



Control Systems Engineering, 8ed (An Indian Adaptation)

By Norman S. Nise, Amit Kumar Singh, Aritro Dey, Manas Kumar Bera, Swastik Acharya

Paperback

9789357463980

₹1,399.00

Pages: 844

Description

This Indian adaptation of the text maintains those aspects of the previous editions that have led to the book being so successful. In addition to introducing a new chapter on Optimal Control Systems, this edition strengthens the coverage by including new sections on Servomechanism, Multivariable Systems, Tuning of PID Controller, and All-Pass and Non-Minimum Phase Systems. Many of the end-of-chapter problems have been revised and new problems have been added. It also includes multiple choice questions based on the questions from various competitive examinations.

About the Author

Norman S. Nise, Amit Kumar Singh, Aritro Dey, Manas Kumar Bera, Swastik Acharya

Norman S. Nise, California State Polytechnic University, Pomona

Table of Contents

1. INTRODUCTION

1.1 Introduction

1.2 System Configurations

1.3 Servomechanism

1.4 A History of Control Systems

1.5 Analysis and Design Objectives

1.6 The Design Process

1.7 Multivariable Systems

1.8 Computer-Aided Design

1.9 The Control Systems Engineer

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

2. MODELING IN THE FREQUENCY DOMAIN

- 2.1 Introduction
- 2.2 Laplace Transform Review
- 2.3 The Transfer Function
- 2.4 Electrical Network Transfer Functions
- 2.5 Translational Mechanical System Transfer Functions
- 2.6 Rotational Mechanical System Transfer Functions
- 2.7 Transfer Functions for Systems with Gears
- 2.8 Electromechanical System Transfer Functions
- 2.9 Electric Circuit Analogs
- 2.10 Nonlinearities
- 2.11 Linearization

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Hardware Interface Laboratory

Bibliography

3. MODELING IN THE TIME DOMAIN

- 3.1 Introduction
- 3.2 Some Observations
- 3.3 The General State-Space Representation
- 3.4 Applying the State-Space Representation
- 3.5 Converting a Transfer Function to State Space
- 3.6 Converting from State Space to a Transfer Function
- 3.7 Linearization

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

4. TIME RESPONSE ANALYSIS

- 4.1 Introduction
- 4.2 Poles, Zeros, and System Response
- 4.3 First-Order Systems
- 4.4 Second-Order Systems: Introduction
- 4.5 The General Second-Order System

- 4.6 Underdamped Second-Order Systems
- 4.7 System Response with Additional Poles
- 4.8 System Response with Zeros
- 4.9 Effects of Nonlinearities upon Time Response
- 4.10 Laplace Transform Solution of State Equations
- 4.11 Time Domain Solution of State Equations

Summary

Multiple Choice Questions

Review Questions

Problems,

Cyber Exploration Laboratory

Hardware Interface Laboratory

Bibliography

5. REDUCTION OF MULTIPLE SUBSYSTEMS

- 5.1 Introduction
- 5.2 Block Diagrams
- 5.3 Analysis and Design of Feedback Systems
- 5.4 Signal-Flow Graphs
- 5.5 Mason's Rule
- 5.6 Signal-Flow Graphs of State Equations
- 5.7 Alternative Representations in State Space
- 5.8 Similarity Transformations

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

6. STABILITY

- 6.1 Introduction
- 6.2 Routh-Hurwitz Criterion
- 6.3 Routh-Hurwitz Criterion: Special Cases
- 6.4 Routh-Hurwitz Criterion: Additional Examples
- 6.5 Stability in State Space

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

7. STEADY-STATE ERRORS

7.1 Introduction

7.2 Steady-State Error for Unity-Feedback Systems

7.3 Static Error Constants and System Type

7.4 Steady-State Error Specifications

7.5 Steady-State Error for Disturbances

7.6 Steady-State Error for Nonunity-Feedback Systems

7.7 Sensitivity

7.8 Steady-State Error for Systems in State Space

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

8. ROOT LOCUS TECHNIQUES

8.1 Introduction

8.2 Defining the Root Locus

8.3 Properties of the Root Locus

8.4 Sketching the Root Locus

8.5 Refining the Sketch

8.6 An Example

8.7 Transient Response Design via Gain Adjustment

8.8 Generalized Root Locus

8.9 Root Locus for Positive-Feedback Systems

8.10 Pole Sensitivity

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Hardware Interface Laboratory

Bibliography

9. DESIGN VIA ROOT LOCUS

9.1 Introduction

9.2 Improving Steady-State Error via Cascade Compensation

9.3 Improving Transient Response via Cascade Compensation

9.4 Improving Steady-State Error and Transient Response

9.5 Feedback Compensation

9.6 Physical Realization of Compensation

9.7 Tuning of PID Controllers

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Hardware Interface Laboratory

Bibliography

10. FREQUENCY RESPONSE TECHNIQUES

10.1 Introduction

10.2 Asymptotic Approximations: Bode Plots

10.3 All-Pass and Non-Minimum Phase Systems

10.4 Introduction to the Nyquist Criterion

10.5 Sketching the Nyquist Diagram

10.6 Stability via the Nyquist Diagram

10.7 Gain Margin and Phase Margin via the Nyquist Diagram

10.8 Stability, Gain Margin, and Phase Margin via Bode Plots

10.9 Relation Between Closed-Loop Transient and Closed-Loop Frequency Responses

10.10 Relation Between Closed- and Open-Loop Frequency Responses

10.11 Relation Between Closed-Loop Transient and Open-Loop Frequency Responses

10.12 Steady-State Error Characteristics from Frequency Response

10.13 Systems with Time Delay

10.14 Obtaining Transfer Functions Experimentally

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

11. DESIGN VIA FREQUENCY RESPONSE

11.1 Introduction

11.2 Transient Response via Gain Adjustment

11.3 Lag Compensation

11.4 Lead Compensation

11.5 Lag-Lead Compensation

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

12. DESIGN VIA STATE SPACE

12.1 Introduction

12.2 Controller Design

12.3 Controllability

12.4 Alternative Approaches to Controller Design

12.5 Observer Design

12.6 Observability

12.7 Alternative Approaches to Observer Design

12.8 Steady-State Error Design via Integral Control

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

13. OPTIMAL CONTROL SYSTEMS (Available Online)

13.1 Introduction

13.2 Performance Indices

13.3 Optimal Control Problem

13.4 Regulator Problem

13.5 State Regulator

13.6 Output Regulator

13.7 Tracking Problem

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

14. DIGITAL CONTROL SYSTEMS (Available Online)

14.1 Introduction

14.2 Modeling the Digital Computer

14.3 The z-Transform

14.4 Transfer Functions

14.5 Block Diagram Reduction

14.6 Stability

14.7 Steady-State Errors

14.8 Transient Response on the z-Plane

14.9 Gain Design on the z-Plane

14.10 Cascade Compensation via the s-Plane

14.11 Implementing the Digital Compensator

Summary

Multiple Choice Questions

Review Questions

Problems

Cyber Exploration Laboratory

Bibliography

APPENDIX A1 List of Symbols

APPENDIX A2 Antenna Azimuth Position Control System

APPENDIX A3 Unmanned Free-Swimming Submersible Vehicle

APPENDIX A4 Key Equations

GLOSSARY

ONLINE APPENDICES

APPENDIX B MATLAB Tutorial

APPENDIX C Simulink Tutorial

APPENDIX D LabVIEW Tutorial

APPENDIX E MATLAB's GUI Tools Tutorial

APPENDIX F MATLAB's Symbolic Math Toolbox Tutorial

APPENDIX G Matrices, Determinants, and Systems of Equations

APPENDIX H Control System Computational Aids

APPENDIX I Derivation of a Schematic for a DC Motor

APPENDIX J Derivation of the Time Domain Solution of State Equations

APPENDIX K Solution of State Equations for $t_0 \neq 0$

APPENDIX L Derivation of Similarity Transformations

APPENDIX M Root Locus Rules: Derivations

ANSWERS TO SELECTED PROBLEMS

INDEX

To purchase this product, please visit:

<https://www.wileyindia.com/control-systems-engineering-8ed-an-indian-adaptation.html>



Scan to buy