HW Assignment 11

Due date: Thursday 16/6/2016

Question 1

Consider the state equations:

$$\dot{x}_1(t) = x_2(t) + 2f(t)$$
$$\dot{x}_2(t) = -x_1(t) - x_2(t) + f(t)$$

1. find the transition matrix A.
2. Defining the new state vector ω
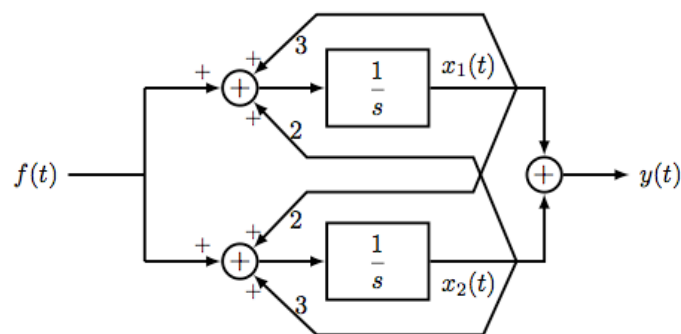
$$\omega_1(t) = x_1(t)$$
$$\omega_2(t) = x_2(t) - x_1(t)$$

write the state equation using the new state variables.

Question 2

Consider the following system

1. Find the system's state equations.
2. Is the system stable?
3. Defining a new state vector ω at the base in which $\hat{A}$ is diagonal, find the new state equations.
4. Is the system controllable? if so, what is the input that gives $x_1(0^+) = 1, x_2(0^+) = 2$?

Question 3

Consider the system

$$\begin{pmatrix} \dot{\omega}_1 \\ \dot{\omega}_2 \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & -3 \end{pmatrix} \begin{pmatrix} \omega_1 \\ \omega_2 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix} f(t)$$

$$\text{where} \quad \begin{pmatrix} \omega_1 \\ \omega_2 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$

1. Is the system controllable?
2. Find the input $f(t)$ that gives $x_1(0^+) = 2$, $x_2(0^+) = 6$.