PME 3380 - EXERCÍCIO AULA 17/09
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1. Linearização de $f(x) = \cos x$

$$f(x) = f(\bar{x}) + \frac{df}{dx}\bigg|_{x=\bar{x}} (x - \bar{x}) + o^2 = \cos\bar{x} - (x - \bar{x})\operatorname{sen}\bar{x}$$

a. para $\bar{x} = 0$:

$$f(x) = 1 - x \cdot 0 \Rightarrow \boxed{f(x) \approx 1}$$

b. para $\bar{x} = \pi/4$:

$$f(x) = \cos\left(\frac{\pi}{4}\right) - \left(x - \frac{\pi}{4}\right)\operatorname{sen}\left(\frac{\pi}{4}\right) \Rightarrow \boxed{f(x) \approx \frac{\sqrt{2}}{2} - \left(x - \frac{\pi}{4}\right)\frac{\sqrt{2}}{2}}$$

2. Linearização de $f(\dot{v}, r, \dot{r}, u, x) = -m\dot{v} - mru + mxr = -F(t)$

$$\therefore -F(t) \approx f(\bar{\dot{v}}, \bar{r}, \bar{\dot{r}}, \bar{u}, \bar{x}) + \frac{\partial f}{\partial \dot{v}}\bigg|_{eq}(\dot{v} - \bar{\dot{v}}) + \frac{\partial f}{\partial r}\bigg|_{eq}(r - \bar{r}) + \frac{\partial f}{\partial \dot{r}}\bigg|_{eq}(\dot{r} - \bar{\dot{r}})$$

$$+ \frac{\partial f}{\partial u}\bigg|_{eq}(u - \bar{u}) + \frac{\partial f}{\partial x}\bigg|_{eq}(x - \bar{x})$$

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

$$-F(t) \approx f(\bar{\dot{v}}, \bar{r}, \bar{\dot{r}}, \bar{u}, \bar{x}) + \left[-m(\dot{v} - \bar{\dot{v}})\right] + \left[-m\bar{u}(r - \bar{r})\right] + \left[m\bar{x}(r - \bar{r})\right]$$

$$+ \left[-m\bar{r}(u - \bar{u})\right] + \left[m\bar{r}(x - \bar{x})\right]$$

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

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