

SE 424
State-Space Methods for Control Design and Analysis
MWF 1-1:50 PM, Room 101 Transportation Building

Instructor: Prof. Carolyn Beck, 216C Transportation Bldg., beck3@illinois.edu
office hours: Tuesdays 2-3pm, room **216C TB**

TA: Lucas Buccafusca, buccafus@illinois.edu
office hours: Wednesdays 4-5pm, room **CSL 160** (or CSL 154)

Required Text: *Feedback Systems: An Introduction for Scientists and Engineers*,
by Karl Åström and Richard Murray, Princeton University Press
NOTE: available on course Compass 2g site, and online:
http://www.cds.caltech.edu/~murray/amwiki/index.php/Second_Edition

Recommended Notes: *GE 424 Course Packet*, Lecture Notes by Prof. R.S. Sreenivas

TENTATIVE COURSE OUTLINE:

Reading	Topics	Lectures
Å&M: Chapters 1-4, 6, 9 Notes: Parts 1, 3 and 7	Review of SE 320/Introduction to state-space models: Examples; Intro. to linearization of nonlinear systems; Laplace Transform review; Relating differential equations, transfer functions and state-space models;	Weeks 1-4
Å&M: Chapter 6 Notes: Part 2 Handouts	Linear algebra fundamentals: linear independence, rank, range space, null space, change of basis/similarity transformations; eigenvalue decomposition, Jordan form, Cayley-Hamilton theorem, singular value decomposition	Weeks 5-7
Å&M: Chapters 6, 9 Notes: Part 3	Solutions to state equations: matrix exponentials, convolution integrals and Laplace methods	Weeks 7-9
Å&M: Chapter 5 Notes: Parts 1 and 7	Stability: definition of stability; tests for state-space stability; poles and eigenvalues; Lyapunov stability	Weeks 9-10
Å&M: Chapter 7 Notes: Part 4	Reachability and state feedback design; decomposition structures, duality	Weeks 11-13
Å&M: Chapter 8 Notes: Part 5	Observability and state estimation, separation principle, error dynamics	Weeks 13-14
TBD	Advanced Topics	Weeks 14-15

Assignments and Exams:

- Problem sets will be assigned approximately every-other-week, and will include MATLAB-based exercises.
- Two or three problems will be selected “randomly” from each assignment for grading. Solutions for all problems will be provided to students.
- **Late homework policy:** for each day a homework assignment is turned in late, a 10% deduction will be taken.
- There will be 6-7 in-class quizzes held roughly every-other week; these will be announced in the lectures prior to the quiz date. Missed quizzes can only be made up (due to illness or unavoidable conflicts) if Prof. Beck and/or Mr. Buccafusca are notified **in advance**, and a quiz make-up date is agreed to at that time.
- There will be **one 2-hour evening midterm exam: tentatively March 13th or 14th.**
- There will be a 3-hour in-class **final exam during the regular final time slot: 7-10pm, Monday May 6th.**

Course Grade Composition:

Item	% of grade
Homework Problem Sets	20% total
Quizzes	20% total
Midterm Exam	25%
Final Exam	35%

Grading policy:

1. Any student attaining a total of 90% or above is guaranteed an A (i.e., A+, A or A-)
2. Any student attaining a total of 79% or above is guaranteed a B (i.e., B+, B or B-)
3. Any student attaining a total of 67% or above is guaranteed a C (i.e., C+, C or C-)
4. Any student attaining a total of 55% or above is guaranteed a D (i.e., D+, D or D-)
5. This grading scale will be curved as appropriate; specifically, at a minimum the top 20% of the class is guaranteed an A (i.e., A+, A or A-) and the remaining cutoffs will be scaled appropriately.