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1- Linearização de $g(x) = \cos(x)$

$$g(x) = \cos(\bar{x}) - \sin(\bar{x})\,(x - \bar{x})$$

$\bar{x} = 0$:

$$g(x) = \cos(0) - \sin(0).x = 1$$

$\bar{x} = \frac{\pi}{4}$:

$$g(x) = \cos\left(\frac{\pi}{4}\right) - \sin\left(\frac{\pi}{4}\right).\left(x - \frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}\left(1 - x - \frac{\pi}{4}\right)$$

$$g(x) = \frac{\sqrt{2}}{2}\,(0{,}2146 - x)$$

2- Linearização de $m\ddot{v} = F(t) - m\dot{r}u + m\dot{x}\dot{r}$

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

$\bar{r} = 0 \quad \dot{\bar{r}} = 0$

$\frac{\partial f}{\partial x}\Big|_{eq} = m\dot{r} = 0 \quad \frac{\partial f}{\partial a}\Big|_{eq} = -m\ddot{r} = 0 \quad \frac{\partial f}{\partial r}\Big|_{eq} = -m\bar{u} \quad \frac{\partial f}{\partial \dot{r}}\Big|_{eq} = m\bar{x} \quad \frac{\partial f}{\partial \dot{v}}\Big|_{eq} = -m$

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

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