Name and surname: .....

Control Systems

Test # 2 – January 11, 2011

Exercise 1 [10 points] Consider the transfer function $G(s) = \frac{1}{s(s-2)}$. Use the root locus to design a feedback control scheme and a controller $G_c(s)$ such that the real part of the poles of the closed loop system is less than -3. Use the Routh Criterium to compute the range of values of the gain of $G_c(s)$ such that the above specification on the position of the poles of the closed loop system is satisfied.

Exercise 2 Consider a control scheme as depicted in Figure 1,

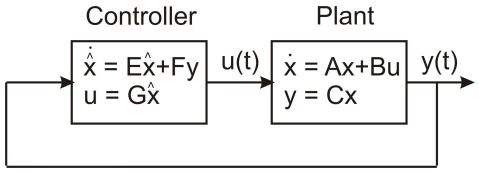

Fig. 1. Control scheme.

where $A = \begin{bmatrix} 1 & 5 \\ a & 4 \end{bmatrix}$, $B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $C = \begin{bmatrix} c & 0 \end{bmatrix}$, with $a, c \in \mathbb{R}$ real parameters.

a. [5 points] Design the matrices E, F, G as functions of the parameters a, c, such that the closed loop system is asymptotically stable, and such that the transient is negligible after 1s.

b. [5 points] Discuss:
1. stabilizability with state feedback
2. detectability
3. stabilizability with output feedback

of the above system with respect to the values of a and c.

Exercise 3 [10 points] Illustrate the controllability of linear time invariant systems and provide significant examples.