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610 Fall 2018 – Homework 6 Due Th 11/01/18

1. (30 points, Hurwitz polynomials)
   By using a continued fraction expansion about infinity, determine which of the following polynomials are Hurwitz and/or strictly Hurwitz (if imaginary roots, determine them). [all have a real root; you might look into finding them also].
   a) $p1(s) = s^4 + 8s^3 + 20s^2 + 31s + 30$
   b) $p2(s) = s^4 + 6s^3 + 6s^2 + 11s + 30$
   c) $p3(s) = s^4 + 7s^3 + 12s^2 + 14s + 20$

2. (50 points, Richards' function LPR synthesis)
   a) Synthesize twice the following LPR admittance by using the Richards' function evaluated first at k=1 and then at k=2 and compare
      $y(s) = [3s(s^2+4)]/(s^2+2)$
   b) Repeat on this function as an impedance, that is
      $z(s) = [3s(s^2+4)]/(s^2+2)$

3. (20 points, fractional order differentiators)
   Since it is possible to make fractional order capacitors there are now many papers using fractional order differentators described by
   $y(s)=Cs^{\alpha}$
   (that is, s is raised to a real number power α, $-\infty<\alpha<\infty$, which is practically often 1/2 or 1/3)
   Determine for which real α this y(s) is positive-real when C>0. For which α it PR and which LPR?