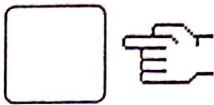Nicolle Ferreira Hyppolito   Nº USP: 10823452

① Linearizar $f(x) = \cos x$

$f(x) = f(\bar{x}) + \dfrac{df}{dx}\Big|_{x=\bar{x}} (x-\bar{x}) + \cancel{\emptyset^2}$

$f(x) \simeq \cos \bar{x} - \operatorname{sen}\bar{x} \cdot (x-\bar{x})$

Para $\bar{x}=0 \rightarrow f(x) \simeq \cos 0 - \operatorname{sen}\overset{0}{\cancel{0}} \cdot (x-0) \Rightarrow f(x) \simeq 1$

Para $\bar{x} = \dfrac{\pi}{4} \rightarrow f(x) \simeq \cos\dfrac{\pi}{4} - \operatorname{sen}\dfrac{\pi}{4}\left(x - \dfrac{\pi}{4}\right) = \dfrac{\sqrt{2}}{2} \cdot \left(1 - x + \dfrac{\pi}{4}\right)$

② Linearizar $m\dot{v} = F(t) - mur + mx\dot{r}$

$f(x,u,r,\dot{r},\dot{v}) = -F(t) = -mur + mx\dot{r} - m\dot{v}$

$\dot{v} \simeq f(\bar{x}, \bar{u}, \bar{r}, \dot{\bar{r}}, \dot{\bar{v}}) + \dfrac{\partial f}{\partial x}\Big|_{\bar{x}}(x-\bar{x}) + \dfrac{\partial f}{\partial u}\Big|_{\bar{u}}(u-\bar{u}) + \dfrac{\partial f}{\partial r}\Big|_{\bar{r}}(r-\bar{r})$

$+ \dfrac{\partial f}{\partial \dot{r}}\Big|_{\dot{\bar{r}}}(\dot{r} - \dot{\bar{r}}) + \dfrac{\partial f}{\partial \dot{v}}\Big|_{\dot{\bar{v}}}(\dot{v} - \dot{\bar{v}})$

$\dot{v} = 0 + m\dot{\bar{r}}(x-\bar{x}) - m\bar{r}(u-\bar{u}) - m\bar{u}(r-\bar{r}) + m\bar{x}(\dot{r}-\dot{\bar{r}}) - m\cdot(\dot{v}-\dot{\bar{v}})$

Como no equilíbrio $\dot{\bar{v}} = \bar{r} = \dot{\bar{r}} = 0$:

$-F(t) = -m\bar{u}r + m\bar{x}\dot{r} - m\dot{v}$

$m\dot{v} = F(t) - m\bar{u}r + m\bar{x}\dot{r}$