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ENEE 610

Problems to consider, Set 2

LC-RC - RL Synthesis

1. Read portions of Chapter 8 skipped before. Call poles and zeros "critical frequencies."

2. A real rational function z(s) is known to be the driving point impedance of a passive RC circuit if and only if the following four conditions hold:

RCa) z(s) has critical frequencies only on the negative real axis

RCb) In magnitude the smallest critical frequency must be a pole and the largest a zero.

RCc) The slope, dz(s)/ds, for real s, is negative (so that poles and zeros alternate)

RCd) $z(1) \geq 0$.

a) Give the similar conditions for RL circuits

b) Show that none of the conditions can be violated.

c) Do these conditions guarantee a synthesis by using the 2-port Richards' section extractions?

2. Synthesize the following driving point functions by various means, including where possible the Foster and Cauer forms:

a) $z(s) = \frac{(s+2)(s+8)}{(s+1)(s+3)}$

b) $y(s) = \frac{(s+2)(s+8)}{(s+1)(s+3)}$

c) $y(s) = \frac{2s(s^2+9)}{(s^2+1)(s^2+3)}$

d) $z(s) = \frac{2s(s^2+9)}{(s^2+1)(s^2+3)}$

3. Consider the functions to be 2,1 entries of 2-port Z or Y matrices. Give possible Z or Y matrices by filling in the three other entries.

4. Synthesize by two different kinds of circuits, those of Figs. 8.7-6 and 8.7-8, the following voltage to voltage transfer functions.

a) $H(s) = \frac{A}{(s^2+5s^2+9)}$; determine the range of A possible

b) $H(s) = \frac{As}{(s^2+5s^2+9)}$; determine the range of A possible