Note Title 9/2/2019

ENEE 610 Fall 2019 Homework 5 Due Tu 10/08/19

#1(50 points; lossless synthesis)

For the impedance z(s) = [6s^3 + 4s]/[12s^4+14s^2+1]

a) Give the poles and zeroes and plot them in the s-plane.

b) Give the four canonical circuits of Foster and Cauer.

c) Repeat b) for the same function being an admittance y(s), that is y(s) = [6s^3 + 4s]/[12s^4+14s^2+1]

c) If a circuit for z(s) is in parallel with a 1 Ohm resistor, give the new (parallel) impedance $z_p(s)$ and discuss its relation to an Hurwitz polynomial.

#2 (50 points, negative impedance converters).

a) A 2-port has $i_2=K_i i_1$ and $v_2=K_v v_1$ where K_i and K_v are non-zero current and voltage gain constants of the same sign. Load the 2-port in an impedance $Z_L(s)$ and give (the negative impedance converted) $Z_{in}(s)$.

b) Another form of negative impedance converter is shown in the following figure where R is a positive number (so the middle resistor is active). Find its 2-port impedance matrix, its 2-port admittance matrix, its 2-port scanttering matrix and its Z_{in} when loaded in Z_L.

c) When loading the following 2-port in Z_L and R is normalized to 1 Ohm (or $K_i=K_v$) find the scattering matrix (a reflection coefficient as n=1) for Z_{in} and compare with that of Z_L.