Gabriel Barbosa Paganini - 10772539 - Modelagem aula 17/09

① Linearizar $f(x) = \cos x$: a) $\bar{x} = 0 \rightarrow f(x) = f(\bar{x}) + \left.\frac{\partial f}{\partial x}\right|_{\bar{x}} \cdot (x - \bar{x})$

$\therefore f(x) = \cos 0 - \text{sen}\, 0 \cdot (x - 0) = 1 \longrightarrow \boxed{f(x) = 1}$

b) $\bar{x} = \pi/4 \longrightarrow f(x) = \cos(\pi/4) - \text{sen}(\pi/4) \cdot \left(x - \frac{\pi}{4}\right) \longrightarrow \boxed{f(x) = \frac{\sqrt{2}}{2}\left[1 - x + \frac{\pi}{4}\right]}$

② Linearizar $m\dot{v} = F(t) - mr\mu + mx\dot{r}$ por expansão de Taylor

- No equilíbrio, $\bar{\dot{\mu}} = \bar{r} = \bar{\dot{r}} = 0$ e supondo $\bar{F} = 0$
- Assim, $m\dot{\mu} = f(F, r, \mu, \dot{r}, x)$
- A expansão vale: $f(F, r, \mu, \dot{r}, x) = f(\bar{F}, \bar{r}, \bar{\mu}, \bar{\dot{r}}, \bar{x}) + \left.\frac{\partial f}{\partial F}\right|_{eq} (F - \bar{F}) + \left.\frac{\partial f}{\partial r}\right|_{eq} (r - \bar{r})$

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

- Assim:
  - $f(\bar{F}, \bar{r}, \bar{\mu}, \bar{\dot{r}}, \bar{x}) = 0 - 0 + 0 = \underline{\underline{0}}$
  - $\left.\frac{\partial f}{\partial F}\right|_{eq} \cdot (F - \bar{F}) = 1 \cdot (F - 0) = \underline{\underline{F}}$
  - $\left.\frac{\partial f}{\partial r}\right|_{eq} \cdot (r - \bar{r}) = -m\bar{\mu}\,(r - 0) = \underline{\underline{-m\bar{\mu}r}}$
  - $\left.\frac{\partial f}{\partial \mu}\right|_{eq} \cdot (\mu - \bar{\mu}) = -m\bar{r}\,(\mu - \bar{\mu}) = \underline{\underline{0}}$
  - $\left.\frac{\partial f}{\partial \dot{r}}\right|_{eq} \cdot (\dot{r} - \bar{\dot{r}}) = m\bar{x} \cdot (\dot{r} - 0) = \underline{\underline{m\bar{x}\dot{r}}}$
  - $\left.\frac{\partial f}{\partial x}\right|_{eq} \cdot (x - \bar{x}) = m\bar{\dot{r}} \cdot (x - \bar{x}) = \underline{\underline{0}}$

$\therefore f(F, r, \mu, \dot{r}, x) = 0 + F - m\bar{\mu}r + 0 + m\bar{x}\dot{r} + 0 = m\dot{\mu}$

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