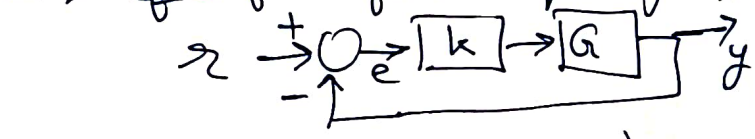
EE302 Tutorial Sheet 3, 13th Feb 2025 Control Systems Course

Q-1: (a) For $G(s) = \frac{4}{s+8}$, standard negative unity feedback configuration, & step response, plot $e(\infty)$ versus k ($k \equiv$ ~~feedforward~~ forward path gain) (be sure to check FVT validity).



(b) For $G(s) = \frac{4}{s^2+3s+2}$, (c) $\frac{s-3}{s+4}$, (d) $\frac{1}{(s+1)(s+2)(s+3)}$ (poles -1, -2, -3)

Q-2: Suppose n & d are monic polynomials with roots
- non-repeated (individually) and
- disjoint (i.e. n & d are coprime).
- in open LHP, on -ve real axis,
- interlaced. (i.e. roots of n & roots of d are interlaced.).

Show: (a) difference in degrees can be atmost 1.
(b) For any +ve & real k, roots of $d(s)+k\,n(s)$ are real & in ~~open~~ -ve.

Q-3: (a) Shift the poles/zeros to get symmetry about $j\mathbb{R}$ and then get breakaway / breakin points: for $G(s) = \frac{1}{(s+1)(s+2)(s+3)}$.

(b) Same for $\frac{(s-1)(s+5)}{s(s+1)(s+3)(s+4)}$

Q-4: For what value of $z \in \mathbb{R}$ does the root locus pass through point $-3+2j$? (for $G(s) = \frac{s-z}{s(s+2)}$).

Q-5: Verify. (Assuming F.V.T. holds).

$e(\infty)$	type 0	type 1	type 2
step input	$\frac{1}{1+K_p}$	0	0
ramp input	∞	$1/K_v$	0
parabolic inp	∞	∞	$1/K_a$

Find steady state errors for step, ramp, parabolic inputs for $G(s) = \frac{k(s+0.01)}{s(s+2)(s+3)}$ (as k varies from 0 to $+\infty$, to use Root locus to check FVT validity)