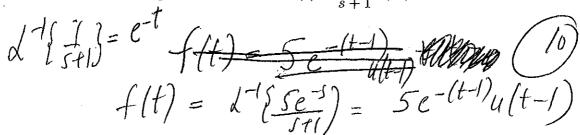
EE 3657 Makeup Test (Optional) - April 18, 2011

1. Find the inverse Laplace transform of $F(s) = \frac{5e^{-s}}{s+1}$. (10)



2. Find all fixed points for the following dynamical system and linearize the system about those points: (30)

$$\dot{x} = -x + x^{3} + y(1+y)$$

$$\dot{y} = -x(1+x)$$
Fixed points are $(0,0), (0,-1), (-1,0), (-1,-1)$ (8)

$$T = \begin{cases} \frac{\partial f_{1}}{\partial x} & \frac{\partial f_{2}}{\partial y} \\ \frac{\partial f_{2}}{\partial x} & \frac{\partial f_{2}}{\partial y} \end{cases} = \begin{cases} -1 + 3x^{2} & (+2y) \\ -1 - 2x & 6 \end{cases}$$
(0,0):
$$\begin{pmatrix} \dot{x} \\ \dot{y} \\ \dot{y} \\ \end{pmatrix} = \begin{pmatrix} -1 & 1/3x \\ 1 & 0/3y \end{pmatrix}$$
(1)
$$\begin{pmatrix} \dot{x} \\ \dot{y} \\ \end{pmatrix} = \begin{pmatrix} -1 & 1/3x \\ 1 & 0/3y \end{pmatrix}$$

$$(0,-1): \begin{cases} \dot{\chi} \\ \dot{y} \end{cases} = \begin{cases} -1 & -1 \\ -1 & 6 \end{cases} \begin{cases} \chi \\ \chi \\ \chi \end{cases}$$

$$(-1,0)$$
: (i) = (2) $(2+1)$ (3)

$$(-1,-1): \left(\frac{\pi}{y}\right) = \left(\frac{2}{1} - \frac{1}{y+1}\right) \left(\frac{3}{1}\right)$$

3. For a second order underdamped system whose characteristic equation is given by $Js^2 + Bs + K = 0$, the gain K has been fixed, all other parameters can be varied. How can you increase damping ratio without affecting settling time. (25)

4. A closed-loop system has a feedforward transfer function that consists of a proportional controller K in series with the plant $G(s) = \frac{1}{s^2}$. The feedback transfer function is given by $H(s) = \frac{1}{1+s}$. Find a range of K (if it exists) for which this system is stable in the closed-loop. (15)

Ch poly for dosed-loop system is

s3+52+k, since 's' kem is missig,

system is unstable for all k values.

5. When are poles closest to the imaginary axis not dominant? (10)

When They are close to zeros.

6. Unity feedback systems of Type n exhibit a zero steady-state error to a ramp input. What value(s) of n will make the preceding statement true? (10)

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