

610 Fall 2017 – Homework 5 Due Th 10/12/17

1. (60 points, Foster & Cauer synthesis)
 - a) For the following admittance show that it is lossless PR and give the two Foster and the two Cauer realizations.
$$y(s) = \frac{3s(s^2+4)}{(s^2+3)(s^2+8)}$$
 - b) Comment on the differences.
 - c) Sketch $[y(j\omega)]/j$
 - d) Give the dual impedance, $z(s)=y(s)$ and its circuit for all of the above cases.
 - e) Give the Richards function, R_y , using $k=2$ for this admittance.

2. (25 points, reflection coefficient properties)
 - a) Give the scattering matrix (=reflection coefficient), $S(s)$, for the above PR $y(s)$; include R_y .
 - b) Check that $S(s)$ is bounded real.
 - c) Give the poles and zeros of $S(s)$ and compare their locations with those of $y(s)$ and of the Richards' function.

3. (15 points, Hurwitz polynomial)
 - a) Check to see if $P(s)=s^6+5s^5+10s^3+4s^2+3s+1$ is Hurwitz
 - b) Check if the truncation after the fifth term of the series expansion of $\exp(as)$ is an Hurwitz polynomial for any real constant a .