EE 184: Review Problems
10/12/2015

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

PROBLEM 3
1) Find the state space model for the circuit of figure 2-bottom.
2) 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

\[
G(s) = \frac{49}{s^2 + 3s + 49}
\]

is shown in figure 3.
1) From the time response deduce approximate values for the rise time, the peak time, and the percent overshoot.
2) Show these parameters on figure 3.
3) Deduce the damping ratio and the natural frequency.
4) Use the formulas to determine the settling time, peak time and percent overshoot.
5) 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 \( v_{R1} \) 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