פתרון תרגיל 13

\[
\dot{x} = f(x) + g(x)u, \quad \dot{u} = -\frac{\partial f}{\partial x}g(x)u + \frac{\partial f}{\partial u}u
\]

\[
u(x) = \frac{\dot{V}(x)}{V(x)} = \frac{\frac{\partial V}{\partial x}g(x)u + \frac{\partial V}{\partial u}u}{f(x) + g(x)u}
\]

\[
V(x) = \frac{\partial V}{\partial x}g(x)u + \frac{\partial V}{\partial u}u = -c_3\|x\|^2
\]

\[
\mathbf{X} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}, \quad \mathbf{U} = \begin{bmatrix} u \\ \delta(x)u \end{bmatrix}, \quad \dot{\mathbf{X}} = \mathbf{A}
\]

\[
\mathbf{A} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}
\]

\[
\mathbf{A} = \begin{bmatrix} 0 & 1 \\ 1 & -1 \end{bmatrix}, \quad \dot{\mathbf{X}} = \mathbf{A}
\]

\[
V(x) = \frac{\partial V}{\partial x}g(x)u + \frac{\partial V}{\partial u}u = -c_3\|x\|^2
\]

\[
V(x) = \mathbf{x}^T P \mathbf{x}
\]
לינארית
לא בקרה

\[ \frac{d}{dx} \left[ f(x) + g(x) \phi(x) \right] = \frac{d}{dx} A x = x^T (PA + A^T P)x = -x^T Q x = -\|x\|^2 \Rightarrow c_3 = 1 \]

\[ \delta(x) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta'(x) = \delta(x) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(x)) = \delta(x) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta'(\delta(x)) = \delta'(x) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta'(x)) = \delta'(x) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(\delta(x))) = \delta(\delta(x)) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(\delta(\delta(x)))) = \delta(\delta(\delta(x))) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(\delta(\delta(\delta(x)))))) = \delta(\delta(\delta(\delta(x)))) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(\delta(\delta(\delta(\delta(x))))))) = \delta(\delta(\delta(\delta(\delta(x))))) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(\delta(\delta(\delta(\delta(\delta(x))))))) = \delta(\delta(\delta(\delta(\delta(\delta(x)))))) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(x))))))) = \delta(\delta(\delta(\delta(\delta(\delta(\delta(x))))))) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(x))))))))) = \delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(x)))))))) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

\[ \delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(x))))))))) = \delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(x)))))))) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]

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\[ \delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(x)))))))))))) = \delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(x)))))))) \Rightarrow \phi(x) \text{ פוגע בנתיב ה-3 שניבים} \]