ECE 486 **Assignment # 5**

Issued: February 23 Due: March 1, 2024

Reading Assignment:

FPE, Sections 5.1 - 5.3

Note: *It is in your interest to consult MATLAB only after completing a hand sketch.*

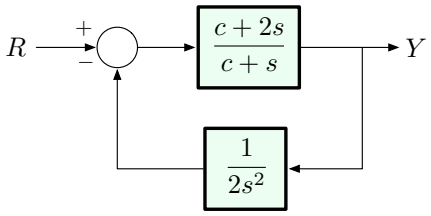
You are encouraged to verify your results using MATLAB, and you will need help from MATLAB to complete Problem 2: `rlocus` and `rltool` are useful and fun!

Problems:

1. Sketch the root loci below by hand, applying rules A—F.
   $KL(s) =$

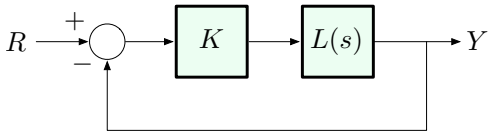
   (a) $K\dfrac{1}{s^2+2s+10}$ (b) $K\dfrac{s-2}{s^2+2s+10}$ (c) $K\dfrac{(s+1)(s+2)}{s(s^2+4)(s^2+5)}$ (d) $K\dfrac{s+2}{s^5+1}$

2. Consider the feedback system shown below.



   Determine the transfer function $Y(s)/R(s)$, and from this the characteristic equation. Sketch the root locus for $c > 0$.

3. Consider the Evans-style feedback configuration



   Suppose that $L(s)$ has

   (i) 3 LHP poles and 1 LHP zero;
   (ii) 1 RHP pole, 2 LHP poles, and 3 LHP zeros;
   (iii) 5 LHP poles, 4 LHP zeros, 1 RHP zero.

   In each of these three cases, use your knowledge of the effect of open-loop poles and zeros on the root locus to explain whether or not the corresponding closed-loop system can always be stabilized by choosing large enough gain K. Be sure to give detailed justification for your answers.