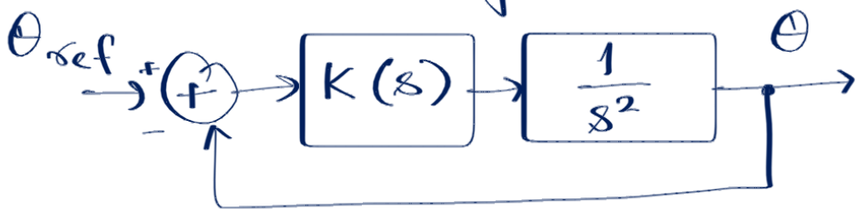
Assignment (take home) for EE302 summer'26.

Full marks = 30.

Question: Consider the satellite altitude control system



Assume that controller transfer f^n has the form $K(s) = \frac{k(s+a)}{s+b}$. Choose b = the last digit of your roll number if it is nonzero, otherwise, choose b = the second last digit of your roll number. Suppose, the design objective is to ensure 20% or less overshoot and 0.3 sec or less rise time for the closed loop system's step response.

(a) Find out the desired closed-loop pole pair. [4]

(b) Sketch by hand (to scale) the pole-zero map of the system showing open loop poles and the desired closed loop poles. [4]

(c) on your sketch above, show the angles necessary to find out a that ensures that the root locus passes through the desired closed loop poles. [4]

(d) Find out a. [4]

(e) Find out k. Show all your calculations. [4]

(f) Using MATLAB, find out the step response of the closed loop. Show the plot. Find out actual %-overshoot and rise time. [4]

(g) Using MATLAB, find out the actual closed loop poles and zeros. [4]

(h) Sketch the root locus of $G(s) = \frac{s+a}{s^2(s+b)}$ with a, b as obtained here. [2]