

Topic: Linearization of nonlinear processes

Task: Linearize nonlinear process which mathematical description in state space is set in the following look: (see variant). Write down the received mathematical description of the linearized system in matrix and scalar forms.

Variants:

$$1) \quad \begin{aligned} \dot{X}_1 &= -2X_1X_2^2 - 5X_2^2 + 3X_2U_1^2 \\ \dot{X}_2 &= -2X_1 + 3X_2^2 - X_1U_2^2 \end{aligned}$$

$$2) \quad \begin{aligned} \dot{X}_1 &= -X_1^2X_2 - 5X_2 - 5U_1^2 \\ \dot{X}_2 &= -X_1X_2^2 - 4X_2^2 - 3X_1U_2^2 \end{aligned}$$

$$3) \quad \begin{aligned} \dot{X}_1 &= 5X_1X_2^2 - 2X_1X_2 + 7X_1U_1 \\ \dot{X}_2 &= -2X_1 - 3X_2^2 - X_1^2U_2^2 \end{aligned}$$

$$4) \quad \begin{aligned} \dot{X}_1 &= 3X_1 - 5X_2 + X_1U_1^2 \\ \dot{X}_2 &= 2X_1X_2^2 + X_2^2 - 4X_2U_2 \end{aligned}$$

$$5) \quad \begin{aligned} \dot{X}_1 &= -4X_1^2X_2 - 5X_2^2 + U_1^2 \\ \dot{X}_2 &= 2X_1 - 3X_2^2 - 2X_1U_2^2 \end{aligned}$$

$$6) \quad \begin{aligned} \dot{X}_1 &= -X_1^2X_2 + 5X_2 + X_2U_1^2 \\ \dot{X}_2 &= -2X_1 + 3X_2^2 - 9X_1U_2^2 \end{aligned}$$

$$\begin{aligned} \dot{X}_1 &= X_1 X_2^2 - 3X_2 + 2X_1 U_1^2 \\ 7) \quad \dot{X}_2 &= -X_1 - 5X_2^2 - U_2^2 \end{aligned}$$

$$\begin{aligned} \dot{X}_1 &= -X_1^2 - 3X_1 X_2^2 + U_1 \\ 8) \quad \dot{X}_2 &= -X_1 + 5X_2^2 - 3U_2 \end{aligned}$$

$$\begin{aligned} \dot{X}_1 &= -X_1 X_2 + 5X_2^2 + 2U_1^2 \\ 9) \quad \dot{X}_2 &= X_1^2 + X_1 X_2 - 2U_2^2 \end{aligned}$$

$$\begin{aligned} 10) \quad \dot{X}_1 &= -X_1^2 X_2 - 5X_2 + 2X_1 U_1 \\ \dot{X}_2 &= 2X_1^2 + 4X_2^2 - 3X_1 U_2^2 \end{aligned}$$

$$\begin{aligned} 11) \quad \dot{X}_1 &= -4X_1^2 X_2 - 5X_2 - U_1^2 \\ \dot{X}_2 &= -2X_1 X_2^2 - 3X_2^2 - 7X_1 U_2^2 \end{aligned}$$

$$\begin{aligned} \dot{X}_1 &= -X_1^2 - 4X_1 X_2^2 + X_2 U_1^2 \\ 12) \quad \dot{X}_2 &= X_1 X_2 + 3X_2^2 + 2X_2 U_2 \end{aligned}$$