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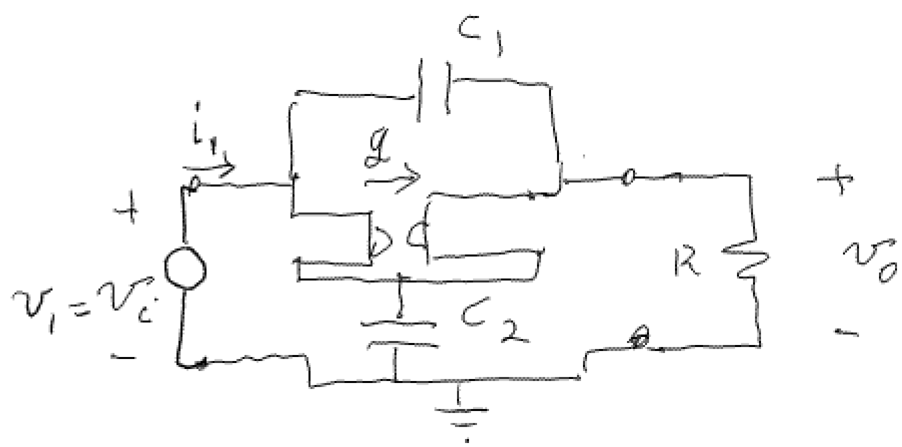
610 Fall 2015 – Homework 3 Due Th 09/24/15 => Tu 09/29/15

1. (50 points, Semistate Equations, Transfer Function Matrix)
   The following circuit discussed in class is associated with the reference: D. A. Dirkasz, J. M. A. Scherpen, A. J. van der Schaft and M. Steinbuch, "Notch Filter for Port-Hamilton Systems," IEEE Transactions on Automatic Control, Vol. 60, No. 9. September 2015, pp. 2440 - 2445.



   a) Use a tree which includes the capacitors and the input voltage source and give the semi-state variables, $x^T=[v_t^T, i_l^T]$; then give the semi-state equations for the input $u=v_1$ being the voltage at the input port and the output, $y = [i_1,v_o]^T$, being the current into the input port along with the output voltage [so that the transfer function is a 2x1 matrix].
   b) Using the semi-state equations of a) give the transfer function matrix [which is the input admittance along with the voltage transfer function].

2. (50 points, Transfer Function Properties)
   For the above circuit,
   a) Consider the voltage transfer function written in the form of the above reference as

$$T(s)=\frac{v_0}{v_1}=\frac{s^2+\beta_1\,\omega_0 s+\omega_0^2}{s^2+\beta_2\,\omega_0 s+\omega_0^2}$$

   and give the transfer function parameters β_1, β_2 & ω_0 in terms of the circuit parameters, g, G, C_1 & C_2.
   b) Choose the transfer function parameters as per Fig. 1 of the above reference (in Problem 1) and run (and submit) the Bode plot curves of that Fig.1.
   c) Show that there is a g, C_1, C_2 such that the C-g 2-port is a constant-R 2-port and determine the values to so make it. As two different g's result, discuss the differences resulting between the two choices.