

## CHEM-E7190/2023: Exercise Extra - Controllable and observable canonical forms

1. Consider the linear and time-invariant dynamical system

$$\begin{aligned}\dot{x}(t) &= Ax(t) + Bu(t) \\ &= \begin{bmatrix} 1 & -1 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}\end{aligned}$$

Find the controllable canonical form for the system

2. Consider the linear and time-invariant system

$$\begin{aligned}\dot{x}(t) &= Ax(t) \\ &= \begin{bmatrix} -2 & 0 & 0 \\ 1 & 0 & 2 \\ 0 & 0 & 0 \end{bmatrix} x(t) \\ y(t) &= Cx(t) \\ &= [1 \ 0 \ 1] x(t)\end{aligned}$$

Find the observable canonical form for the system