ELEC 431 Control Systems (Section 52)

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Electrical Engineering Department, United Arab Emirates University
Fall 2020

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Main Textbook

NSN: Norman S. Nise,"*Control Systems Engineering*", 8th Edition, Wiley, 2019

Recommended References

KO: Katsuhiko Ogata, "*Modern Control Engineering*", 5th Edition, Pearson, 2009
RDRB: Richard C. Dorf and Robert H. Bishop, "*Modern Control Systems*", 13th Edition, Pearson, 2016

Lecture	Topic	Notes	Recording
Lecture 1	**Chapter 1: Introduction** **Sec 1.1** Introduction **Sec 1.3** System Configurations **Sec 1.5** The Design Process **Chapter 2: Modeling in the Frequency Domain** **Sec 2.1** Introduction **Sec 2.2** Laplace Transform Review - Laplace Transform of a Time Function - Inverse Laplace Transform - Partial Fraction Expanssion Case 1: Real & distinct roots Case 2: Real & repeated roots	Lecture 1	Recording
Lecture 2	**Chapter 2: Modeling in the Frequency Domain** **Sec 2.2** Laplace Transform Review - Partial Fraction Expanssion Case 2: Real & repeated roots Case 3: Complex roots **Sec 2.3** The Transfer Function **Sec 2.10** Nonlinearities **Sec 2.11** Linearization	Lecture 2	Recording
Lecture 3	**Chapter 2: Modeling in the Frequency Domain** **Sec 2.4** Electrical Network Transfer Functions	Lecture 3	Recording
Lecture 4	**Chapter 4: Time Response** **Sec 4.2** Poles, Zeros and System Response **Sec 4.3** First Order Systems **Sec 4.4** Second Order Systems: Introduction	Lecture 4	Recording

Lecture	Topic	Notes	Recording
Lecture 5	**Chapter 4: Time Response** **Sec 4.5** The General Second Order System	Lecture 5	Recording
Lecture 6	**Chapter 4: Time Response** **Sec 4.6** Underdamped Second Order Systems **Sec 4.7** System Response with Additional Poles **Sec 4.8** System Response with Zeros	Lecture 6	Recording
Lecture 7	**Chapter 5: Reduction of Multiple Subsystems** **Sec 5.2** Block Diagrams	Lecture 7	Recording
Lecture 8	**Chapter 5: Reduction of Multiple Subsystems** **Sec 5.3** Analysis and Design of Feedback Systems **Chapter 6: Stability** **Sec 6.1** Introduction **Sec 6.2** Routh-Hurwitz Criterion	Lecture 8	Recording
Lecture 9	**Chapter 6: Stability** **Sec 6.3** Routh-Hurwitz Criterion: Special Cases **Sec 6.4** Routh-Hurwitz Criterion: Additional Examples	Lecture 9	Recording
Lecture 10	**Chapter 7: Steady-State Errors** **Sec 7.1** Introduction **Sec 7.2** Steady-State Error for Unity Feedback Systems **Sec 7.3** Static Error Constants and System Type	Lecture 10	Recording
Lecture 11	**Chapter 7: Steady-State Errors** **Sec 7.4** Steady-State Error Specifications **Sec 7.5** Steady-State Error for Disturbances	Lecture 11	Recording
Lecture 12	**Chapter 10: Frequency Response Techniques** **Sec 10.1** Introduction - The Concept of Frequency Response - Analytical Expressions for Frequency Response - Plotting Frequency Response **Sec 10.2** Asymptotic Approximations: Bode Plots	Lecture 12	Recording

Lecture	Topic	Notes	Recording
Lecture 13	**Chapter 10: Frequency Response Techniques** **Sec 10.3** Introduction to the Nyquist Criterion **Sec 10.5** Stability via the Nyquist Diagram	Lecture 13	Recording
Lecture 14	**Chapter 10: Frequency Response Techniques** **Sec 10.6** Gain Margin and Phase Margin via the Nyquist Diagram **Sec 10.7** Stability, Gain Margin, and Phase Margin via Bode Plots	Lecture 14	Recording
Lecture 15	**PID Controller**	Lecture 15	Recording
Lecture 16	**Chapter 8: Root Locus Techniques** **Sec 8.1** Introduction **Sec 8.2** Defining the Root Locus	Lecture 16	Recording
Lecture 17	**Chapter 8: Root Locus Techniques** **Sec 8.3** Properties of the Root Locus	Lecture 17	Recording
Lecture 18	**Chapter 9: Design via Root Locus** **Sec 9.1** Introduction **Sec 9.2** Improving Steady-State Error via Cascade Compensation **Sec 9.3** Improving Transient Response via Cascade Compensation **Sec 9.4** Improving Steady-State Error and Transient Response	Lecture 18	Recording

Full Chapter Notes

Chapter	Topic	Notes
Chapter 1	Introduction	Chapter 1
Chapter 2	Modeling in the Frequency Domain	Chapter 2
Chapter 4	Time Response	Chapter 4
Chapter 5	Reduction of Multiple Subsystems	Chapter 5
Chapter 6	Stability	Chapter 6
Chapter 7	Steady-State Errors	Chapter 7
Chapter 10	Frequency Response Techniques	Chapter 10
PID	PID Controllers	PID
Chapter 8	Root Locus Techniques	Chapter 8
Chapter 9	Design via Root Locus	Chapter 9

Homework List

The list of homework questions below are based on the 6th International Edition of "Control Systems Engineering by Norman S. Nise. If you dont have this edition of the book, then please check the Blackboard folder Book Problems in which you will find the photocopied problems for Chapter 2, Chapter 4, Chapter 5, Chapter 6, Chapter 7 and Chapter 10.

Homework	Chapter	Problems Numbers	Problems Document
HW 1	Ch 2	1, 2, 3, 4, 7, 8, 9, 10, 11, 49, 50, 51, 17, 18, 19	Chapter 2 Problems
HW 2	Ch 4	8, 17, 18, 23, 28, 29, 30, 32	Chapter 4 Problems
HW 3	Ch 5	3, 5, 6, 8, 15, 16, 17	Chapter 5 Problems
HW 4	Ch 6	3, 6, 9, 11, 14, 17, 27, 28, 30, 31	Chapter 6 Problems
HW 5	Ch 7	1, 13, 20, 32, 39	Chapter 7 Problems
HW 6	Ch 10	1, 4, 10 (just System 1), 11 (just K=1000 and just System 1)	Chapter 10 Problems

Important Dates

	Chapter	**Due Date**
Quiz 1	Ch 2	Tuesday, 8th September, 2020 (Online in-class exam)
HW 1	Ch 2	Tuesday, 8th September, 2020 at 11:59 PM (Online submission)
Quiz 2	Ch 4	Tuesday, 22nd September, 2020 (Online in-class exam)
HW 2	Ch 4	Tuesday, 22nd September, 2020 at 11:59 PM (Online submission)
HW 3	Ch 5	Tuesday, 29th September, 2020 at 11:59 PM (Online submission)
Quiz 3	Ch 5	Sunday, 4th October, 2020 (Online in-class exam)
HW 4	Ch 6	Tuesday, 6th October, 2020 at 11:59 PM (Online submission)
Quiz 4	Ch 6	Sunday, 11th October, 2020 (Online in-class exam)
Test 1	Lectures 1 to 9 HW 1 to 4	Monday, 18th October, 2020 (Online in-class exam)
Midterm	Lectures 1 to 9 HW 1 to 4	Wednesday, 20th October, 2020 (Online in-class exam)
HW 5	Ch 7	Tuesday, 27th October, 2020 at 11:59 PM (Online submission)
Quiz 5	Ch 7	Sunday, 1st November, 2020 (Online in-class exam)
HW 6	Ch 10	Sunday, 22nd November, 2020 at 11:59 PM (Online submission)
Quiz 6	Ch 10	Tuesday, 24th November, 2020 (Online in-class exam)
National Day		Tuesday, 1st December, 2020
Test 2	Lectures 10 to 18 HW 5 and 6	Tuesday, 8th December, 2020 (Online in-class exam)
Final	Lectures 10 to 18 HW 5 and 6	Thursday, 10th December, 2020 from 3:30 to 5:30 PM (Online)

UAEU Academic Calendar (Fall 2020)

Day	Date	Event
Sun	16 Aug	Reporting of new Faculty & Instructors and Academic Administrators
Sun - Wed	16 Aug - 19 Aug	New Student Orientation, Advising, Testing, and Registration
Tue	18 Aug	Reporting of current Faculty & Instructors
Sun	23 Aug	Classes Begin , add/drop begins
Thu	27 Aug	Last day to add courses
Sun	30 Aug	Academic Advising period begins
Thu	17 Sep	Last day to withdraw/drop without failure
Thu	01 Oct	Deadline for temporary withdrawal requests
Sun	11 Oct	Beginning of traditional mid-term examination period
Thu	22 Oct	End of traditional mid-term examination period
Sun	08 Nov	Registration for Spring semester begins
Sun	22 Nov	Application for inter-college transfer
Thu	10 Dec	Deadline for inter-college transfer
Thu	10 Dec	Last day of classes
Sat	12 Dec	Final Examinations begin
Sat	19 Dec	Final Examinations end
Tue	22 Dec	Grades announced
Tue	22 Dec	Grades due to Registrar's Office
Wed - Thu	23 Dec - 31 Dec	Winter Break (Faculty, Instructors and Academic Administrators)
Wed - Thu	23 Dec - 07 Jan	Winter Break (Students)