SYLLABUS

CHE 493 Process Dynamics and Controls Fall 2016

Instructor: Prof. C. Heath Turner

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Office Hours: 11:00-12:00 on MWF (or make appointment)

Class Schedule: 10:00-10:50 MWF / NL 2008


Class Website: http://unix.eng.ua.edu/~checlass/Controls/

Prerequisites: CHE 255 (minimum grade C-), MATH 238 (minimum grade C-)

Course Description:
The course provides a framework for analyzing process dynamics relevant to chemical engineers and for developing strategies for controlling these processes within design specifications. Dynamic models for open-loop (uncontrolled) processes are formulated and solved. These models may evolve from either the conservation laws (mass, energy, momentum balances) or empiricism. Both analytical and numerical methods are used to solve the model equations. The models and mathematical methods used for open-loop processes are applied to the analysis of closed-loop (controlled) processes. Both linear and nonlinear processes are addressed.

Outline:
(1) Process modeling
(2) Dynamic system behavior
(3) PID feedback control
(4) PID control tuning
(5) Frequency-response analysis

Grading:*  
Homework 25%
Exams (~3) 75%

* Grades will not be posted unless ABET-related materials have been completed.

- Exams. Each student can drop one exam grade. If you miss more than one hourly exam with certified medical excuses or other university-approved excuses, you may take a makeup exam at a designated time near the end of the semester. Only one
makeup exam will be given, and it will be comprehensive. Exams missed without a certified excuse will be graded as zero. The certified excuse must be provided within one week of the missed assignment.

- **Homework** is due at the start of the class – late assignments will not be accepted. The total homework score is cumulative and graded out of 140 total points. More than 140 points will be possible (due to an excess of homework assignments), but the maximum homework grade will be 100%.

- **Attendance** during lectures is strongly encouraged, but it is not required. It is the student’s responsibility to acquire any handouts or information missed during an absence.

- All students in attendance at the University of Alabama are expected to be honorable and to observe standards of conduct appropriate to a community of scholars. The University expects from its students a higher standard of conduct than the minimum required to avoid discipline. Academic misconduct includes all acts of dishonesty in any academically related matter and any knowing or intentional help or attempt to help, or conspiracy to help, another student. The Academic Misconduct Disciplinary Policy will be followed in the event of academic misconduct.

- If you are registered with the Office of Disability Services, please make an appointment with me as soon as possible to discuss any course accommodations that may be necessary. If you have a disability, but have not contacted the Office of Disability Services, please call 348-4285 or visit 133-B Martha Parham Hall East to register for services. Students who may need course adaptations because of a disability are welcome to make an appointment to see me during office hours. Students with disabilities must be registered with the Office of Disability Services, 133-B Martha Parham Hall East, before receiving academic adjustments.

- Severe weather protocol: In the case of a tornado warning (tornado has been sighted or detected by radar; sirens activated), all university activities are automatically suspended, including all classes and laboratories. If you are in a building, please move immediately to the lowest level and toward the center of the building away from windows (interior classrooms, offices, or corridors) and remain there until the tornado warning has expired. Classes in session when the tornado warning is issued can resume immediately after the warning has expired at the discretion of the instructor. Classes that have not yet begun will resume 30 minutes after the tornado warning has expired provided at least half of the class period remains.

UA is a residential campus with many students living on or near campus. In general classes will remain in session until the National Weather Service issues safety warnings for the city of Tuscaloosa. Clearly, some students and faculty commute from adjacent counties. These counties may experience weather related problems not encountered in Tuscaloosa. Individuals should follow the advice of the National Weather Service for that area taking the necessary precautions to ensure personal safety. Whenever the National Weather Service and the Emergency Management
Agency issue a warning, people in the path of the storm (tornado or severe thunderstorm) should take immediate life saving actions.

**When West Alabama is under a severe weather advisory, conditions can change rapidly. It is imperative to get to where you can receive information from the National Weather Service and to follow the instructions provided. Personal safety should dictate the actions that faculty, staff and students take.** The Office of Public Relations will disseminate the latest information regarding conditions on campus in the following ways:

- Weather advisory posted on the UA homepage
- Weather advisory sent out through Connect-ED--faculty, staff and students (sign up at myBama)
- Weather advisory broadcast over WVUA at 90.7 FM
- Weather advisory broadcast over Alabama Public Radio (WUAL) at 91.5 FM
- Weather advisory broadcast over WVUA 7. WVUA 7 Storm Watch provides a free service you can subscribe to that allows you to receive weather warnings for Tuscaloosa via e-mail, pager or cell phone. Check [http://www.wvua7.com/stormwatch.html](http://www.wvua7.com/stormwatch.html) for details.

- Turn off cell phones in lecture or set to a vibrate alert.

- Bring your textbook and calculator to class.

**Grade Cutoff Points:**
- 98 A+, 93 A, 90 A-, 88 B+, 83 B, 80 B-, 78 C+, 73 C, 70 C-, 68 D+, 63 D, 60 D-
Guide to Accreditation

This document will assist The University of Alabama Chemical and Biological Engineering students and alumni in understanding the process of accreditation. Some of this material has been adapted from other sources.

Accreditation assures quality in educational programs. Accreditation is a voluntary, non-governmental process of peer review. It requires an educational program to meet defined standards or criteria. Accreditation is sometimes confused with certification. Schools and programs are accredited whereas individuals are certified. Institutional accreditors, such as those referred to as "regional" accreditors, examine the university as a whole educational institution. The Southern Association of Colleges and Schools (SACS) accredits the University of Alabama (UA).

Specialized accreditors evaluate medicine, law, architecture and engineering. The Accreditation Board for Engineering and Technology (ABET) accredits engineering programs. ABET accreditation signifies that these programs have met specific criteria that are determined by engineering professionals working in industry and education.

Accreditation serves to notify:
1. Parents, students and licensing boards that a program meets minimum standards;
2. Administrators of program needs;
3. Employers that graduates are prepared for professional practice;
4. The public that graduates are aware of public health and safety considerations;
5. Taxpayers and scholarship/loan programs that funds are well spent.

Programs either receive accreditation or are denied accreditation. ABET does not rank programs. The University of Alabama Chemical and Biological Engineering (UA ChBE) department has had continuous accreditation for the BS in Chemical Engineering (BS ChE) since 1949-50, the first year considered. ABET accreditation is for six years. We were reviewed in the fall of 2001. Our next general review will be in the fall of 2007.

The UA ChBE department gathers information on students, curriculum, assessment methods and results, corrective actions, faculty, administration, facilities and institutional support. The self-study report (SSR), sent to the program evaluator (PE), summarizes all this information. The PE, a highly qualified chemical engineer, reviews the SSR against ABET criteria. A two-day campus visit follows. The PE meets with students, faculty and administrators. The PE examines labs, classrooms, and student work. The SSR and the campus visit determine accreditation. The PE publishes a program evaluation report. The SSR and program evaluation report will help improve The UA ChE program.
ABET criterion require us to develop program education objectives and educational outcomes. ABET criterion require us to perform self-assessment to insure we meet all of our objectives and outcomes. Objectives are attributes that working engineers will have several years after graduation. Outcomes are specific skills, developed in specific courses, that can be tested here on the UA campus. The UA ChE program education objectives and outcomes are listed below. They were reviewed and approved by the UA ChBE Advisory Board and Faculty in the spring of 2006.

UA ChE Program Educational Objectives
ChE graduates are expected to:
1. have knowledge of and a sound understanding of fundamentals
2. have analysis and problem solving skills
3. have synthesis and design skills
4. understand the responsibility to society by integrating global, environmental, and ethical concerns within the engineering functions
5. have effective oral and written communication skills
6. have teamwork and leadership skills
7. be prepared for post BS ChE opportunities

UA ChE Program Educational Outcomes
1. (a) an ability to apply knowledge of mathematics
1. (b) an ability to apply knowledge of science
1. (c) an ability to apply knowledge of engineering
2. (a) an ability to design and conduct experiments
2. (b) an ability to analyze and interpret experimental data
3. an ability to design a process to meet desired needs
4. an ability to function on multi-disciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional ethical responsibility
7. (a) an ability to communicate effectively in writing
7. (b) an ability to communicate effectively verbally
8. broad education to understand impact of engineering solutions in a global and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern eng. tools necessary for engineering practice
12. Thorough grounding in chemistry and a working knowledge of organic, analytical, biochemistry, materials chemistry or physical chemistry
13. *Working knowledge of material and energy balances applied to chemical processes
14. *Working knowledge of thermodynamics of physical and chemical equilibria
15. *Working knowledge of heat, mass, and momentum transfer
16. *Working knowledge of chemical reaction engineering
17. *Working knowledge of continuous and stage-wise separation operations
18. *Working knowledge of process dynamics and control
19. *Working knowledge of process design
20. (a)*Working knowledge of modern experimental techniques
20. (b)*Working knowledge of modern computing techniques

*13 through 20 must including safety and environmental aspects