Note Title 9/2/2019

ENEE 610 Fall 2019 Homework 8 Due Th 11/14/19

#1(50 points; 5th degree max flat low pass syntheis)

This problem is for the synthesis of a degree 5 maximally flat low pass filter

a) Obtain the degree five Butterworth polynomial in factored and unfactored form

b) Using a Cauer form synthesize the low pass maximally flat $V2/V1(s) = 1/B_5(s)$ with a 1 Ohm load.

c) Using that circuit denormalize to a 50 Ohm load [thus multiply all impedances by 50] and change the frequency response at 1 Hz to 1 KHz by a scaling of the complex frequency s.

d) Describe another way this filter could be designed.

#2 (50 points; band pass synthesis).

Assume as giiven is a low pass maximally flat transfer function $T(p)=1/B_n(p)$. In part b) the imaginary part is designated Im(.).

a) For n=2 Transform to a band pass V2V1(s) by the change of variable to $p = (s/w_o)+(w_o/s)$ where w_o is a fixed positive constant. giving V2/V1(s). Thus T(p)=V2/V1(s).

b) Noting that $|T(jIm(p))|$ is maximun at p=0, find the frequency w_m , ($s_m=jw_m$), for which $|V2/V1(jw)|$ is maximum as a function of w_o.

c) For this n=2 case synthesize V2/V1(s) by synthesizing T(p)=v2/v1(p) using the ladder structure and changing the p dependent components by s-variable ones.

d) Sketch $|V2/V1(jw)|$ for the cas $w_o=4$. Recall for this that T(p)=V2/V1(s).

e) All of this extends tp give an even degree, 2n, band-pass design. Comment upon what you think one might consider in order to obtain an odd degree band pass filter.