

$$\varphi = \arcsin\left(\frac{R}{x_0 + vt}\right) \quad (1.1)$$

$$\begin{aligned} \omega = \frac{d\varphi}{dt} &= \frac{1}{\sqrt{1 - (R / (x_0 + vt))^2}} \cdot \frac{Rv}{(x_0 + vt)^2} = \\ &= \frac{Rv}{(x_0 + vt)\sqrt{(x_0 + vt)^2 - R^2}} \end{aligned} \quad (1.2)$$