

ENEE 610 To Consider #3

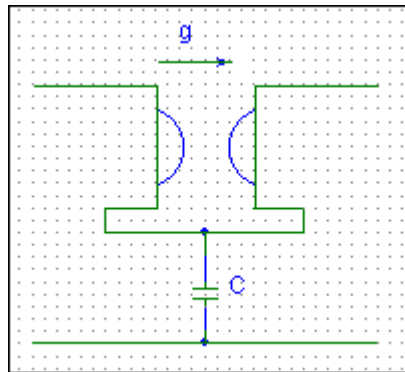
1. For those constants  $a$  for which the following function is lossless synthesize it by 5 different methods, including a cascade synthesis via the Richards' function. Discuss advantages and disadvantages of each method and result.

$$y(s) = \frac{s(s^2 + a)(s^2 + 8)}{(s^2 + 1)(s^2 + 5)}$$

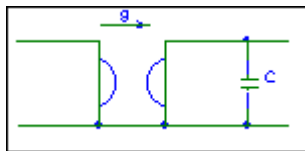
2. For the admittance of problem 1. find the corresponding reflection coefficient and investigate its properties, such as bounded real-ness, pole and zero positions, etc..

3. Consider the following coupling 2-port

- a) Find its  $Y(s)$ ,  $Z(s)$ , and  $S(s)$  matrices
- b) Consider that it is loaded in  $y_L(s)$  and find  $y_L(s)$  in terms of the input admittance  $y_{in}(s)$ . Are there choices of  $g$  and  $C$  such that this gives a Richards' function?.
- c) Develop a cascade synthesis for lossless  $y_{in}(s)$  using this 2-port. Carry out an example using the  $y(s)$  of problem 1. above.
- d) Repeat part c) for a given input reflection coefficient,  $s_{in}(s)$ .



4. Repeat problem 3. for the following 2-port.



5. Given a rational voltage to (open circuit)-voltage transfer function set up a means to realize it using admittance matrix entries. Repeat using impedance and scattering matrices.