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ENEE 610 Fall 2017 – Homework 3 Due Th 09/28/17

1. (50 points; semistate realization)
The following semistate equations describe a 2-port characterized by its admittance matrix, y=Y(s)u where y=i and u=v are the port 2-vectors and x is a 3-vector semistate.

$$\begin{pmatrix} C & -C & 0 \\ -C & C & 0 \\ 0 & 0 & 0 \end{pmatrix} \cdot \frac{dx}{dt} := \begin{pmatrix} 1 & -1 & 1 \\ 1 & 0 & -1 \\ 0 & 1 & 0 \end{pmatrix} \cdot x + \begin{pmatrix} 0 & 0 \\ -1 & 0 \\ 0 & -1 \end{pmatrix} \cdot u$$

$$y := \begin{pmatrix} 0 & 0 & 1 \\ 0 & G & -1 \end{pmatrix} \cdot x$$

a) Transform the semistate x such that E is the direct sum of the 1x1 (capacitor constant) C and a 2x2 zero matrix.

b) Find the 2-port admittance matrix Y(s).

2. (50 points; constant R circuit)
A constant R lattice has $y_1(s)=sC+1/(sL)$ and $R=(1/G)$.
a) Give $y_2(s)$ and vo/vi(s).
b) Draw the resulting lattice circuit including source (with internal resistance R) and load of resistance R.
c) Give the poles and zeros of vo/vi and determine G, C & L for which they are real and double.
d) For a circuit of part c) with R=50Ohms do a Spice run and plot the amplitude and phase over an important range of frequencies.
e) Discuss the possibility of using two constant R circuits of smaller degree.