بسم الله الرحمن الرحيم

ELECTRICAL ENGINEERING DEPARTMENT
EE 550-01 LINEAR CONTROL SYSTEM
Second Semester 2004/2005

HW 3

March 19, 2005
Due Date: March 26, 2005

1. Is it possible to define rules of addition and multiplication such that the set (0,1,2) form a field.

2. Do problem 3.2 of Text.

3. Do problem of 4.1 of Text.

4. Do problem of 4.17 of Text.

5. Consider the system given by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & 1 \\ -\frac{1}{2} & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{2} \end{bmatrix} u, \qquad y = \begin{bmatrix} 1, & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

   Determine $x(0)$ so that for $u(t) = e^{-4t}$, $y(t) = ke^{-4t}$, where k is a real constant. Determine k for the present case. Notice that $y(t)$ does not have any transient components.

6. Consider the equation of the pendulum

$$\frac{d^2\theta}{dt^2} + \frac{K_d l}{m}\frac{d\theta}{dt} + \frac{g}{l}\sin(\theta) = 0$$

   where K_d is the damping coefficient. See the picture below.

   The equivalent system is

$$\begin{cases} \dfrac{d\theta}{dt} = v \\ \dfrac{dv}{dt} = -\dfrac{g}{l}\sin(\theta) - \dfrac{K_d l}{m} v \end{cases}$$

   Linearize the system around the first two operating points.

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