- U U V Dynamics

$$x = \begin{bmatrix} \eta_I \\ v_I \end{bmatrix}$$ (no position, no velocity)

$$\dot{x} = \begin{bmatrix} \dot{\eta}_I \\ \dot{v}_I \end{bmatrix} = \begin{bmatrix} V_I \\ R_B^I f_B + g_I + \delta_I \end{bmatrix}$$

$M\dot{V} = \tau + \tau_{env} - C(v)v - D(v)v - g(\eta)$

$= \tau - C(v)v - D(v)v - g(\eta) + \tau_{env}$

is this actually τ?

$M\dot{V} = \tau_{sys} + \tau_{env} - g(\eta)$

$m a_B = \tau_{sys} + \tau_{env}$

$\tau_{sys} \in \mathbb{R}^3$

$\tau_{sys} - g(\eta) \in \mathbb{R}^3$

$\hat{a}_B = a_B + b_a + g_B + \eta$

$\Rightarrow a_B = \hat{a}_B + b_a - g_B - \eta_a$

$x_t = [p, v, R, b_a, b_g, g]$

$\dot{R}_t = V_t$

$\dot{V}_t = R_t(\tilde{a} - b_{a_t} - \eta_a) + g$

$\dot{R}_t = R_t(\tilde{w} - b_{g_t} - \eta_g)^\wedge$

$\dot{b}_{g_t} = \eta_{b_g}$

$\dot{b}_{a_t} = \eta_{b_a}$

$\dot{g} = 0$

$p_t = \bar{p} + \delta p$
$v_t = v + \delta v$
$R_t = R\,\delta R$
$b_{g_t} = b_g + \delta b_g$
$b_{a_t} = b_a + \delta b_a$
$g_t = g + \delta g$

nominal state

$\delta\dot{p} = \delta v$
$\delta\dot{b}_g = \eta_g$
$\delta\dot{b}_a = \eta$
$\delta\dot{g} = 0$