

Dynamic Optimization of Motion

The integral sum of squared errors of velocity (x_2) and position (x_1) are minimized. The optimization time horizon is 5 where the acceleration (u) can be adjusted from -1 to 1. Find the optimal sequence of acceleration moves to minimize the objective function.

$$\min_u \frac{1}{2} \int_0^5 x_1(t)^2 + x_2(t)^2 dt$$

$$s. t. \quad \frac{dx_1(t)}{dt} = x_2(t)$$

$$\frac{dx_2(t)}{dt} = u(t)$$

$$x(0) = [0, 1]$$

$$-1 \leq u(t) \leq 1$$