

ENEE 610 Fall 2006 Final Exam

Due M 12/18/06 6pm; Rm EGR 1108; can be done at home in signed UMCP exam book (only signed exams will be graded; signature certifies that all work is your own). Open notes open book; 2 hour time limit. 200 points total. Be sure to turn in your notebook.

#1 (90 points, 45 minutes) For this problem take a to be a real constant and the

$$\text{admittance as } y(s) = \frac{s^2 + as + 1}{s^2 + 2s + 1}$$

- Find the even part of $y(s)$ and the even part zeros as a function of a
- Find all positive integers a for which the even part has real zeros.
- For the smallest integer $a > 2$ found in part b) show that $y(s)$ is positive-real.
- For the a of part c), use the largest even part zero as k and synthesize $y(s)$ using a cascade of two degree one gyrator-C lossless sections (and a load) found via the Richards' function.

#2 (40 points, 20 minutes) Assume that $y(s)$ and $f(s)$ are positive real functions.

- Determine the conditions for the product $y(s)f(s)$ to be positive-real.
- For the admittance

$$y(s) = \frac{s^2 + 2}{s(s^2 + 5)}$$

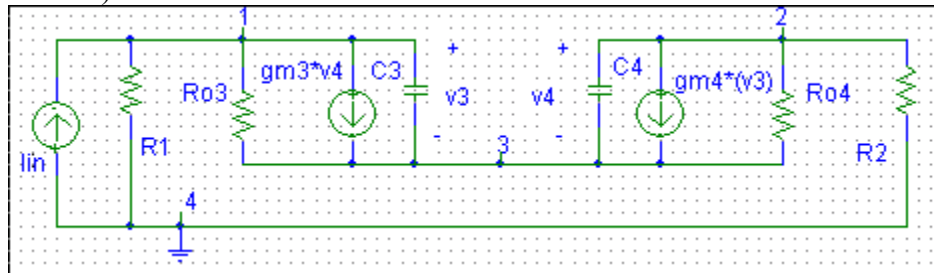
synthesize, using a minimum number of reactive elements, by five different methods with one method using the Richards' function with even part zeros at $s = k = 2$.

- For the $y(s)$ of b) form $y(f(s))$ when

$$f(s) = \frac{s + 1}{s + 2}$$

show that this $y(f(s))$ is positive-real; give a synthesis using the 1st Cauer synthesis of $y(s)$.

#3 (70 pts, 35 minutes)



For the above circuit number branches of its graph according to component numbering (for a total of four branches), and nodes according to the numbers above the nodes

- Draw the graph and orient it with arrows from the smallest to the largest node numbers on a branch. Give the tree using branches having the smallest numbers. Give the resulting cut-set and tie-set matrices (organizing the equations in the order of the tree or cotree branches).
- Setting $R1 = R2 = R$, $R03 = R04 = R0$, $gm3 = gm4 = gm$. give the indefinite admittance matrix, $Y_{ind}(s)$, and use it to get the nodal admittance matrix, $Y_{node}(s)$, when node 4 is grounded.
- Set $v_2 = v_{24}$ ($=v$ on $R2$). Using $Y_{node}(s)$ find the transfer function $v_2/I_{in}(s)$.

. taken from the paper presented by Mr. Kanyogoro
L. W. Massengill, "SEU-Hardened Resistive-Load Static RAMs," IEEE Transactions on Nuclear
Science, Vol. 38, No. 6, December 1991, pp. 1478 - 1485.