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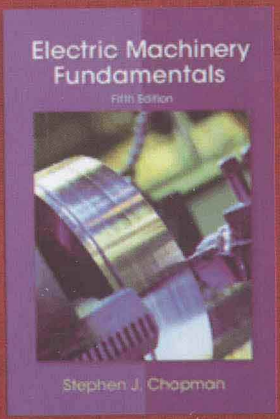

电机原理及驱动

——电机学基础（第5版）

Electric Machinery Fundamentals

(Fifth Edition)

Stephen J. Chapman 著

满永奎 编译

清华大学出版社

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ABOUT THE AUTHOR

Stephen J. Chapman received a B.S. in Electrical Engineering from Louisiana State University (1975) and an M.S.E. in Electrical Engineering from the University of Central Florida (1979), and pursued further graduate studies at Rice University.

From 1975 to 1980, he served as an officer in the U.S. Navy, assigned to teach electrical engineering at the U.S. Naval Nuclear Power School in Orlando, Florida. From 1980 to 1982, he was affiliated with the University of Houston, where he ran the power systems program in the College of Technology.

From 1982 to 1988 and from 1991 to 1995, he served as a member of the technical staff of the Massachusetts Institute of Technology's Lincoln Laboratory, both at the main facility in Lexington, Massachusetts, and at the field site on Kwajalein Atoll in the Republic of the Marshall Islands. While there, he did research in radar signal processing systems. He ultimately became the leader of four large operational range instrumentation radars at the Kwajalein field site (TRADEX, ALTAIR, ALCOR, and MMW).

From 1988 to 1991, Mr. Chapman was a research engineer for Shell Development Company in Houston, Texas, where he did seismic signal processing research. He was also affiliated with the University of Houston, where he continued to teach on a part-time basis.

Mr. Chapman is currently manager of systems modeling and operational analysis for BAE Systems Australia, in Melbourne.

Mr. Chapman is a senior member of the Institute of Electrical and Electronic Engineers (and several of its component societies). He is also a member of Engineers Australia.

编译者序

改革开放以来，我国经济进入了快速发展期，很快融入了世界经济发展的大潮。随着我国加入 WTO，日益国际化的经济对我国专业人员的国际化水平提出了更高的要求。较高的国际化水平的一个突出的方面是专业人员的专业英文交流能力有待极大提高。

因为客观市场对此有迫切需求，国家教育部也将双语教学列为高等学校教育质量评估中的一项重要指标。

作为本书的编译者，我在多年与英国大学的合作研究和与外国公司的合作中，深刻认识到，专业英文的直接交流会极大地帮助我们发挥自身的潜能，增加在世界舞台上的竞争能力。而另一方面，在东北大学的多年教学中和在面试研究生和博士生的口语时，我也发现目前国内学生的专业英文能力比之他们的口语能力差距较大。因此我坚信：坚持双语教学，对于提高我国专业技术人员的直接交流能力，适应我国快速的经济发展需要，必将会起到积极的推动作用。

本书是基于由 Stephen J. Chapman 编写的，McGraw-Hill 出版社出版的 *Electric Machinery Fundamentals* 一书的第 5 版(2012)改编。原著凝聚了作者在美国佛罗里达海军核动力学院和休斯敦大学的教学经验，作者在著书时掌握的主要原则是使其尽可能地通俗易懂，便于自学，这是本书的最大特点。此外，书中的内容最大限度地跟踪最新技术的发展，因此，原著自 1985 年第 1 版出版以来，已经成为世界上的畅销教材①。

随着现代电力电子技术和交流控制技术的发展，交流电机在更多的领域不断取代直流电机的应用，而原著的第 5 版也正是为了适应新技术的发展，先阐述交流部分内容，开创了以交流内容作为重点的先河，有别于一般传统教材。

本书保留了原著第 5 版的大部分章节。在原著中，关于同步电机有两章，即同步发电机和同步电动机(原书的第 4 章和第 5 章)，而我们在教授这门课程时，往往没有很多课时用在同步电机上，因此将原著的两章合并为一章(作为本书的第 4 章)。

为了便于读者理解，编译者增加了“词汇”和“导读”部分。在“词汇”部分，侧重点是专业词汇，给出了相对应的汉语术语。尽管穿插在书中各节列出了一些词汇，但是，为了读者查阅方便，在最后附录中，还按字母顺序列出了总的汉英对照词汇表。

为了使读者减少对中文的依赖性，编译者在“导读”部分，使用汉语注释的侧重点是理解上的难点，而不是本章节的重点；而本章节的重点内容，读者可以阅读原文中的“Summary”，还可以由教师在讲课中予以指导。

参加本书编译工作的还有边春元、杨珺、杨东升等，在此，向他们表示谢意。

---

① 满永奎教授曾于 2008 年编译出版该书第 4 版(ISBN：9787302177302)，并被多所知名高校采用，累计发行 7000 多册。——编辑注

在本教材的编译过程中，得到了清华大学出版社的鼎力支持，在此，表示诚挚的感谢。

本教材可以作为高等学校电气工程和自动化专业本科生的专业基础课双语教材和研究生教材，也可以作为电气工程和自动化领域工程技术人员的技术参考书。

东北大学　满永奎

2013 年 5 月

PREFACE

In the years since the first edition of *Electric Machinery Fundamentals* was published, there has been rapid advance in the development of larger and more sophisticated solid-state motor drive packages. The first edition of this book stated that dc motors were the method of choice for demanding variable-speed applications. That statement is no longer true today. Now, the system of choice for speed control applications is most often an ac induction motor with a solid-state motor drive. DC motors have been largely relegated to special-purpose applications where a dc power source is readily available, such as in automotive electrical systems.

The third edition of the book was extensively restructured to reflect these changes. The material on ac motors and generators is now covered in Chapters 3 through 6, before the material on dc machines. In addition, the dc machinery coverage was reduced compared to earlier editions. This edition continues with this same basic structure.

In addition, the former Chapter 3 on solid-state electronics has been deleted from the fifth edition. Feedback from users has indicated that that material was too detailed for a quick overview, and not detailed enough for a solid-state electronics course. Since very few instructors were using this material, it has been removed from this edition and added as a supplement on the book's website. Any instructor or student wishing to continue using the material in this chapter can freely download it.

Learning objectives have been added to the beginning of each chapter to enhance student learning.

Chapter 1 provides an introduction to basic machinery concepts, and concludes by applying those concepts to a linear dc machine, which is the simplest possible example of a machine. Chapter 2 covers transformers, which are not rotating machines, but which share many similar analysis techniques.

After Chapter 2, an instructor may choose to teach either dc or ac machinery first. Chapters 3 through 6 cover ac machinery, and Chapters 7 and 8 cover dc machinery. These chapter sequences have been made completely independent of

each other, so that an instructor can cover the material in the order which best suits his or her needs. For example, a one-semester course with a primary concentration in ac machinery might consist of parts of Chapters 1, 2, 3, 4, 5, and 6, with any remaining time devoted to dc machinery. A one-semester course with a primary concentration in dc machinery might consist of parts of Chapters 1, 2, 7, and 8, with any remaining time devoted to ac machinery. Chapter 9 is devoted to single-phase and special-purpose motors, such as universal motors, stepper motors, brushless dc motors, and shaded-pole motors.

The homework problems and the ends of chapters have been revised and corrected, and more than 70% of the problems are either new or modified since the last edition.

In recent years, there have been major changes in the methods used to teach machinery to electrical engineering and electrical technology students. Excellent analytical tools such as MATLAB® have become widely available in university engineering curricula. These tools make very complex calculations simple to perform, and they allow students to explore the behavior of problems interactively. This edition of *Electric Machinery Fundamentals* makes selected use of MATLAB to enhance a student's learning experience where appropriate. For example, students use MATLAB in Chapter 6 to calculate the torque–speed characteristics of induction motors, and to explore the properties of double-cage induction motors.

This text does not teach MATLAB; it assumes that the student is familiar with it through previous work. Also, the book does *not* depend on a student having MATLAB. MATLAB provides an enhancement to the learning experience if it is available, but if it is not, the examples involving MATLAB can simply be skipped, and the remainder of the text still makes sense.

This book would never have been possible without the help of dozens of people over the past 25 years. It is gratifying for me to see the book still popular after all that time, and much of that is due to the excellent feedback provided by reviewers. For this edition, I would especially like to thank:

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为了更好地服务中国教育界，提升教学质量，2003 年麦格劳-希尔教师服务中心在京成立。在您确认将本书作为指定教材后，请您填好以下表格并经系主任签字盖章后寄回，麦格劳-希尔教师服务中心将免费向您提供相应教学课件，或网络化课程管理资源。如果您需要订购或参阅本书的英文原版，我们也会竭诚为您服务。

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