

$$\text{HJB: } 0 = J_t + \min_{u(t)} \{g + J_x^T f\}$$

$$\text{E-L: } 0 = g_x - \frac{d}{dt}(g_{\dot{x}})$$

$$\text{Hamiltonian: } H = g + p^T(t)f(x(t), u(t), t)$$

$$\text{costate: } \dot{p}(t) = -H_x$$

$$\text{free state: } 0 = g_{\dot{x}} \text{ or } h_x - p = 0$$

$$\text{free time: } 0 = g - g_{\dot{x}}^T \dot{x} \text{ or } H + h_t = 0$$

$$\text{goal: } 0 = g + g_{\dot{x}}^T [\dot{\theta} - \dot{x}] \text{ or } H + h_t + (h_x - p)^T \dot{\theta} = 0$$

$$\text{W-E: } g_{\dot{x}} \text{ and } g - g_{\dot{x}}^T \dot{x} \text{ continuous}$$