Control Systems
EGR 414

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Office: S 322C
Office Hours: MW 10:00 – 11:00 AM; MTR 1:30 – 3:00 PM;
Department: Department of Physics and Astronomy
Class meeting time and place: Lecture - TR 9:30 am – 10:45 am / S 323

Course Description:
Introduction to automatic control systems; mathematical models of physical systems; block diagrams and signal flow graphs; transient and steady state responses; PID controllers; stability of linear feedback systems; root-locus and Routh's criteria; frequency response methods; polar, Nyquist and Bode plots; stability margins; state-variable formulation. Prerequisite: EGR 370.

Text and Materials:

Course Calendar:

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Chapter</th>
<th>Reading Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 15</td>
<td>Introduction to Control Systems</td>
<td>1</td>
<td>1.2-1.10</td>
</tr>
<tr>
<td>2</td>
<td>Jan 22</td>
<td>Mathematical Models of Systems</td>
<td>2</td>
<td>2.2-2.10</td>
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<tr>
<td>3</td>
<td>Jan 29</td>
<td><strong>Exam 1 (Chapter 1, 2)</strong></td>
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<tr>
<td>4</td>
<td>Feb 5</td>
<td>State Variable Models</td>
<td>3</td>
<td>3.2-3.5</td>
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<tr>
<td>5</td>
<td>Feb 12</td>
<td>State Variable Models</td>
<td>3</td>
<td>3.6-3.10</td>
</tr>
<tr>
<td>6</td>
<td>Feb 19</td>
<td>Feedback Control System Characteristics</td>
<td>4</td>
<td>4.2-4.10</td>
</tr>
<tr>
<td>7</td>
<td>Feb 26</td>
<td><strong>Exam 2 (Chapter 3,4)</strong></td>
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<tr>
<td>8</td>
<td>Mar 5</td>
<td>The Performance of Feedback Control Systems</td>
<td>5</td>
<td>5.2-5.11</td>
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<tr>
<td>9</td>
<td>Mar 12</td>
<td><strong>SPRING BREAK</strong></td>
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<tr>
<td>10</td>
<td>Mar 19</td>
<td>The Stability of Linear Feedback Systems</td>
<td>6</td>
<td>6.2-6.7</td>
</tr>
<tr>
<td>11</td>
<td>Mar 26</td>
<td>The Root Locus Method</td>
<td>7</td>
<td>7.2-7.5</td>
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<tr>
<td>12</td>
<td>Apr 2</td>
<td>PID Controllers</td>
<td>7</td>
<td>7.6-7.10</td>
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<tr>
<td>13</td>
<td>Apr 9</td>
<td><strong>Exam 3 (Chapter 7, 8)</strong></td>
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<tr>
<td>14</td>
<td>Apr 16</td>
<td>Frequency Response Methods</td>
<td>8</td>
<td>8.2-8.8</td>
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<tr>
<td>15</td>
<td>Apr 23</td>
<td>Stability in the Frequency Domain</td>
<td>9</td>
<td>9.2-9.5</td>
</tr>
<tr>
<td>16</td>
<td>Apr 30</td>
<td>Stability in the Frequency Domain</td>
<td>9</td>
<td>9.6-9.11</td>
</tr>
<tr>
<td>17</td>
<td>May 7</td>
<td>Final Exam (All Chapters)</td>
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Assignments:
There will be assignments almost every week. These assignments are due one week after they have been posted. Assignments will be submitted using D2L dropbox. Keep in mind that the HW should be clean and organized, for more details about HW submission refer to “Homework Guidelines” in this document. Once you finish the HW scan the work, and upload it to D2L.

Quizzes:
Quizzes will be posted on D2L. The idea is to reinforce knowledge from lecture, and reading assignments.
Exams:
There will be a total of three regular exams during the semester, and one comprehensive final exam. The exams will be based on the homework, and the materials covered during the lecture.

Grading Policy:

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
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<tr>
<td>Attendance</td>
<td>5%</td>
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<tr>
<td>Quizzes</td>
<td>15%</td>
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<tr>
<td>Exams</td>
<td>40%</td>
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<tr>
<td>Final Exam</td>
<td>25%</td>
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Late Policy
Any assignment should be returned in time. In the case that the assignment is returned late it will be affected by the following policy:

<table>
<thead>
<tr>
<th>Time Late</th>
<th>Deduction</th>
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<tbody>
<tr>
<td>Less than 2 hours</td>
<td>5</td>
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<tr>
<td>More than 2 hours less than 12</td>
<td>10</td>
</tr>
<tr>
<td>More than 12 hours less than 24</td>
<td>20</td>
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<tr>
<td>More than 24 hours less than 48</td>
<td>50</td>
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<tr>
<td>More than 48 hours</td>
<td>100</td>
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</tbody>
</table>

Homework Guidelines
As engineers, you should learn how to be organized, you will need to present reports and results to your superiors and these needs to be professional. For that reason, you will need to start learning how to be organized. The homework should be returned complying with the following format:

1. Use clean paper that will scan properly
2. Name should be on the top left corner
3. Pages should be numbered on the top right corner using the following format “3/10”
4. Problems should be organized and in order
5. Problem number should be clear and readable
6. Only one document should be submitted in PDF format
7. Use the following file naming format “LastnameFirstNameInitial_AssignmentNumber.pdf.”
   For example: OchoaH_Assignment 7.pdf

Failing to comply with any of these will result in a 10 points deduction.

Attendance Policy:
Attendance will be taken at the beginning of each class. Five points was allocated for attendance. I understand that things happen, and you are not able to attend class a couple of times. Therefore, you can miss only 3 lectures without deduction. However, it is your responsibility to investigate the topics covered in class, and any assignments or quizzes that were made that day. As a professor, I don’t have the responsibility to hunt you down to tell you what was assigned. Only in very special situations I will grant you with an extension. Coming to my office the day the assignment is due asking for an extension, because you didn’t know about assignment is not a valid reason. Do not assume that you will get an extension.

Student Learning Outcomes
By the end of the course, a successful student will be able to:
1. Model physical systems using differential equations and linear approximations. (SO-a)
2. Apply the Laplace Transform to model control systems. (SO-k)
3. Formulate a Transfer Function of Linear Systems. (SO-k)
4. Work with block diagram models. (SO-k)
5. Define the state variables for Dynamic Systems. (SO-e)
6. Construct the State differential equation. (SO-e)
7. Formulate the Transfer Function from the state equation. (SO-k)
8. Identify the characteristics of feedback control systems. (SO-b)
9. Evaluate the performance of feedback control systems. (SO-e)
10. Assess the stability of linear feedback systems. (SO-k)
11. Apply the root locus method. (SO-k)
12. Use MATLAB to design a system using root locus method. (SO-c)
13. Implement Frequency Response Methods to analyze control systems. (SO-k)
14. Analyze the stability of control systems in the frequency domain. (SO-k)
15. Recognize how the field of control systems has impacted industry, and as a result how it has changed the way we live. (SO-h)
16. Identify the role of control systems in new technologies been introduced to the public. (SO-i)

Program Learning Outcomes
Graduates of the program will:

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

General Education Core Curriculum Objectives/Outcomes (EEO)
There are no specific general education core curriculum objectives in this course. This course is not a general education core curriculum course.

Academic Integrity (A-9.I)

Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.
Definition of Academic Dishonesty
Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

Please read the complete policy at http://www.sfasu.edu/policies/academic_integrity.asp

Withheld Grades Semester Grades Policy (A-54)

Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

Students with Disabilities

To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.