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ENEE 610
Problems to consider, Set 4
Some Graph Theory for Circuit Analysis

1. Read Chapters 3 and 4 on the use of graph theory in analyzing circuits.

2. a) Without synthesizing the following z(s) show that it is RC realizable.

$$z(s) = \frac{2(s+4)(s+8)}{s(s+5)}$$

b) Give a second Foster synthesis.of the z(s) of a)
c) For the circuit synthesized in b) apply a current source and draw the circuit graph.. Choose a tree which contains all of the capacitors. Give the cut set and tie set matrices using this tree. From these calculate z(s) to check your synthesis.

3. For Figure 3.1-1(c) use one branch for each component edge, nine in all, and set up the cutest and tieset matrices as well as the branch by branch element descriptions. Give b = # branches, n=#nodes, l=#links, t=#tree branches, and s=separate parts. Choose the gyrator, resistor, and capacitor branches in the tree.

4. The number of tree branches in a graph can be counted by the use of the result in problem 3.12 of page 124 of the text. Carry out this calculation for the graphs of problems 2. and 3. above and verify by drawing all the possible trees for those graphs.

5. Consider a graph with three nodes that is completely connected by branches. Choose a tree and find the cutest and tieset matrices and repeat for a different tree. Then take the cutest matrix from the first tree and multiply it on the left of the transpose of the tieset matrix of the second tree and check the result. Repeat for the completely connected graph of five nodes in Figure P3.16, page 124 of the text.