**MAE 4310-001**

**Spring 2016**

**T-TH 11:00-12:20**

**WH 308**

**Instructor: David Hullender**

**Office: Woolf Hall 304B**

**Office Hours: T-TH 9:30 am-11:00 am and by appointment**

**Phone: Office and Cell (817) 272-2014**

**Mailbox: Box 19023**

**E-mail:** **dahullender@gmail.com** **also** **hullender@uta.edu**

**Instructor website:** [**www.uta.edu/profiles/david-hullender**](http://www.uta.edu/profiles/david-hullender)

**Course WWW site for reference notes:** [elearn.uta.com](http://www.elearn.uta.com)

**Course Prerequisites: MAE3360**

**Required Textbook***:* ***Control Systems Engineering*** by Norman Nise, available at the UTA Bookstore

**Recommended additional materials: *Student Ed. of Matlab with Control Tool Box*** available at the UTA Bookstore or **Mathworks.com** website and **“Review of Basic Math Principles, Special Topic Notes, and Previous Exams”**, a notebook by Professor Hullender, available on Blackboard

**Course Description:** An initial objective of this course is to learn how the eigenvalues of a system affect the dynamic behavior of a system once the system experiences a disturbance from equilibrium or is given an input for the output of the system to track or follow. Also, an objective of this course is to learn feedback control techniques for improving the response characteristics of a system. MATLAB algorithms will be used for implementing control laws, solving equations and plotting the output solutions. Prior experience using MATLAB and SIMULINK will be useful but is not mandatory. Students inexperienced with MATLAB should consider this to be the introductory course as most of the solution methods will utilize existing MATLAB algorithms; the simplest way to learn how to use MATLAB is to study examples in this notebook and in the text, ***Control System Engineering***, Norman S. Nise. Professor Hullender expects a student struggling with any aspect of MATLAB to get help from him; questions regarding the use of MATLAB will be included on exams. Key library reserve references are ***Modeling and Simulation of Dynamic Systems***, Woods, Robert and Lawrence, Kent and ***Modern Control Systems***, Dorf and Bishop and ***Modern Control Engineering***, Ogata.

**Student Learning Outcomes:** This course is intended to provide a comprehensive treatment of the analysis and design techniques for achieving dynamic systems performance specifications.

**Requirements:**  Class and exam attendance is mandatory. Reasons for absence must be documented in writing to the instructor. Homework assignments will be included in computing the final grade; unless otherwise stated, all assignments are due at the beginning of the class on the due date. Late homework submissions will not be accepted. Students are expected to do their own work.

**Descriptions of major assignments and examinations**: In-class examinations will be given; all exams are comprehensive. There are no make-up exams. Should absence from an exam be excused, the final average for the course will be based on one less exam. Unless stated otherwise, all exams are closed book and only a calculator provided by the test moderator is allowed. Key Assignments will be included as part of the exams; a passing grade on these key assignments is not mandatory.

**Final Grade Computation at the End of the Semester**: There will be 3 in-class exams (85%) and homework (15%). There will not be a final exam during final exam week. Letter grades at the end of the semester will be determined by the distribution of the averages of the students in the class. For example, in the case of several high averages, the distribution might be 93-100 for A, 83-92 for B, etc. If the highest averages are in the low 90’s, then the distribution might be 86-94 for A, 76-85 for B, etc. Typically, it works out 90-100 for A, 80-89 for B, 70-79 for C, etc.

**Grade Grievances**: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances **as published in the current undergraduate catalog**

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wweb.uta.edu/ses/fao>).

**Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Academic Integrity:** At UT Arlington, academic dishonesty is completely unacceptable and will not be tolerated in any form, including (but not limited to) “cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts” (UT System Regents’ Rule 50101, §2.2). Suspected violations of academic integrity standards will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student’s suspension or expulsion from the University.

**Student Support Services**: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may contact the Maverick Resource Hotline by calling 817-272-6107, sending a message to resources@uta.edu, or visiting [www.uta.edu/resources](http://www.uta.edu/resources).

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory will be asked to complete an online Student Feedback Survey (SFS) about the course and how it was taught. Instructions on how to access the SFS system will be sent directly to students through MavMail approximately 10 days before the end of the term. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback data is required by state law; student participation in the SFS program is voluntary.

**Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Teaching Assistant: To be determined**

## MAE 4310 Spring 2016

 Chapters, pages, and sections refer to *Control Systems Engineering.*

# Tentative Lecture/Topic Schedule

Jan. 19 Overview of course and control system examples, Chapter 1

 21 Review of basic mathematics and MATLAB techniques, pp 33-47 & Notebook

 26 Review continued including linearization, pages 88-93 and Notebook

 28 Modeling in State Space, Chapter 3 and Notebook

Feb. 2 Transformation of Math Models with MATLAB, Section 3.6 & Notebook

4 Transient and Steady-state Response Analyses, Chapter 4 & Notebook

 9 Performance Index techniques for design optimization, Notebook

 11 ITAE Performance Index examples, ITAE eigenvalues, Notebook

 **16 Exam 1, comprehensive, closed book, no personal calculators**

 18 Steady state errors, Chapter 7

23 Ralph's Stability Criterion, Chapter 6

 25 Block diagrams and SIMULINK, Section 5.1-5.4 and Appendix C

March 1 Root-Locus Method, Chapter 8

3 Root-Locus continued

 8 Additional root-locus design examples, Chapter 9

10 Design via State Space, Chapter 12

 15 Spring Break

 17 Spring Break

**22** **Exam 2, comprehensive, closed book, no personal calculators**

 24 Controllability and Observability, Sections 12.3-12.7

 29 Linear quadratic regulator (MATLAB lqr) Notebook

 31 Steady-state error design via integral control, Section 12.8

April 5 Cont. Sys. Analysis and Design, Frequency-Response Method, Chap. 10

 7 Relative stability using the phase and gain margins,Section 10.7

 12 Design in the frequency domain, Chapter 11

14Lead and lag controllers

19 Lead and lag controllers continued

21 PID controllers, Section 9.4 and ‘help pidtune’ in MATLAB

26 Digital implementation of controllers**,** Chapter 13

28 **Exam 3, comprehensive, closed book, no personal calculators**

May 3 Class will not meet

 5 Class will not meet

 No final exam; first three exams were comprehensive