Exercício 17/09

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1) Para casa: Linearizar

$$g(x) = \cos x \quad \begin{cases} \bar{x} = 0 \\ \bar{x} = \pi/4 \end{cases}$$

• Usando a expansão de Taylor apenas no Termo linear:

$$\cos(x) \cong \cos(\bar{x}) + \left.\frac{d\cos x}{dx}\right|_{x=\bar{x}} (x - \bar{x})$$

a) Para $\bar{x} = 0$:

$$\cos(x) \cong \cos 0 + \operatorname{sen} 0\,(x-0) \rightarrow \cos(x) \cong 1$$

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

$$\cos(x) \cong \cos(\pi/4) + \operatorname{sen}\pi/4\,(x - \pi/4) \rightarrow \cos(x) = \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}(x - \pi/4)$$

2) Linearizar por Taylor:

$$m\dot{v} = F - mu\,r + m\bar{x}\dot{r}$$

No equilíbrio: $\dot{v} = r = \dot{r} = 0$

• Temos: $F = m\dot{v} + mu\,r - m\bar{x}\dot{r} = f(x, u, r, \dot{r}, \dot{v})$

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

$$+ \left.\frac{\partial f}{\partial r}\right|_{eq}(r-\bar{r})^{0} + \left.\frac{\partial f}{\partial \dot{r}}\right|_{eq}(\dot{r}-\dot{\bar{r}})^{0} + \left.\frac{\partial f}{\partial \dot{v}}\right|_{eq}(\dot{v}-\dot{\bar{v}})^{0}$$

Calculando os termos da expansão linear

$$\left.\frac{\partial f}{\partial X}\right|_{eq} = 0 \qquad \left.\frac{\partial f}{\partial u}\right|_{eq} = 0 \qquad \left.\frac{\partial f}{\partial r}\right|_{eq} = m\bar{u} \qquad \left.\frac{\partial f}{\partial \dot{r}}\right|_{eq} = -m\dot{\bar{X}} \qquad \left.\frac{\partial f}{\partial \dot{v}}\right|_{eq} = m$$

Portanto, a equação linearizada é:

$$\boxed{F = m\bar{u}\cdot r - m\dot{\bar{X}}\cdot \dot{r} + m\dot{v}}$$