

$$J(x_0, 0) = \min_{\substack{u_j \in U_j \\ j=0,1,\dots,N-1}} \mathbb{E} \left[\sum_{j=0}^{N-1} \{L(x_j, u_j, j)\} + G(x_N, N) \right] \quad (1)$$

s.t.

$$x_{k+1} = f(x_j, u_j, j) + \sigma_{j+1} \xi_{j+1}$$

$$j = 0, 1, \dots, N - 1$$

$$J(x_N, N) = G(x_N, N) \quad (2)$$

$$J(x_k, k) = \min_{u_k \in U_k} \mathbb{E} [J(x_{k+1}, k+1) + L(x_k, u_k, k)] \quad (3)$$

$$\bar{x}_{k+1} = f(\bar{x}_k, \bar{u}_k, k) \quad (4)$$

$$\bar{x}_0 = x_0$$

$$f(x_k, u_k, k) = f(\bar{x}_k, \bar{u}_k, k) \quad (5)$$