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① $f(x) = \cos(x)$

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

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

• $\bar{x} = 0$

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

• $\bar{x} = \frac{\pi}{4}$

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

② Lame $m\ddot{v} = F(t) - m\ddot{r}_u + m\ddot{x}_i$

$$\begin{aligned} f(x, u, \dot{u}, \ddot{u}, v, \dot{v}, \ddot{v}) &= mx\ddot{v} - m\ddot{r}_u - m\ddot{v} \\ f &= f(q) + \cancel{\frac{\partial f}{\partial x}(x-\bar{x})}^0 + \cancel{\frac{\partial f}{\partial u}(u-\bar{u})}^0 + \cancel{\frac{\partial f}{\partial \dot{u}}(\dot{u}-\bar{\dot{u}})}^{m\ddot{u}} + \cancel{\frac{\partial f}{\partial v}(v-\bar{v})}^0 + \cancel{\frac{\partial f}{\partial \dot{v}}(\dot{v}-\bar{\dot{v}})}^{m\ddot{v}} + \\ &\quad \cancel{\frac{\partial f}{\partial \ddot{v}}(\ddot{v}-\bar{\ddot{v}})}^0 \\ &- m \end{aligned}$$

Dai:

$$\begin{aligned} f &\equiv -m\ddot{u}(\ddot{u}-\bar{\ddot{u}}) + m\ddot{x}(\ddot{v}-\bar{\ddot{v}}) - m(\ddot{v}-\bar{\ddot{v}})^0 \\ -F(t) &= -m\ddot{u}\ddot{u} + m\ddot{x}\ddot{v} - m\ddot{v} \end{aligned}$$

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