EE 184: Review Problems
10/08/2014

Fig. 1. Circuit for problem 1

**Problem 1**

Consider the circuit of figure 1.
1) Write the state space model knowing that the output is the resistor current denoted by $i_1(t)$.
2) Obtain the transfer function from the state space model.
3) Write the solution for $i_1(t)$ knowing that $v_C(0) = 0.5V$ and $i_L(0) = 0.1A$ and the input is a unit step.

**Problem 2**

- Find the state space model for the circuit of figure 2-top.
- Identify and write the numerical values for matrices $A$, $B$, $C$ and $D$.

**Problem 3**

- Find the state space model for the circuit of figure 2-bottom.
- Identify and write the numerical values for matrices $A$, $B$, $C$ and $D$.

**Problem 4**

The time response of a second order system given by

$$G(s) = \frac{49}{s^2 + 3s + 49} \quad (1)$$

is shown in figure 3.
- From the time response deduce approximate values for the rise time, the peak time, and the percent overshoot.
- Show these parameters on figure 3.
- Deduce the damping ratio and the natural frequency.
- Use the formulas to determine the settling time, peak time and percent overshoot.
- Compare with the values you found previously from the time response.

**Problem 5**

1) Write the state equations for the circuit of figure 4 below.
2) Identify matrices $A$ and $B$ and calculate their numerical values.
3) Write the output equation knowing that the output is $v_{B1}$, and identify matrices $C, D$.
4) Write the output equation knowing that the output is $i_3$, and identify matrices $C, D$.
PROBLEM 6

For the following second order system

\[ G(s) = \frac{48}{(s + 1)(s + 5)} \]  \hspace{1cm} (2)

1) Develop the state space cascade equivalent system
2) Develop the state space parallel equivalent system