

EE 610 Final Exam Fall 2012

Open Book Open Notes 125 points total. Notebooks are due at the end of exam.
Good luck and have a good semester break.

1. (40 points)

For this problem a,b,c,d are all real positive constants and

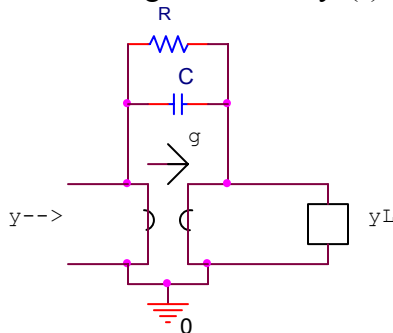
$$y(s) = [as+b]/[cs+d]$$

is a driving point admittance.

- Give the zeroes of the Even part of $y(s)$.
- Determine the constants such that $y(s)$ is PR
- Which of these PR $y(s)$ are RC realizable?
- Give the first and second Cauer forms for these RC realizable $y(s)$.

2. (20 points)

a) For the following circuit find $y_L(s)$ in terms of $y(s)$, C , g , and R .



b) If all capacitors come with parallel dissipation, R , as a fixed percentage of C , that is the RC combination has $y_{R\&C}(s) = C(s + a)$ where $a = 1/(RC)$ is the same for all capacitors, show how the above circuit can be used to synthesize a PR $y(s)$ if $y(s-a)$ is PR.

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3. (40 points)

a) Prove the following equivalence giving L in terms of C , g_1 & g_2 .

b) Insert a voltage source on the left and a load resistor, of resistance R , on the right and draw an oriented graph of the inductor circuit (just the left circuit). Number the nodes 1, 2 on the top and branches 1 to 3 from left to right with orientations from higher numbered nodes to lower ones.

c) Choose a tree as branches 1 & 3 and give the cut-set and tie-set matrices.

d) From the chosen graph and tree set up the semistate equations using input, $u=v_i$, as the voltage source (+ at top), output, $v_o=y$, as the voltage on the load resistor (+ at the top) and semi-state x as the combination of tree voltages, v_t , and link currents, i_l ; $x^T=[v_t^T, i_l^T]^T$.. From that give the loaded voltage transfer function, $v_o/v_i(s)=y/u(s)$.

