ENEE 610 To Consider #2

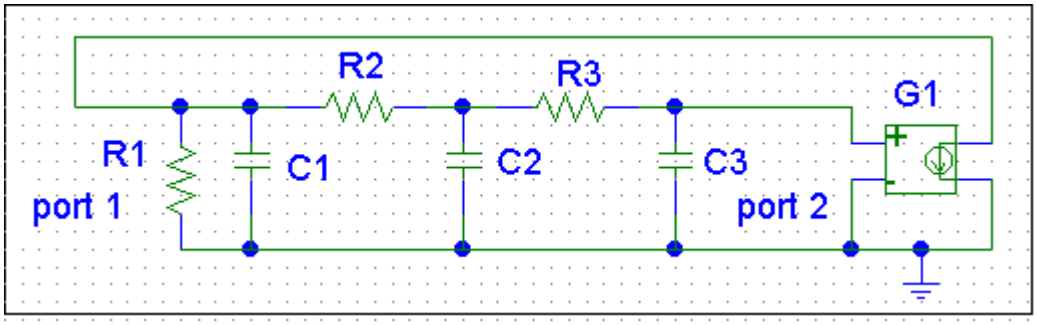
1. Read section 8.4, pages 348 - 352 on RC synthesis. Read pages 161 - 179 of the text about network functions including scattering and hybrid matrices and glance through the rest of Chapter 4.
2. Give the conditions that must be satisfied by an RC admittance function. Do the same for an RC admittance matrix.
3. Synthesize by several RC circuits the admittance:

$$y(s)=\frac{s(s+2/2)(s+4/2)(s+7/2)}{(s+1/2)(s+3/2)(s+5/2)}$$

4. Find the range of the parameter a such that the following is realizable by an RC circuit: and then give several realizations:

$$y(s)=\frac{(s+2/2)(s+4/2)(s+7/2)}{(s+a)(s+[a+1])(s+[a+2])}$$

5. For the following circuit, where G1 is the Spice 2-port VCCS of transconductance g, find the Y matrix for the 2-port RC circuit. Use RC synthesis to design the circuit to give oscillations at 1 Hz and then denormalize to obtain oscillations at 10 KHz. To do this you can break the loop at port 1, apply a current source and find transfer function for the current coming out of G1 in terms of the Y matrix entries; then set this equal to 1 at the oscillation frequency by a choice of zeros and poles of RC realizable Y from which you can then use the RC Cauer synthesis on a driving point y.



6. In some cases hybrid matrices are more convenient than immittance matrices. Consider the hybrid matrix G defined by, for an (n+m)-port with i_1 and v_1 n-vectors and i_2 and v_2 m-vectors,

$$\begin{bmatrix} i_1 \\ v_2 \end{bmatrix} = G \begin{bmatrix} v_1 \\ i_2 \end{bmatrix}$$

If the (n+m)-port is passive, show by two different means (one mathematical and the other based on physical reasoning, possibly using gyrators) that G should be positive-real.
7. In Figure 4.7-16 of the text, p. 179, replace the inductors by capacitors of capacitance c and find the S matrix by two means, one by analyzing the network and one by replacement of the variable. Also find the G matrix.
8. Obtain a formula for going between the G matrix and the S matrix.