

# EE 513 Power Electronics

Spring, 2016

**Instructor:** Haoyu Wang

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**Class Hours:** Mondays and Wednesdays 8:15am-9:55am; Rm. 216, Bldg. H2

**Office Hours:** Fridays 2:00pm-4:00pm; the other times are fine, but by appointment only

**Course Website:** <http://pearl.shanghaitech.edu.cn/ee513/>

**Course Description:** An introduction course to switched-mode power converters. The first part of the course treats basic circuit operation, including steady-state converter modeling and analysis, switch realization, discontinuous conduction mode, and transformer-isolated converters. Next, converter control systems are covered, including ac modeling of converters using averaged methods, small-signal transfer functions, and classical feedback loop design. Finally, current programmed control is discussed, including: oscillation for  $D > 0.5$ , a simple first-order model, and a more accurate model.

**Prerequisite(s):** Circuits Theory; Advanced Mathematics; Control Theory

**Credit Hours:** 3

**Required Text:**

R. W. Erickson, and D. Maksimovic, *Fundamentals of Power Electronics*, 2<sup>nd</sup> Edition, Springer Science & Business Media, 2001. ISBN: 978-0-79-237270-7

**Recommended Texts:**

The following recommended texts will provide background for the course.

N. Mohan, and T. M. Undeland, *Power Electronics: Converters, Applications, and Design*, 3<sup>rd</sup> Edition, John Wiley & Sons, 2007. ISBN: 978-0-47-122693-2

M. H. Rashid, *Power Electronics: Circuits, Devices and Applications*, 4<sup>th</sup> Edition, Prentice Hall, 2013. ISBN: 978-0-13-312590-0

**Course Contents:**

1. Introduction
2. Principle of Steady State Analysis
3. Steady-state equivalent circuit modeling, losses, and efficiency
4. Switch realization
5. Discontinuous conduction mode
6. Converter circuits
7. AC equivalent circuit modeling
8. Converter transfer functions
9. Controller design
10. Current programmed control
11. Advanced topics

**Course Material:** Most of the course material will be delivered within the lecture. Supplementary material, such as homework and course announcement, will be updated on the class website at <http://pearl.shanghaitech.edu.cn/ee513/> and/or via direct email to students in the class. In case of email notification, I will send it to your @shanghaitech.edu.cn email by default. All class announcements will be mirrored onto the class website as an alternative means of retrieving updated information.

**Homework:** Homework will be given roughly every other week for approximately 2/3 of the semester. They will be distributed from the webpage. Homework will typically be due in class one week after it is posted and will be collected right before the lecture. The remainder of the semester will focus on an individual design project.

**Late Policy:** Late homework is allowed five days maximum after its due date, but its weight will be deducted by 10% per day.

**Exams:** Your exam score in the class will be based on two equally-weighted exams. The exact dates of the exams will be determined later and announced in class at least one and a half weeks in advance. Exam questions will be based on the lecture notes and homework.

**Project:** Students are also responsible for projects, where you will work individually to design, analyze, and simulate a novel power electronic converter/control method that improves the performance of existing converter/control method from the literature. Students will be required to submit a written report, as well as give an oral presentation, describing the project in detail. Details of the project will be provided later.

**Grading:** Grading will be based on: homework (20%), mid-term exam (25%), final project (30%), final exam (25%). Scores will be translated into final grades at the end of the semester with a grading scale that will likely be:  $0 - 40\% = F$ ,  $40\% - 65\% = C$ ,  $65\% - 85\% = B$ ,  $85\% - 100\% = A$ .

**Academic Dishonesty:** Although I sincerely wish that I will not have to cope with this issue, I would like to make it very clear that academic dishonesty will not be tolerated. The following acts of academic dishonesty are absolutely prohibited: cheating, fabrication, facilitating academic dishonesty, and plagiarism. Academic dishonesty in this course includes copying of homework or deliberately taking unfair advantage of the other students in the course. Once been found, it can lead one to a fail grade in this class and will be referred to the academic committee in the School of Information Science and Technology.