Syllabus of ME 3040 Modeling and Simulation of System

Fall, 2015

Course Code: ME 3040
Course Name: Modeling and Simulation of System
Credit：2.5
Credit Hours: 40（Lab Work: 6 hours）

1. Instructor

Dr. Zou Yuan
National Engineering Lab for Electric Vehicles
Phone: 68944115
Email: zouyuan@bit.edu.cn

Dr. Zhang Xu,
410 Qiushi Building
Email: zhangxu@bit.edu.cn

2. Course Description

This course is designed for an introductory undergraduate course in modeling and simulation for dynamic systems. It consists of MATLAB application-based modeling, and control-oriented simulation of dynamic systems. Some fundamental physical rules and engineering method will be applied to model the typical dynamic systems. Frequency domain-based analysis for dynamic systems will be introduced. Feedback controller will be designed and analyzed at the end of the lecture.

This course will help the undergraduates to be capable of modeling and simulation of variable and typical dynamic systems by using Matlab/Simulink software and enhance their understanding and usage of the numeric algorithm and solver for dynamic systems. The attendees will also build the model-based design methodology and familiarize with some tools and platforms.

3. Prerequisites

MTH17005,7006 Calculus A（Ⅰ、Ⅱ）
MTH17013 Linear Algebra B
PHY17016, 17017 Physics（Ⅰ、Ⅱ）
MEC01075 Theoretical Mechanics
ME2022 Theory of Machines and Mechanisms

4. Corequisites: None

5. Course Outcomes

Students will enhance the concept of system dynamics and obtain the thorough understanding of typical dynamics process and their characters. They will be equipped with the knowledge and application capability for system modeling, simulation and analysis.

6. Course Content

1 Introduction to system dynamics
2 Solution methods for dynamic models
3 Solution methods for dynamic models
4 Spring and damper elements in mechanical systems
5 Spring and damper elements in mechanical systems
6 State-variable models and simulation method
7 State-variable models and simulation method
8 State-variable models and simulation method
9 Electric and electromechanical systems
10 Electric and electromechanical systems
11 Electric and electromechanical systems
12 System analysis in the frequency domain
13 System analysis in the frequency domain
14 System analysis in the frequency domain
15Transient response and block diagram models
16Transient response and block diagram models
17Transient response and block diagram models

7. Calendar

Section	***Topic***	***Assignments***
Lecture 01	Introduction to system dynamics	RWP, H
Lecture 02	Solution methods for dynamic models	RWP
Lecture 03	Solution methods for dynamic models	RWP, H
Lecture 04	Spring and damper elements in mechanical systems	RWP
Lecture 05	Spring and damper elements in mechanical systems	RWP, H
Lecture 06	State-variable models and simulation method	RWP
Lecture 07	State-variable models and simulation method	RWP
Lecture 08	State-variable models and simulation method	RWP, H
Lecture 09	Electric and electromechanical systems	RWP
Lecture 10	Electric and electromechanical systems	RWP
Lecture 11	Electric and electromechanical systems	RWP, H
Lecture 12	System analysis in the frequency domain	RWP
Lecture 13	System analysis in the frequency domain	RWP
Lecture 14	System analysis in the frequency domain	RWP, H
Lecture 15	Transient response and block diagram models	RWP

Lecture 16	Transient response and block diagram models	RWP
Lecture 17	Transient response and block diagram models	RWP, H

Assignments codes: D = Discussion, RWP = Reading with problems, H=Homework; T = Test

8. Lab works (6 hours)

Lab	*Topic*	*Assignments*
Lab 1	DC motor system modeling and simulation (3 hours)	DC motor modeling and simulation; test data-based Parameter estimation; response experiment. (After chapter 6)
Lab 2	Mass-spring-damper mechanical system ; (3 hours)	Free vibration measurements and comparisons with responses predicted from modeling and calibration. (After chapter 9)

9. Assignments

Matlab/Simulink software is the main tool in the lecture. All the homework will be solved by Matlab/Simulink. Reading with problems is the also important homework of this course. Students are expected through reading not only to understand the main topics given in classes, but also to extend their competence of applying processes and equipment in industries. Homework will be assigned, collected, and graded.

Discussions will be organized to test students' comprehensive understanding the dynamics of the different types of processes and system. Students will be divided into groups and will be responsible for a discussion and a short presentation (PPT is not required) on a given related topic each time.

10. Grading

10.1 Evaluation

- 7 Homework;
- Final test;
- Discussions and presentations;
- 2 Labs.

10.2 Final Grade Percentages

- Homework: 30 %
- Performance in class： 10%
- Lab performance: 20 %
- Final test: 40 %

10.3 Attendance Policy

The instructor will reduce (1) point per class he/she misses. On the other hand, if he / she does not miss any class the instructor will add an additional (2) points to his/her final class average. Missed classes include plant trips, sporting events, sick days, interviews, etc. The additional points may help if his/her grade is a borderline case.

10.4 Other Class Policies

a. Lab work is a part of this course. The instructor strongly recommends that all students make every effort possible to attend the lab work, including the trip to excellent resources to reinforce lecture information.

b. It is mandatory for every student to take all tests and to participate in the group discussions and presentations. If he/she does miss a test (exclusive to final test) or group presentation he/she will NOT receive a passing grade for that portion of the course and this will most likely result in a failing grade for the course. If a student misses the final test, he/she fails the course and there is no make-up exam.

c. Grades are not curved.

d. Submit all homework and other assignments on time, late homework will be reduced 10% of points for each day it is late. Late pass/fail assignments must be handed in by the next class after the due date or they will be graded as a fail.

e. Unless noted, homework can be written in pen, pencil, or a word processor may be used. Just make sure it is neat. Check all of work for correct spelling and grammar.

f. Students are expected to review the assigned reading before attending class. As part of the process, the student should take notes as he/she reads the chapters. Then, bring his/her notes to class as a reference material and fill in any additional information presented during the lecture.

g. Student work is checked against on-line reference sources for plagiarism. If work has been plagiarized it is reported to the Associate Dean for Undergraduate Studies for appropriate action. The minimum penalty for plagiarism is a failing grade for that portion of the class. This policy applies to individual and group assignments. For group assignments it is strongly suggested that all group members check work for plagiarism before submitting an assignment.

11. References

Textbook

William J. Palm. System Dynamics. McGraw-Hill, 2nd Edition, 2010

Recommended References

Katsuhiko Ogata. System Dynamics. Prentice Hall, 2003.