Handout 6: Proportional Compensation
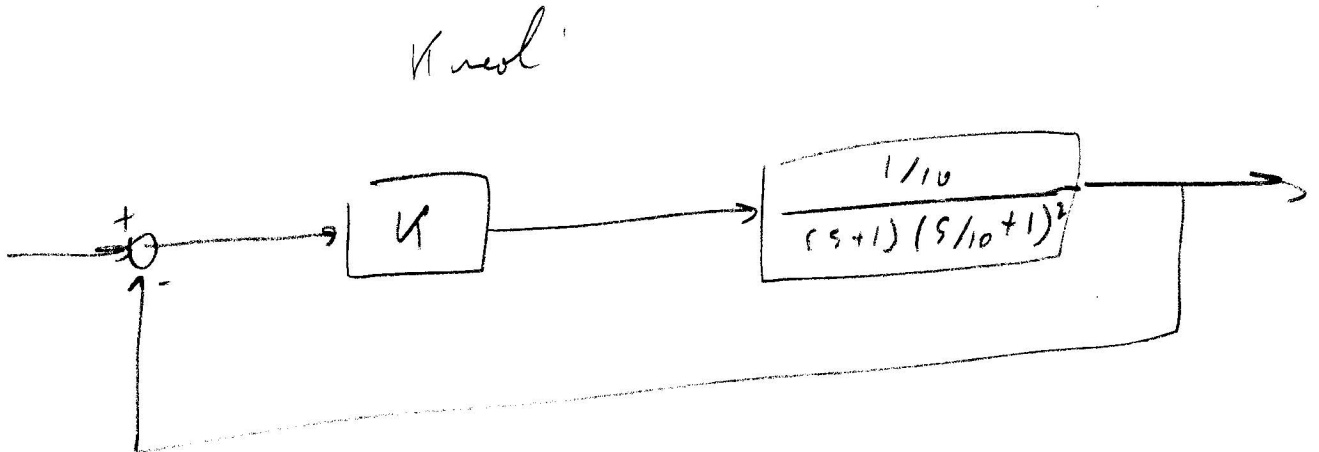
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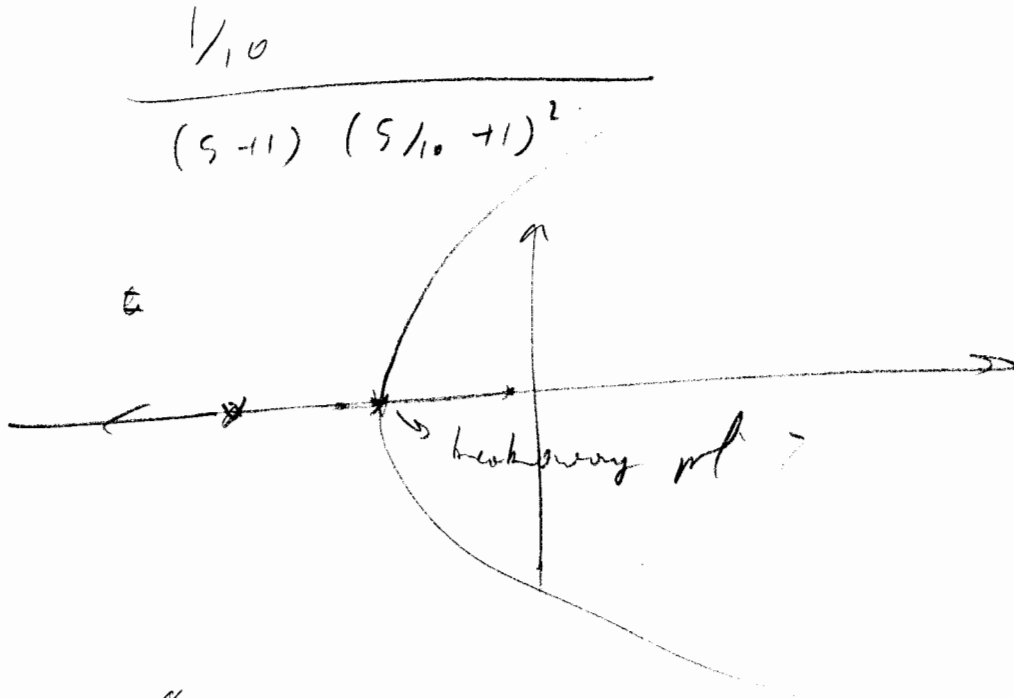
Plant under study:

$$G(s) = \frac{1/10}{(s+1)(s/10+1)^2}$$

Compensation Scheme: We adjust the gain K in the feedback loop
(draw the feedback loop below)

Root locus for Proportional compensator
System becomes unstable when gain is

$$\frac{1/10}{(s-1)\,(s/10+1)^2}$$

breakaway pt ?

$$\frac{s}{10}(s/10+1)^2 + \frac{2}{10}(s+1)(s/10+1) = 0$$

$$(s/10+1)\left(s/10+1+\frac{s}{5}+\frac{1}{5}\right) = 0$$

$$3\,s/10 + 6/5 = 0$$

$$\frac{s}{10} + \frac{2}{5} = 0$$

$$\boxed{s = \frac{10}{5} = -4}$$

Bode and Nyquist plots for Proportional compensator
Phase margin becomes zero when gain is

Closed loop transfer functions
As seen from reference input to output:

As seen from unmodelled dynamics output to uncertain dynamics input