Assignment 9

The due date for submitting this assignment has passed.

Due on 2021-03-24, 23:59 IST.

As per our records you have not submitted this assignment.

1) A mechanical system is described by $\ddot{x}(t) = u(t)$What will be its optimal control obtained by minimizing *1 point*

$$J = \frac{1}{2}\int_0^5 u^2(t)\,dt$$

with the boundary conditions

$$x(t=0) = 2\,;\ x(t=5) = 0\,;\ \dot{x}(t=0) = 2\,;\ \dot{x}(t=5) = 0$$

- $u^\star(t) = \frac{84}{125}t - \frac{25}{52}$
- $u^\star(t) = \frac{84}{125}t - \frac{52}{25}$
- $u^\star(t) = \frac{84}{25}t - \frac{52}{25}$
- $u^\star(t) = \frac{84}{125}t + \frac{52}{25}$
- $u^\star(t) = \frac{84}{125}t + \frac{25}{52}$
- $u^\star(t) = -\frac{84}{125}t + \frac{52}{25}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$u^\star(t) = \frac{84}{125}t - \frac{52}{25}$

2) Which of the following is/are the optimal control $u^\star(t)$ of the plant *1 point*

$$\dot{x}_1(t) = x_2(t)\ ;\ x_1(0) = 3\,,\ x_1(2) = 0$$
$$\dot{x}_2(t) = -2x_1(t) + 5u(t)\ ;\ x_2(0) = 5\,,\ x_2(2) = 0$$

which minimizes the performance index

$$J = \frac{1}{2}\int_0^2 \left[x_1^2(t) + u^2(t)\right] dt$$

- $u^\star(t) = 5\lambda_2^\star(t)$
- $u^\star(t) = \lambda_2^\star(t)$
- $u^\star(t) = -\lambda_2^\star(t)$
- $u^\star(t) = -5\lambda_2^\star(t)$
- $u^\star(t) = -3\lambda_2^\star(t)$
- $u^\star(t) = 3\lambda_2^\star(t)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$u^\star(t) = 5\lambda_2^\star(t)$
$u^\star(t) = -5\lambda_2^\star(t)$

3) For a second order system *1 point*

$$\dot{x}_1(t) = x_2(t)$$
$$\dot{x}_2(t) = -2x_1(t) + 3u(t)$$

with performance index

$$J = 0.5x_1^2(\pi/2) + \int_0^{\pi/2} 0.5u^2(t)\,dt$$

with boundary conditions $x(0) = [0\ \ 1]'$ and $x(t_f)$ is free. What is/are the optimal control of the given system ?

- $u^\star(t) = 5\lambda_2^\star(t)$
- $u^\star(t) = \lambda_2^\star(t)$
- $u^\star(t) = -\lambda_2^\star(t)$
- $u^\star(t) = -5\lambda_2^\star(t)$
- $u^\star(t) = -3\lambda_2^\star(t)$
- $u^\star(t) = 3\lambda_2^\star(t)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$u^\star(t) = -3\lambda_2^\star(t)$
$u^\star(t) = 3\lambda_2^\star(t)$