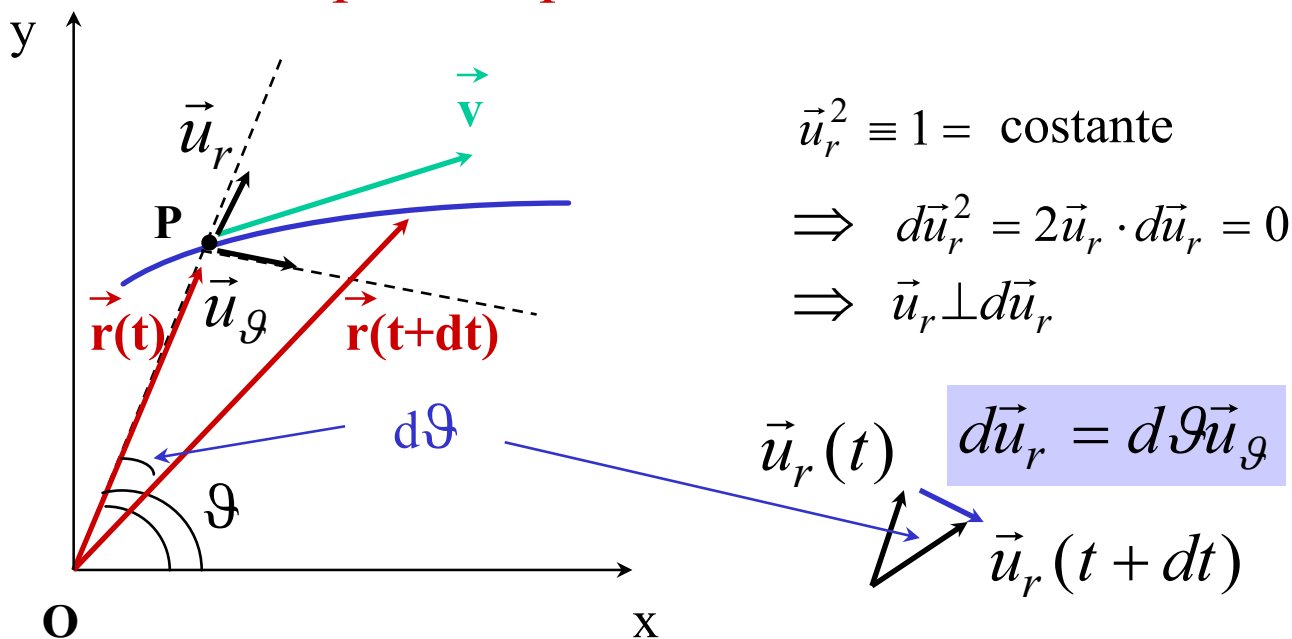


Componenti polari della velocità:



$$\vec{r}(t) = r(t)\vec{u}_r(t) \quad \frac{d}{dt} \vec{u}_r = \frac{d\theta}{dt} \vec{u}_g$$

$$\vec{v}(t) = \frac{d\vec{r}(t)}{dt} = \frac{dr(t)}{dt} \vec{u}_r + r(t) \frac{d\vec{u}_r(t)}{dt}$$

$$\Rightarrow \vec{v}(t) = \frac{dr(t)}{dt} \vec{u}_r + r(t) \frac{d\theta(t)}{dt} \vec{u}_g$$



“velocità radiale”

“velocità trasversa”

$$\vec{v}(t) = \left(\frac{dr(t)}{dt}, r(t) \frac{d\theta(t)}{dt} \right) = \left(\frac{dx(t)}{dt}, \frac{dy(t)}{dt} \right)$$

componenti polari

componenti cartesiane

Moto circolare uniforme:

coordinata curvilinea

velocità con modulo costante:

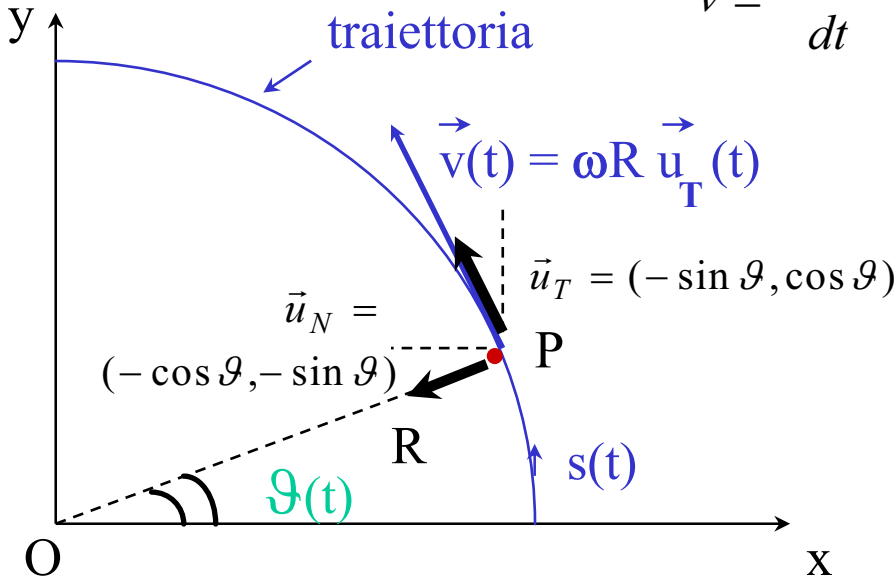
$$s(t) = R\vartheta(t)$$

$$v \equiv \frac{ds(t)}{dt} = R \frac{d\vartheta(t)}{dt} = \omega R$$

“velocità angolare”

$$\omega \equiv \frac{d\vartheta(t)}{dt}$$

$$\vartheta(t) = \vartheta_0 + \omega t$$



$$\begin{aligned} x(t) &= R \cos \vartheta(t) & \Rightarrow & \quad v_x(t) = \frac{dx(t)}{dt} = -R \sin \vartheta(t) \frac{d\vartheta}{dt} \equiv -R\omega \sin \vartheta(t) \\ y(t) &= R \sin \vartheta(t) & \Rightarrow & \quad v_y(t) = \frac{dy(t)}{dt} = R \cos \vartheta(t) \frac{d\vartheta}{dt} \equiv R\omega \cos \vartheta(t) \end{aligned}$$

$$\Rightarrow \quad \vec{v}(t) = (v_x(t), v_y(t)) = R\omega(-\sin \vartheta(t), \cos \vartheta(t))$$

$$\Rightarrow \quad \boxed{\vec{v}(t) = R\omega \vec{u}_T(t) = v \vec{u}_T(t)}$$

\vec{u}_T

$$a_x(t) = \frac{dv_x(t)}{dt} = -R\omega \cos \vartheta(t) \frac{d\vartheta}{dt} = -R\omega^2 \cos \vartheta(t)$$

$$a_y(t) = \frac{dv_y(t)}{dt} = -R\omega \sin \vartheta(t) \frac{d\vartheta}{dt} = -R\omega^2 \sin \vartheta(t)$$

$$\Rightarrow \quad \vec{a}(t) = (a_x(t), a_y(t)) = R\omega^2(-\cos \vartheta(t), -\sin \vartheta(t))$$

$$\Rightarrow \quad \boxed{\vec{a}(t) = R\omega^2 \vec{u}_N(t) = \frac{v^2}{R} \vec{u}_N(t)}$$

\vec{u}_N