TTK4150 Nonlinear Control Systems
Exercise 6
Part 1

Department of Engineering Cybernetics
Norwegian University of Science and Technology

Fall 2003

Exercise 1 (Exercise 13.1 in Khalil)

Exercise 2 (Exercise 13.2 in Khalil)

Exercise 3
Given the system

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -x_1 + e^{x_2}u \\ x_1 x_2 + u \\ x_2 \end{bmatrix}$$
$$y = x_3$$

1. *Find the relative degree of the system and specify the region on which this relative degree holds.*

2. *Show that the system is input-output linearizable. Specify the region on which it is input-output linearizable.*

3. *Find a coordinate transformation $z = T(x)$ such that $T(x)$ is diffeomorphism on the region of interest and $T(0) = 0$.*

4. *Express the system on normal form. Determine all functions and constants involved in the normal form. Which part of the normal form counts for the internal dynamics?*

5. *Find the zero dynamics and show that it has a globally stable equilibrium at the origin.*

6. *Choose an input u to solve the stabilization problem for the entire system (asymptotically stable equilibrium in the origin).*

7. *Choose an input u to solve the tracking problem for the entire system (asymptotically stable equilibrium at the origin).*