CPE 391, spring 2012

Homework #1

1. Calculate the dynamic system response ($y\left(t\right)$) of following system. $u\left(t\right)$ is the unit step function.

$$\dot{x}=\left[\begin{matrix}0&1\\0&0\end{matrix}\right]x+\left[\begin{matrix}0\\1\end{matrix}\right]u$$

$$y=\left[\begin{matrix}1&0\end{matrix}\right]x$$

Initial condition is $x\left(t=0\right)=\left[\begin{matrix}1\\1\end{matrix}\right]$

1. Calculate the eigenvalues and eigenvectors of the following system.

$$A=\left[\begin{matrix}0&1&0\\3&0&2\\-12&-7&-6\end{matrix}\right]$$

(1) Determine the value of $K$ for which the system is stable;

$$\dot{x}=\left[\begin{matrix}-1&1\\-\frac{K}{2}+1&K\end{matrix}\right]x$$

(2) Check the observability and controllability of following system.

 $A=\left[\begin{matrix}1&0&0\\2&2&3\\-2&0&1\end{matrix}\right]$,$B=\left[\begin{matrix}1\\2\\3\end{matrix}\right]$, $C=\left[\begin{matrix}1&1&2\end{matrix}\right]$

1. Find the minimal state vector representation of the following system. The transfer function is:

$$G\_{p}\left(s\right)=\left[\begin{matrix}\frac{1}{\left(s+1\right)\left(s+2\right)}&\frac{1}{\left(s+2\right)\left(s+3\right)}\end{matrix}\right]$$