

Exam 3 Study Guide

Exam 3 is Mon, 4/6/20, starting at 10:30am

The exam will be **open book**, and will be in pdf form. A link will be emailed to you about 10:20, A password needed to open the exam will be emailed at 10:30. Scan and return exam by 12:30. You text pictures at 12:30 and then send better-quality scans as pdf files later.

The exam will cover

1. Root - Locus method

a) Main rules

b) **Gain at any point** on the root locus: $k = \frac{1}{|G(s)|}$

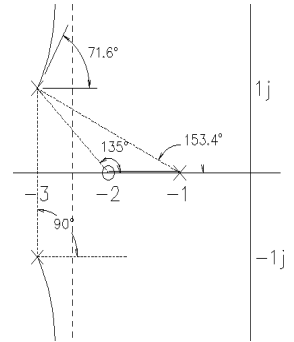
c) Additional rules.

The **breakaway/in points** are also solutions to:
$$\sum_{\text{all}} \frac{1}{(s + -p_i)} = \sum_{\text{all}} \frac{1}{(s + -z_i)}$$

Phase angle of $G(s)$ at any point on the root locus: $\arg(G(s)) = \arg(N(s)) - \arg(D(s)) = \pm 180^\circ, \pm 540^\circ, \dots$

Or: $\arg\left(\frac{1}{G(s)}\right) = \arg(D(s)) - \arg(N(s)) = \pm 180^\circ, \pm 540^\circ, \dots$

Departure angles from complex poles: Example. $180 - 90 - 153.4 + 135 = 71.6 \text{ deg}$



2. Root - Locus Interpretation and design

Concepts of what a root locus plot is and what it tells you. Movement of poles

Good vs bad, fast response vs slow, OK damping vs bad.

Compensators

Know pole & zero locations of P, PI, lag, PD, lead & PID Compensators.

PI and Lag, purpose and design, ties in with steady-state error

PD and Lead, purpose and design ties in with root locus angle rules

Choose points on the s-plane to achieve given required characteristics based on the 2nd-order assumption (RL Crib)

Know that the 2nd-order assumption may be accurate if other CL poles and/or zeros aren't 5x farther from Imag. axis.

Design of a compensator to force the RL point through a given point (like RL7).

3. Unconventional root-locus

4. Compensator circuits & Instrumentation amplifier

5. PID tuning.

6. PLCs and Ladder logic. Basic switching logic.

7. **Bode Plots** (limited to page 1 of notes)

Be able to draw both magnitude and phase plots

Be able to draw the smooth curves as well as the asymptotic lines

I may ask you to start with a circuit

Basic rules

8. Concentrate on Homeworks RL5 - Bd1 I'll scan through for problems

9. Up to Lab 5b (PID)

