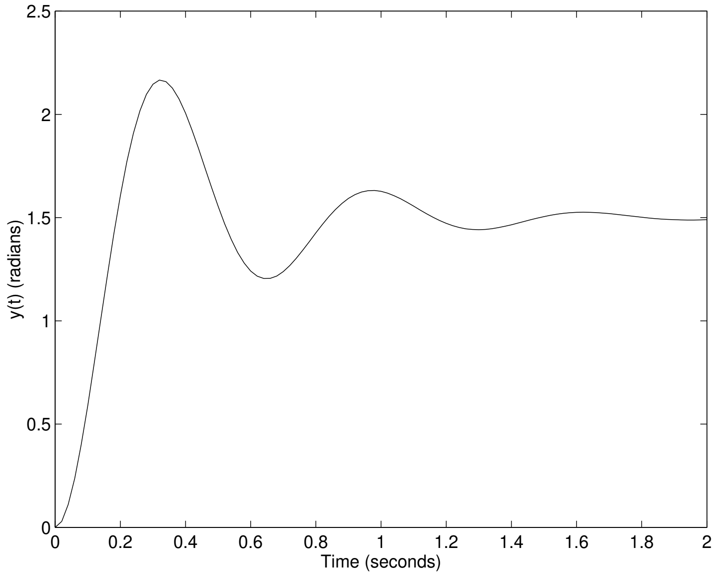
ECE 410 QUIZ #1B

Wednesday October 15, 1997

NAME:
NUMBER:

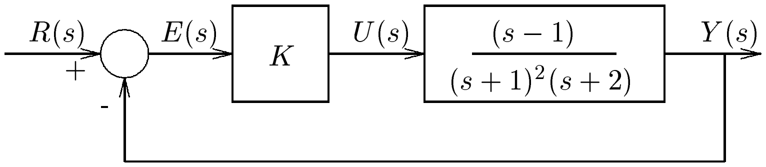
Problem 1. What is a good transfer function model for the system with step response below? (You may find the attached formulae useful.) Assume all initial conditions are zero.



For $H(s) = \frac{\omega_n^2}{s^2+2\delta\omega_n s+\omega_n^2}$,

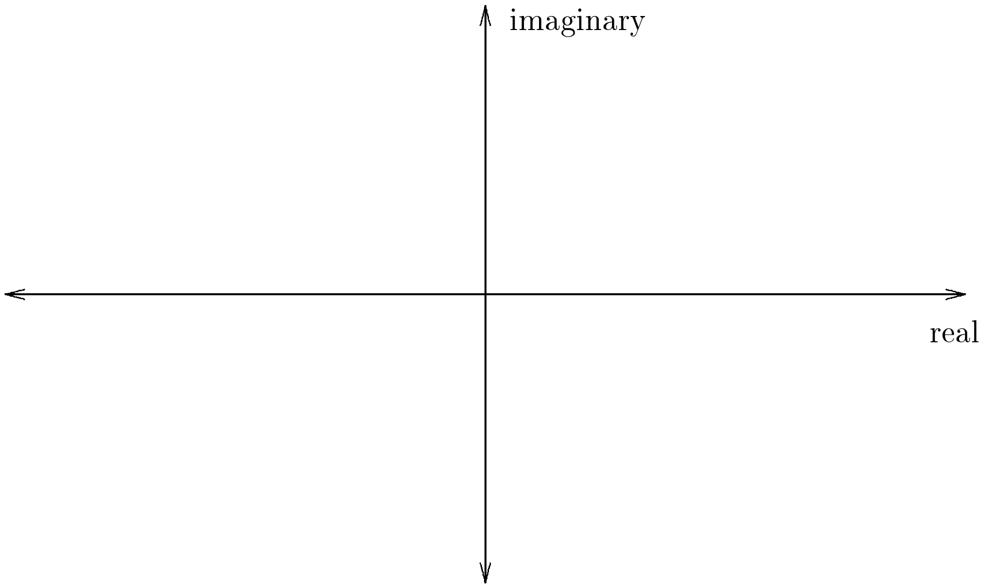
$$\text{percent overshoot } = 100e^{-\frac{\delta\pi}{\sqrt{1-\delta^2}}}$$
$$\text{damped frequency } = \omega_d = \omega_n \cdot \sqrt{1-\delta^2}$$
$$\text{settling time } = t_s = \frac{3}{\delta\omega_n}$$

Problem 2. Given the closed-loop system

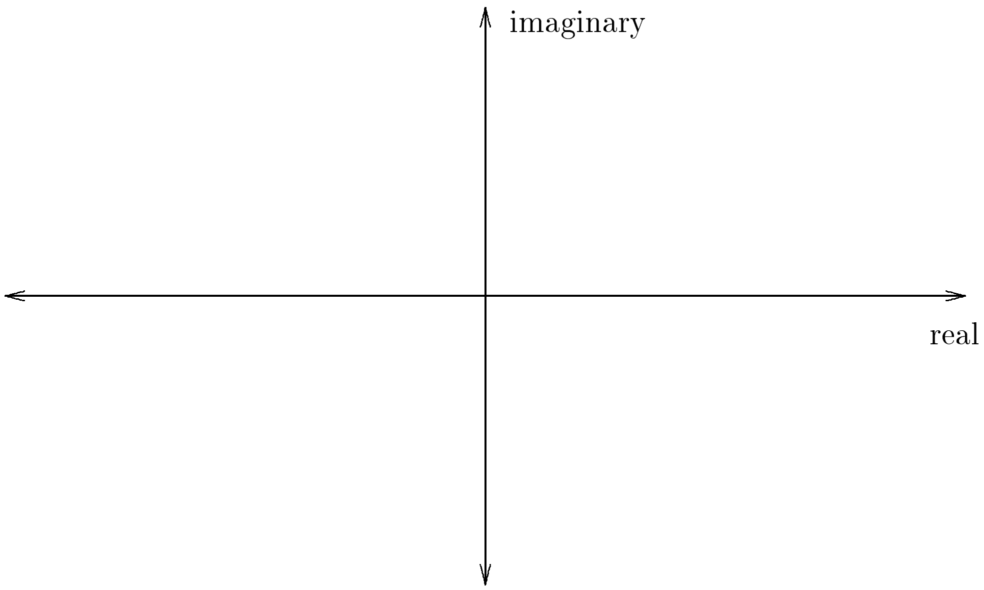


Draw the root locus (the closed-loop pole locations as a function of K) for **both** $K \geq 0$ and $K \leq 0$ below. Is there an interval $a < K < b$ for which the closed-loop system is stable? If so, find this range using a Routh array.

$\boldsymbol{K \geq 0}$:



$\boldsymbol{K \leq 0}$:



Range of K: