16784 Underactuated Project

November 2018

derivations of state equations

$g_1(\mathbf{x}_n, \mathbf{u}_n, n) = 0$

$$\approx g_1(\mathbf{x}_n^{nom}, \mathbf{u}_n^{nom}, n) + \frac{\partial g_1}{\partial \mathbf{x}}\Big|_{\substack{\mathbf{x}_n^{nom} \\ \mathbf{u}_n^{nom}}}(\mathbf{x} - \mathbf{x}_n^{nom}) + \frac{\partial g_1}{\partial \mathbf{u}}\Big|_{\substack{\mathbf{x}_n^{nom} \\ \mathbf{u}_n^{nom}}}(\mathbf{u} - \mathbf{u}_n^{nom})$$

$$\approx -\mathbf{e}_n + \mathbf{D}_n \delta\mathbf{x}_n + \mathbf{E}_n \delta\mathbf{u}_n = 0$$

$$\mathbf{e}_n = \mathbf{D}_n \delta\mathbf{x}_n + \mathbf{E}_n \delta\mathbf{u}_n$$

$g_2(\mathbf{x}_n, n) = 0$

$$\approx g_2(\mathbf{x}_n^{nom}, n) + \frac{\partial g_2}{\partial \mathbf{x}}\Big|_{\mathbf{x}_n^{nom}}(\mathbf{x} - \mathbf{x}_n^{nom})$$

$$\approx -\mathbf{d}_n + \mathbf{C}_n \delta\mathbf{x}_n$$

$$\mathbf{d}_n = \mathbf{C}_n \delta\mathbf{x}_n$$

$g_3(\mathbf{x}_N, N) = 0$

$$\approx g_3(\mathbf{x}_N^{nom}, N) + \frac{\partial g_3}{\partial \mathbf{x}}\Big|_{\mathbf{x}_N^{nom}}(\mathbf{x} - \mathbf{x}_N^{nom})$$

$$\approx -\mathbf{d}_N + \mathbf{C}_N \delta\mathbf{x}_N$$

$$\mathbf{d}_N = \mathbf{C}_N \delta\mathbf{x}_N$$