Exercise Sheet 11: Feedback Linearization

Problem 26:

We are given the second-order nonlinear system

$$\begin{aligned}\dot{x}_1 &= x_2\\ \dot{x}_2 &= -x_1 + a(1-x_1^2)x_2 + u, \quad a > 0\end{aligned}$$

a. Compute the relative degree of the system for the output $y = x_1$

b. Compute the relative degree of the system for the output $y = x_2$

c. Use the result from **a.** and **b.** to find the relative degree for the output $y = x_1 + 5x_2$

Problem 27:

The following nonlinear system is given

$$\begin{aligned}\dot{x}_1 &= x_1^2\\ \dot{x}_2 &= x_2 + u\\ y &= x_1\end{aligned}$$

a. Explain why the relative degree of the above system for the given output is not well-defined

b. Find a different output that leads to a well-defined relative degree