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1-

$\bar{x}=0$: $g(x) \simeq g(\bar{x}) + \left.\frac{\partial g}{\partial x}\right|_{x=\bar{x}} \cdot (x-\bar{x}) = \cos(0) + (-\sin(0)) \cdot (x-0) = 1+0$

$\underline{\cos x \simeq 1}$

$\bar{x}=\frac{\pi}{4}$: $g(x) \simeq \cos\left(\frac{\pi}{4}\right) - \left(\sin\frac{\pi}{4}\right)\left(x-\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}\left(x-\frac{\pi}{4}\right)$

$\underline{\cos x \simeq \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}\left(x-\frac{\pi}{4}\right)}$

2-

$\dot{v} = \frac{F(t)}{m} - ru + x\dot{r} = f_3(r, x, u, t)$

$\dot{\bar{v}} = \left.\frac{\partial f_3}{\partial \dot{v}}\right|_{\bar{v}} (v-\bar{v}) + \left.\frac{\partial f_3}{\partial r}\right|_{\bar{r}} (r-\bar{r}) + \left.\frac{\partial f_3}{\partial \dot{r}}\right|_{\bar{\dot{r}}} (\dot{r}-\bar{\dot{r}}) + \left.\frac{\partial f_3}{\partial u}\right|_{\bar{u}} (u-\bar{u}) + \left.\frac{\partial f_3}{\partial x}\right|_{\bar{x}} (x-\bar{x}) + \left.\frac{\partial f_3}{\partial F}\right|_{\bar{F}} (F_{ext}-\bar{F})$

$\dot{\bar{v}} = 0 + (-u \cdot (r-\bar{r})) + (x \cdot (\dot{r}-\bar{\dot{r}})) + (-r \cdot (u-\bar{u})) + (\dot{r}(x-\bar{x})) + \frac{1}{m}(F-\bar{F})$

$\dot{\bar{v}} = -ur + u\bar{r} + x\dot{r} - x\bar{\dot{r}} + ru + r\bar{u} + \dot{r}x - \dot{r}\bar{x} + \frac{1}{m}(F-\bar{F})$

Com $\bar{v} = \bar{r} = \bar{\dot{r}} = 0$, e desprezando termos de segunda ordem, temos

$\underline{m\dot{v} = mr\bar{u} - mr\bar{x} + F}$