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① $f(x) = \cos(x)$

$$f(x) = f(\bar{x}) + \left.\frac{df}{dx}\right|_{x=\bar{x}} (x-\bar{x}) + \dots$$

$$f(x) \cong \cos(\bar{x}) + [-\sin(\bar{x})\cdot(x-\bar{x})]$$

- $\bar{x} = 0$

$$f(x) = 1 + [\,0\cdot(x-\bar{x})] \Rightarrow f(x) = 1$$

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

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

② ~~Lina~~ $m\dot{v} = F(t) - m\pi u + m\dot{x}\dot{\pi}$

$$f(x,u,\pi,\dot{\pi},\dot{v}) = m\dot{x}\dot{\pi} - m\pi u - m\dot{v}$$

$$f = f(eq) + \frac{\partial f}{\partial x}(x-\bar{x}) + \frac{\partial f}{\partial u}(u-\bar{u}) + \frac{\partial f}{\partial \pi}(\pi-\bar{\pi}) + \frac{\partial f}{\partial \dot{\pi}}(\dot{\pi}-\dot{\bar{\pi}}) + \frac{\partial f}{\partial \dot{v}}(\dot{v}-\dot{\bar{v}})$$

($\frac{\partial f}{\partial x}$, $\frac{\partial f}{\partial u}$: 0; $\frac{\partial f}{\partial \pi} = -m\bar{u}$; $\frac{\partial f}{\partial \dot{\pi}} = m\bar{x}$; $\frac{\partial f}{\partial \dot{v}} = -m$)

Daí:

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

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

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