

Department of Mechanical Engineering
2.14 Analysis and Design of feedback Control Systems

Fall Term 2003

Problem Set 9

Assigned: Nov. 17, 2003

Due: Nov. 24, 2003

Reading: Class Handouts on State-Space Methods:
Intro. to Matrices
State-Space Representation of LTI Systems
Time-Domain Solution of LTI State Equations
Nise, Chapter 3 State Space Modeling Methods
Nise, Chapter 4 (4.10, 4.11) Solution of State Equations
Nise, Chapter 5 (5.7, 5.8) Representations and Transformations in State Space
Nise, Chapter 7 (7.8) Steady-State Error for Systems in State Space
Nise, Chapter 12 Design via State Space

Note: The Matlab command `ss(system)` does not produce a *phase variable* form of the state equations. It produces a set of *control canonical* form equations, as described in Nise p. 278.

Problem 1: Nise, Ch. 3, Problem 3 (p. 164)

Use the voltages on the two capacitors, and the current through the inductor, as state-variables.

Problem 2: Nise, Ch. 3, Problem 13 (p. 166)

Give the answer in phase-variable form.

Problem 3: Nise, Ch. 3, Problem 22 (p. 171)

Hint: Define a suitable \mathbf{C} matrix for each case. Enter the system into Matlab and find the transfer function.

Problem 4: Nise, Ch. 4, Problem 35 (p. 241)

Problem 5: Nise, Ch. 4, Problem 36 (p. 241)

Problem 6: Nise, Ch. 5, Problem 37 (p. 313)

Problem 7: Nise, Ch. 5, Problem 39 (p. 313)

See Nise p. 275 for a description of the *parallel* form.