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1) Linearizar $f(x) = \cos x$

a) $\bar{x} = 0$

$$f(x) = f(\bar{x}) + \left.\frac{\partial f}{\partial x}\right|_{\bar{x}} (x-\bar{x}) = \cos 0 - \operatorname{sen} 0 \, (x-0) = 1$$

$\therefore f(x) = 1$

b) $\bar{x} = \pi/4$

$$f(x) = f(\bar{x}) + \left.\frac{\partial f}{\partial x}\right|_{\bar{x}} (x-\bar{x}) = \cos(\pi/4) - \operatorname{sen}\left(\frac{\pi}{4}\right)\left(x - \frac{\pi}{4}\right)$$

$$\therefore f(x) = \frac{\sqrt{2}}{2}\left(1 - \frac{\pi}{4} + x\right)$$

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

Linearizar por expansão de Taylor.

Definimos

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

Por Taylor

$$f \cong f(\bar{r}, \dot{\bar{r}}, \dot{\bar{v}}, \bar{u}, \bar{x}) + \left.\frac{\partial f}{\partial r}\right|_{eq}(r-\bar{r}) + \left.\frac{\partial f}{\partial \dot{r}}\right|_{eq}(\dot{r}-\dot{\bar{r}}) + \left.\frac{\partial f}{\partial \dot{v}}\right|_{eq}(\dot{v}-\dot{\bar{v}}) + \left.\frac{\partial f}{\partial u}\right|_{eq}(u-\bar{u}) + \left.\frac{\partial f}{\partial x}\right|_{eq}(x-\bar{x})$$

No equilíbrio $\bar{r} = \dot{\bar{r}} = \dot{\bar{v}} = 0$ logo $f(eq) = 0$ e

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

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

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