EENG307: Introduction to Root Locus[1]

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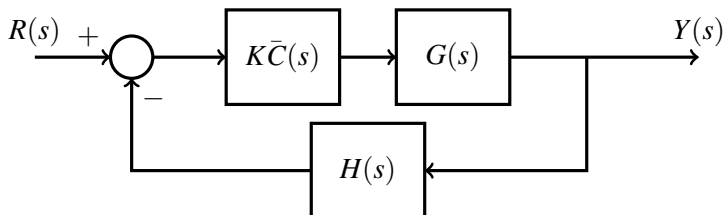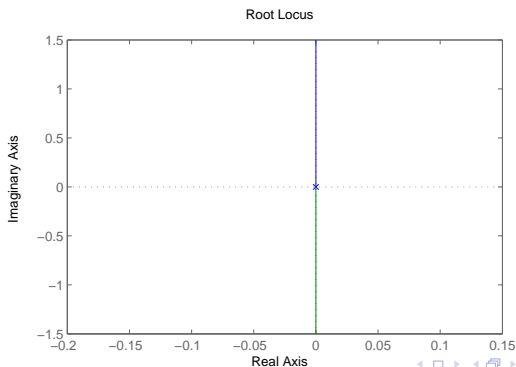
Lecture 18

Design Question:

What closed loop poles are achievable by varying the gain K in the feedback system below for a given plant $G(s)$, sensor $H(s)$, and basic controller structure $\bar{C}(s)$?
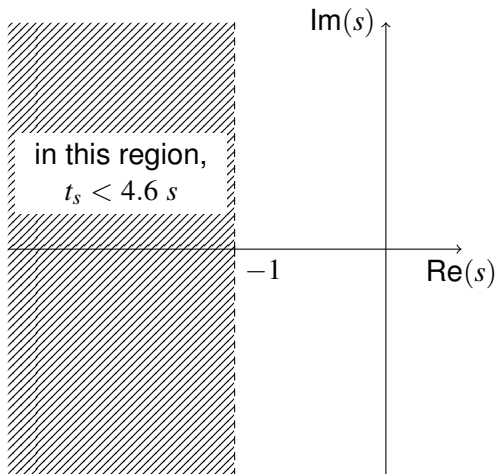
Plotting the root locus using MATLAB

```
» s = tf('s'); % note:   another way to define a TF
using s as a variable
» L = 1/s^2
» rlocus(L)
```
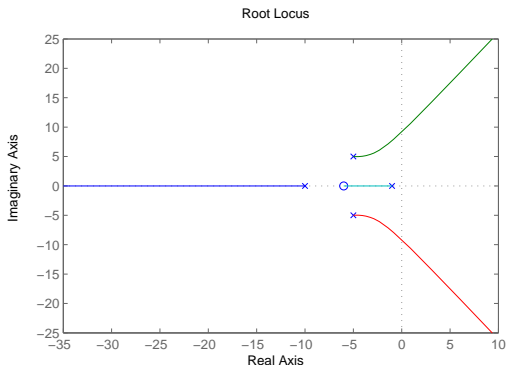

Root Locus

Settling Time Requirement for Example
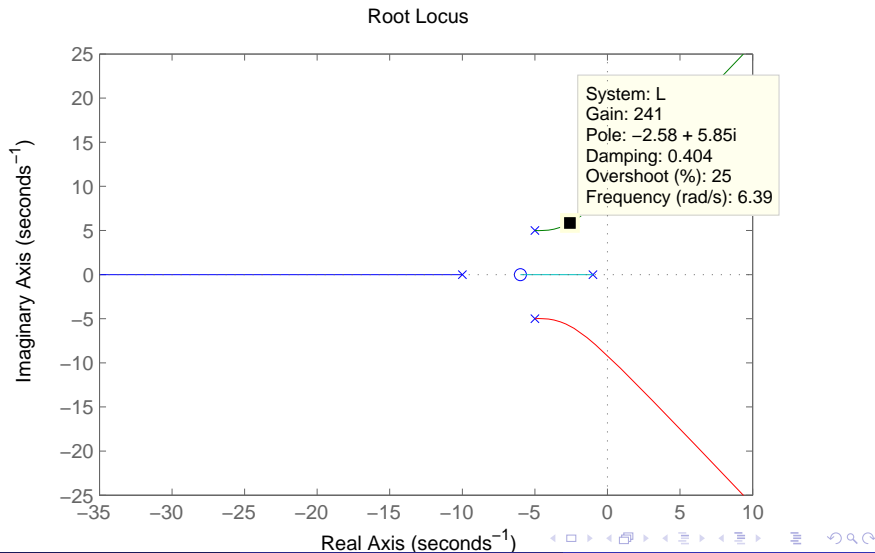

In this region, $t_s < 4.6\ s$

By comparing the root locus (closed-loop poles on the imaginary axis) from Example **??** to the allowable region for the closed-loop poles (real

Plotting the root locus using MATLAB

```
» s = tf('s');
» G = (s+6)/((s+1)*(s+10)*(s^2+10*s+50))
» rlocus(G)
```
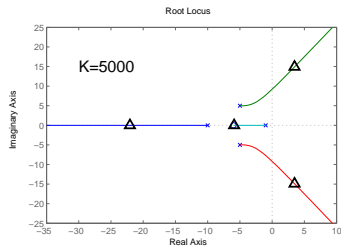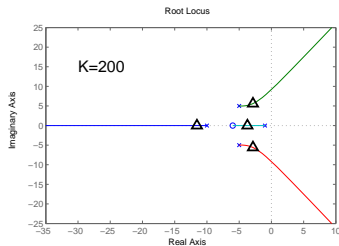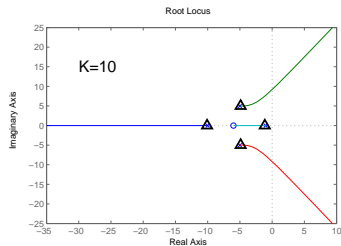

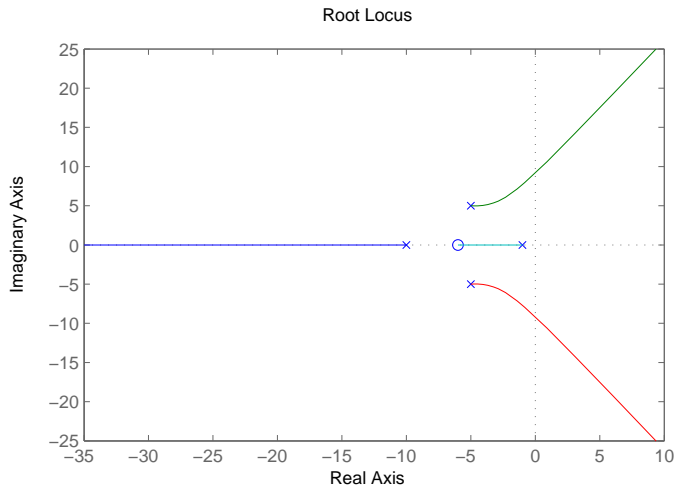Root Locus

Pole Location Information

Four Questions for Root Locus Features

- How many loci will we have?
- Where do the loci begin ($K = 0$) and end ($K = \infty$)?
- When do we have loci on the real axis?
- At what angles do the loci approach magnitude ∞? (Especially relevant to whether they enter the right half plane, meaning the closed loop system becomes unstable.)
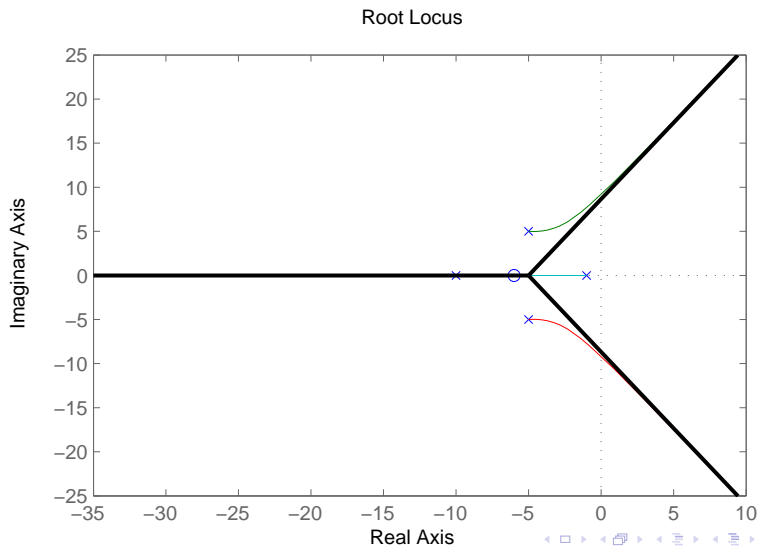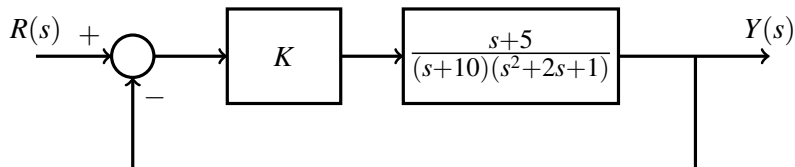
Root Locus with closed loop pole overlay

Root locus on the real axis

Root Locus

Root Locus Asymptotes

Root Locus

Root Locus Example Problem 1

$R(s)$ $+$ K $\dfrac{s+5}{(s+10)(s^2+2s+1)}$ $Y(s)$

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- What closed loop poles are achievable using proportional control?