omega t + \cos\omega t)\hat{e}_\varphi - A\omega^2(\sin\omega t + \cos\omega t)\hat{e}_\varrho$$

$$\vec{a}(t) = -2A\omega^2(\sin\omega t + \cos\omega t)\hat{e}_\varrho + 2A\omega^2(\cos\omega t - \sin\omega t)\hat{e}_\varphi$$

$$\hat{t} = \frac{\frac{d\vec{r}}{dt}}{\left|\frac{d\vec{r}}{dt}\right|} = \frac{\vec{v}}{|v|} \;; |V| = A\omega\sqrt{(\cos^2\omega t + \sin\omega t)\cdot 2} = A\omega\sqrt{2}$$

$$\Rightarrow \hat{t} = \frac{1}{\sqrt{2}}\left[(\cos\omega t - \sin\omega t)\hat{e}_\varrho + (\cos\omega t + \sin\omega t)\hat{e}_\varphi\right]$$

$$\hat{n} = \frac{\frac{d\hat{t}}{dt}}{\left|\frac{d\hat{t}}{dt}\right|} \qquad \dot{\hat{t}} = \frac{2\omega}{\sqrt{2}}\left[(-\sin\omega t - \cos\omega t)\hat{e}_\varrho + (\cos\omega t - \sin\omega t)\hat{e}_\varphi\right]$$

$$|\dot{\hat{t}}| = \frac{2\omega}{\sqrt{2}}\sqrt{2} = 2\omega$$

$$\Rightarrow \quad \hat{n} = \frac{1}{\sqrt{2}}\left[(-\sin\omega t - \cos\omega t)\hat{e}_\varrho + (\cos\omega t - \sin\omega t)\hat{e}_\varphi\right]$$

$$a_t = \hat{t}\cdot\vec{a} = \frac{2A\omega^2}{\sqrt{2}}\left[+\sin^2\omega t - \cos^2\omega t + \cos^2\omega t - \sin^2\omega t\right] = 0$$

$$a_n = \vec{a}\cdot\hat{n} = \frac{2A\omega^2}{\sqrt{2}}\left[1 + 2\sin\omega t\cos\omega t + 1 - 2\sin\omega t\cos\omega t\right] = \frac{4A\omega^2}{\sqrt{2}}$$

$^2 \quad ^2 \quad = A^2\omega^2 \quad A$

$$a_n = \frac{v^2}{\rho} \Rightarrow \rho = \frac{v^2}{a_n} = \frac{\cancel{2} A^{\cancel{2}} \cancel{\omega^2}}{\cancel{2}\sqrt{2}\, \cancel{A} \cancel{\omega^2}} = \frac{A}{\sqrt{2}}$$

$$\vec{r} = r(t)\,\hat{e}_r + z\,\hat{e}_z$$

$$d\vec{r} = dr(t)\,\hat{e}_r + d\varphi \cdot r\,\hat{e}_\varphi + dz\,\hat{e}_z$$

$$\Rightarrow ds = \sqrt{dr^2 + r^2 d\varphi^2 + dz^2}$$

$$z(t) = 0 \Rightarrow dz = 0$$

$$\varphi(t) = \omega t \Rightarrow d\varphi = \omega\, dt$$

$$r = A(\sin\omega t + \cos\omega t) \Rightarrow dr = A\omega(\cos\omega t - \sin\omega t)\,dt$$

$$\Rightarrow \quad ds = \sqrt{A^2\omega^2(\cos\omega t - \sin\omega t)^2 dt^2 + A^2\omega^2(\sin\omega t + \cos\omega t)\,dt^2}$$

$$ds = A\omega\,dt \cdot \sqrt{1 - 2\sin\cos + 1 + 2\sin \ldots}$$

$$ds = A\omega\sqrt{2}\,dt$$

$$\Rightarrow \quad L = \int_0^{\frac{3\pi}{4\omega}} A\omega\sqrt{2}\,dt = \frac{3\pi A\sqrt{2}}{4}$$