Assignment 10

The due date for submitting this assignment has passed.

Due on 2021-03-31, 23:59 IST.

As per our records you have not submitted this assignment.

1) Which of the following is/are the Hamilton-Jacobi-Bellman Equation for the system *1 point*

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

with the performance index as

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

with boundary condition as

$$J\left(x\left(t_f\right), t_f\right) = S\left(x\left(t_f\right), t_f\right) = 0$$

- $J_t + \frac{1}{2}x_1^2(t) + J_{x_1}x_2(t) + J_{x_2}\left(2x_2(t) - 3x_1^2(t) - \frac{1}{2}J_{x_2}\right) = 0$
- $J_t + \frac{1}{2}x_1^2(t) + J_{x_1}x_2(t) + J_{x_2}\left(2x_2(t) + 3x_1^2(t) - \frac{1}{2}J_{x_2}\right) = 0$
- $J_t + \frac{1}{2}x_1^2(t) + J_{x_1}x_2(t) + J_{x_2}\left(-2x_2(t) - 3x_1^2(t) - \frac{1}{2}J_{x_2}\right) = 0$
- $J_t + \frac{1}{2}x_1^2(t) + J_{x_1}x_2(t) + J_{x_2}\left(3x_2(t) - 2x_1^2(t) - \frac{1}{2}J_{x_2}\right) = 0$
- $J_t + \frac{1}{2}x_1^2(t) + J_{x_1}x_2(t) + J_{x_2}\left(3x_2(t) + 2x_1^2(t) - \frac{1}{2}J_{x_2}\right) = 0$
- $J_t + \frac{1}{2}x_1^2(t) + J_{x_1}x_2(t) + J_{x_2}\left(-3x_2(t) - 2x_1^2(t) - \frac{1}{2}J_{x_2}\right) = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$J_t + \frac{1}{2}x_1^2(t) + J_{x_1}x_2(t) + J_{x_2}\left(-2x_2(t) - 3x_1^2(t) - \frac{1}{2}J_{x_2}\right) = 0$

2) The double integral plant *1 point*

$$\dot{x_1}(t) = x_2(t)$$
$$\dot{x_2}(t) = u(t)$$

is to be transferred from any state to the origin in minimum time with the state and control constraints as $|u(t)| \leq 1$ and $|x_2(t)| \leq 2$. What will be the optimal control law of the above system ?

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

- $u^*(t) = \begin{cases} 1 & \text{if } \lambda_2^*(t) < -1 \\ -\lambda_2^*(t) & \text{if } \lambda_2^*(t) > 1 \\ -1 & \text{if } -1 \leq \lambda_2^*(t) \leq 1 \end{cases}$
- $u^*(t) = \begin{cases} -\lambda_2^*(t) & \text{if } \lambda_2^*(t) < -1 \\ -1 & \text{if } \lambda_2^*(t) > 1 \\ 1 & \text{if } -1 \leq \lambda_2^*(t) \leq 1 \end{cases}$
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No, the answer is incorrect.
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$u^*(t) = \begin{cases} 1 & \text{if } \lambda_2^*(t) < -1 \\ -1 & \text{if } \lambda_2^*(t) > 1 \\ -\lambda_2^*(t) & \text{if } -1 \leq \lambda_2^*(t) \leq 1 \end{cases}$