

Electric Machinery

电机学

Pinjia Zhang



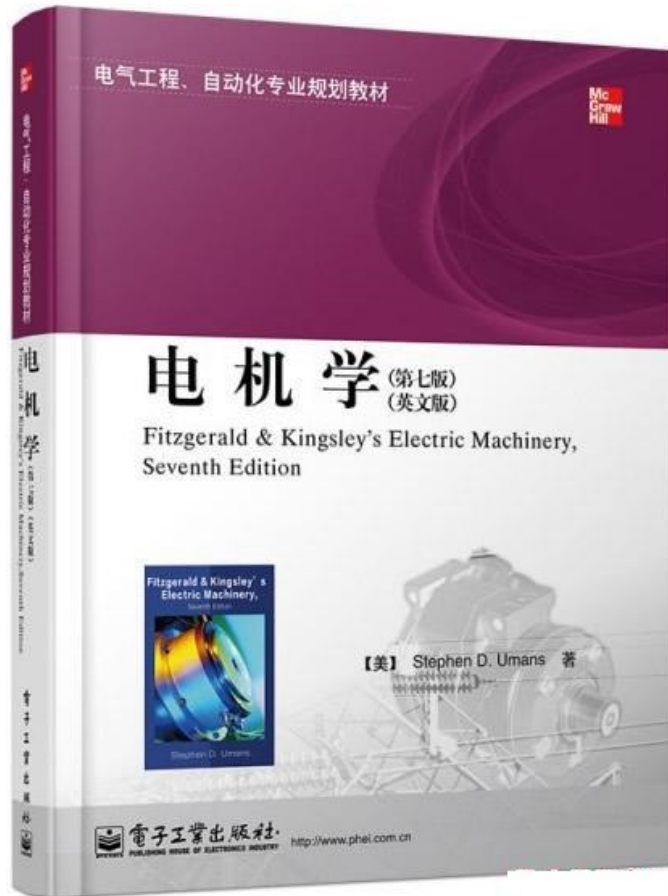
清华大学

Self Introduction

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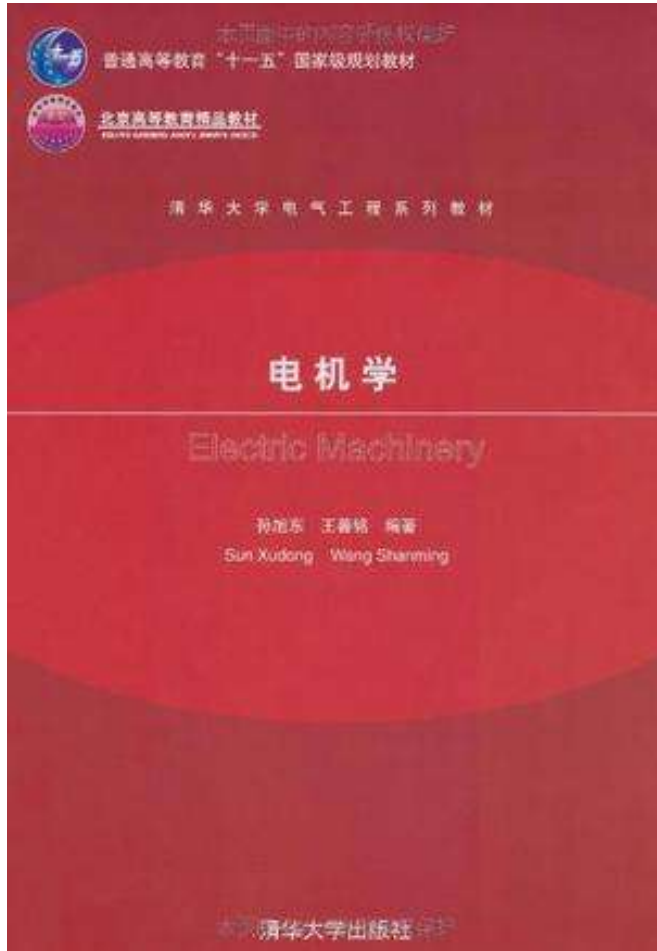
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Text Book



- Electric Machinery (Seventh Edition)
- Stephen D. Umans
- 电子工业出版社

Reference Book



- 电机学
- 孙旭东 王善铭
- 清华大学出版社

Problem Discussions

- 2 problem discussions
- Problems will be released one week ahead
- Will include standard problem and open problems
- Volunteers for open problem discussion may be eligible for bonus points

Presentations

- Students will be divided into 10 groups
- Every group provides a 20 min presentation on a given topic – a special type of electric machine
- Presentation needs to cover:
 - Fundamentals of the given type of machine
 - How does it convert energy?
 - Advantage & disadvantage
 - Where are they typically used? And why?

Assessment

- Homework – 10%
- Presentations – 10%
- Midterm Exam – 30%
- Final Exam – 50%

- Problem discussions – additional bonus points available (up to 5%)

Course Info

- 以英文教材内容为主
- 在英文教材基础上增加部分内容
- 考试内容以讲授内容为准
- 专业英文词汇首次出现会标注并解释

“电机学 (英文)” 教学日历

(2018—2019 学年度 春季学期)

周次	节次	日期/星期	讲 课 内 容
1	1	2.25 / 一	Introduction to Electric Machinery; Machinery Principles
	2	2.27 / 三	Machinery Principles: magnetic field, linear dc machine
2	1	3.04 / 一	Transformers: Introduction to Transformers; Ideal Transformer
	2	3.06 / 三	Transformers: Real Transformer; Equivalent Circuit
3	1	3.11 / 一	Transformers: Parameter testing; Voltage Regulation
	2	3.13 / 三	Transformers: Three Phase Transformers; Per-unit System
4	1	3.18 / 一	<i>Student presentation 1</i>
	2	3.20 / 三	Introduction to rotating machines: induced voltage & torque on rotating loops; induced voltage & torque on stationary winding
5	1	3.25 / 一	Introduction to rotating machines: emf of distributed windings
	2	3.27 / 三	Introduction to rotating machines: rotating magnetic field
6	1	4.01 / 一	Introduction to rotating machines: mmf of polyphase windings
	2	4.03 / 三	Introduction to rotating machines: leakage reactance and power flow
7	1	4.08 / 一	<i>Problem discussion</i>
	2	4.10 / 三	Midterm Exam

8	1	4.15 / 一	Synchronous machines: introduction; no load operation
	2	4.17 / 三	Synchronous machines: loaded operation; armature reaction
9	1	4.22 / 一	Synchronous machines: phasor diagram; equivalent circuit
	2	4.24 / 三	Synchronous machines: salient-pole generator; parameter testing
11	1	5.06 / 一	Synchronous machines: voltage regulation; parallel operation
	2	5.08 / 三	Synchronous machines: frequency regulation; synchronous motor
12	1	5.13 / 一	<i>Student Presentation 2</i>
	2	5.15 / 三	Induction machines: introduction; locked-rotor analysis
13	1	5.20 / 一	Induction machines: normal operation analysis; equivalent circuit
	2	5.22 / 三	Induction machines: parameter testing; power & torque, torque-speed relation
14	1	5.27 / 一	Induction machines: speed control; asynchronous generator
	2	5.29 / 三	DC machines: introduction; armature winding
15	1	6.03 / 一	<i>Student Presentation 3</i>
	2	6.05 / 三	DC machines: armature reaction; emf and torque
16	1	6.10 / 一	DC machines: equivalent circuit; voltage regulation and speed control
	2	6.12 / 三	<i>Problem discussion</i>
第 17~18 周 Final Exam			

注：本日历给出了预定的教学进度计划，届时视具体情况可能有局部调整。

上课时间：周一 第 4 大节，周三 第 2 大节。 上课地点：三教 1103。

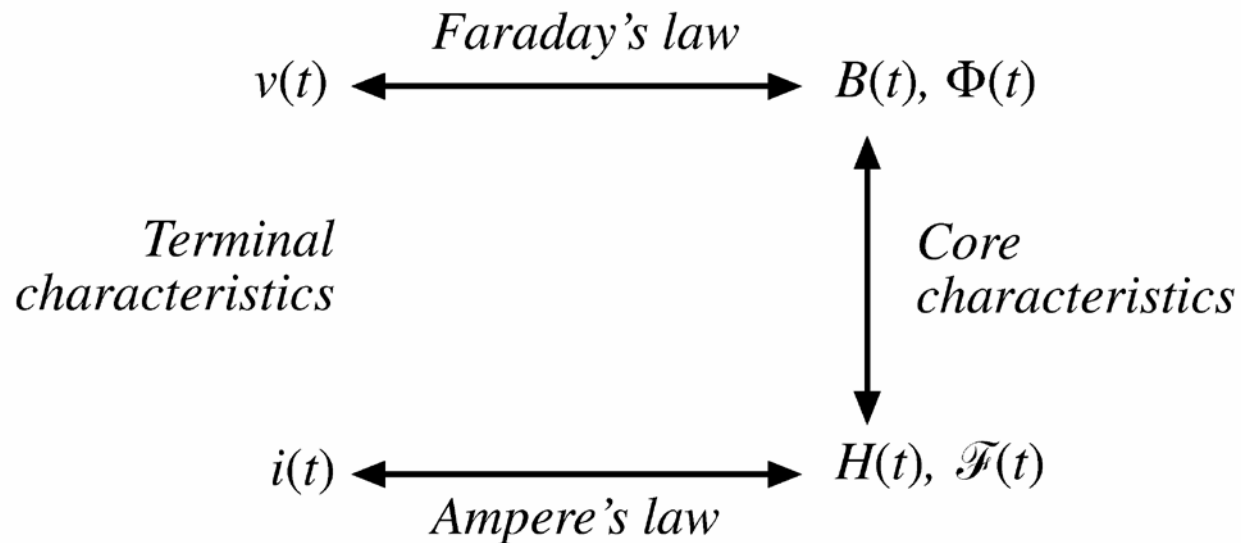
Q&A Every Wed 11:30-12:00 after class

Open office: Wed 15:00-17:00

Course outline

Course Outlines - Overview of relative electromagnetic theories (1 wk)

- Magnetic field (磁场) : Ampere's law
- Magnetic flux (磁通) : magnetic material, hysteresis characteristics
- Voltage: Faraday's law



Course Outlines - Overview of relative electromagnetic theories (conti)

- Magnetic circuit (磁路)
- Motor/generator: Induced voltage, induced force

Course Outlines - Transformer (2wks)

- Ideal/non-ideal transformer （变压器）
- Equivalent transformer circuit （变压器等效电路）
- Voltage regulation, efficiency

Course Outlines - Basic electric machine (motor/generator) theories (3wks)

- AC machine: winding (绕组) structure
- Mmf (magnetomotive force, 磁动势)
- Emf (electromotive force, 电动势)
- How the motor rotates ?
 - Torque/speed
- How the generator builds output voltage ?
 - Voltage/current

Course Outline - synchronous machine (3wks)

- Synchronous generator (SG , 同步发电机) – the most widely used generator in the world
 - Structure and operation theories of SG
 - Equivalent circuit of SG
 - Voltage/current characteristics
 - Parallel operation
- Synchronous motor
 - Operation principles
 - Starting of synchronous motor
 - Torque/speed characteristics

Course Outline - induction (asynchronous) machine (3wks)

- Induction motor (IM , 感应电机) – the most widely used ac motor in the world
 - Structure and operation theories of IM
 - Equivalent circuit of IM
 - Torque/speed characteristics
 - Basic motor control
- Induction generator (rarely used)
 - Output voltage control
 - Voltage/current characteristics

Course Outline - DC machine (2wks)

- DC machines
 - Structure and operation theories of DC machines
 - Equivalent circuit of DC machines
 - Torque/speed characteristics
 - Basic motor control