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610 Fall 2014 – Homework 5 Due Th 10/09/14

1. (50 points, degree the state variable system)
   For the admittance described by the following differential equation
   $$(d^3z/dt^3)+5(d^2z/dt^2)+6(dz/dt)+7z=3v$$
   $$i=2v-3(dz/dt)$$
   a) Set up state variable equations with input v and output i.
   b) Find the admittance y(s)=i(s)/v(s) and give its zeroes.
   c) From the state variable equations form a constant coupling admittance matrix such that if realized by hardware it has y(s)=i(s)/v(s) as its input admittance.
2. (50 points, maximally flat transfer functions)
   a) Create a degree 4 low pass maximally flat transfer function, T(s), normalized so that the gain is 1 at dc and the lead denominator coefficient is also 1.
   b) Give the poles and zeroes of T(s).
   c) If the actual 3db point is to be at 2KHerz and the dc gain is to be 15, give the actual (denormalized) transfer function$T_{dn}(s)$. Give the poles and zeroes of the denormalized transfer function.
   d) In the normalized transfer function make a low pass to band pass transformation s=2p+[1/(2p)]. Give the new normalized band pass transfer function $T_{bp}(p)$ and give its poles and zeroes. Explain how the band-pass circuit results from the low pass circuit if the latter uses only resistors, inductors, and capacitors. What if the low pass circuit also includes OTAs?