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610 Fall 2008 – Homework 4

Missing 2d) inserted 10/02/08 2c),d) made reactance 10/06/08

Pages 336 – 365 of Chapter 8 are devoted to positive real functions and their synthesis.

1. By analytically evaluating for all s in the RHP (= Right Half Plane; Re(s)=σ>0) show that the following are positive real
   a) $Y(s) = 1/Z(s)$ whenever $Z(s)$ is positive real
   b) $Z(s) = (3s^2+27)/(s^3+16s)$
   c) $Z(s) = (2s^2+5s+6)/(2s+3)$

2. Synthesize the reactance functions:by the Cauer and Foster forms
   a) $Z(s) = (3s^2+27)/(s^3+16s)$
   b) $Y(s) = (3s^2+27)/(s^3+16s)$
   c) $Z(s) = ((s^2+2)(s^2+8))/(s(s^2+4)(s^2+9))$
   d) $Y(s) = ((s^2+2)(s^2+8))/(s(s^2+4)(s^2+9))$
3. Synthesize by using Richards function extractions with gyrator-C 2-ports:
   a) The functions of problem 2 above.
   b) $Y(s) = (4s^2+6s+8)/(s^2+2)$; compare with the circuit for it on p. 364 found from the expansion $Y(s) = 4 + (6s)/(s^2+2)$

4. Using the continued fraction synthesis on problem 2a) remove a part of the pole at $s^2=-16$ to obtain a non-canonical synthesis. If leads are attached at the end component in the synthesis determine the location of the zeros of transmission in the 2-port open circuit voltage transfer function.