Assignment 9

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment.

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

\[
J = \frac{1}{2} \int_0^1 \dot{x}(t)^2 \, dt
\]

with the boundary conditions

\[
x(0) = 2 \quad ; \quad x(5) = 0 \quad ; \quad \dot{x}(0) = 2 \quad ; \quad \dot{x}(5) = 0
\]

- \( u^*(t) = \frac{84}{125} \), \( u^*(t) = \frac{52}{25} \)

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No, the answer is incorrect.
Score: 0

Accepted Answers:

\( u^*(t) = \frac{84}{125} \), \( u^*(t) = \frac{52}{25} \)

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

\[
\begin{align*}
x_1(t) &= x_2(t) \quad ; \quad x_1(0) = 3 \quad ; \quad x_1(2) = 0 \\
x_2(t) &= -2x_1(t) + 5u(t) \quad ; \quad x_2(0) = 5 \quad ; \quad x_2(2) = 0
\end{align*}
\]

which minimizes the performance index

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

- \( u^*(t) = 54x_2^2(t) \)
- \( u^*(t) = 12x_2^2(t) \)
- \( u^*(t) = -4x_2^2(t) \)
- \( u^*(t) = -2x_2^2(t) \)
- \( u^*(t) = -4x_2^2(t) \)
- \( u^*(t) = -3x_2^2(t) \)
- \( u^*(t) = 3x_2^2(t) \)

No, the answer is incorrect.
Score: 0

Accepted Answers:

\( u^*(t) = 54x_2^2(t) \)

3) For a second order system

\[
\begin{align*}
x_1(t) &= x_2(t) \\
x_2(t) &= -2x_1(t) + 3u(t)
\end{align*}
\]

with performance index

\[
J = 0.5x_1^2(t) + \int_0^1 0.5u^2(t) \, dt
\]

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

- \( u^*(t) = 54x_2^2(t) \)
- \( u^*(t) = 12x_2^2(t) \)
- \( u^*(t) = -2x_2^2(t) \)
- \( u^*(t) = -4x_2^2(t) \)
- \( u^*(t) = -3x_2^2(t) \)
- \( u^*(t) = 3x_2^2(t) \)

No, the answer is incorrect.
Score: 0

Accepted Answers:

\( u^*(t) = -2x_2^2(t) \)

\( u^*(t) = 3x_2^2(t) \)