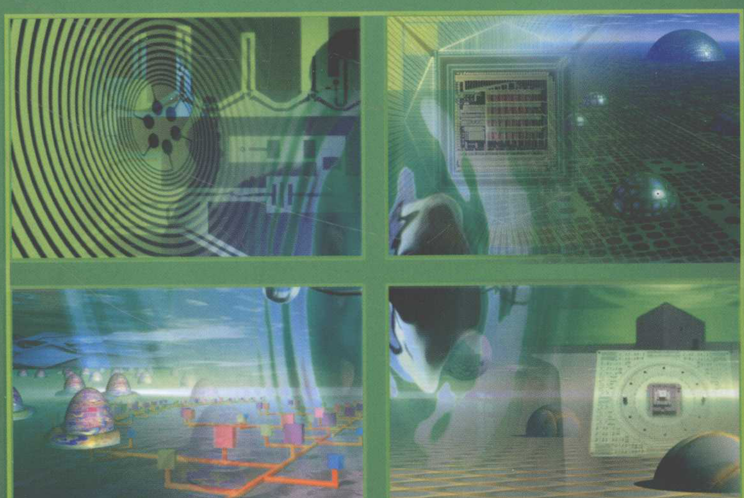
普通高等教育电子信息类规划教材

电气工程与自动化专业英语

ENGLISH FOR ELECTRICAL ENGINEERING AND AUTOMATION



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机械工业出版社
CHINA MACHINE PRESS

本教材共分 10 个单元，每个单元由三部分组成：Section A 为该单元阅读和翻译教学的重点，主要包括电气工程简介、电路、晶体管、控制系统中的直流电机、DC-DC 开关式变流器、开环控制系统、转差功率控制驱动、可编程序逻辑控制器、FACTS 装置及应用、变速永磁同步风力发电机的控制。Section B 为写作指导，主要包括求职信、个人简介、学术会议邀请及回复信函、学术论文写作的基本知识、作者与编辑的往来信函、会议主持词、会议日程、课题进展报告、电子邮件、备忘录、便条和通知等实用文体写作。Section C 为该单元辅助阅读部分，内容包括数字电子电路、交流电机驱动、AC-DC 开关式逆变器、自动控制系统简介、太阳能电站的自动控制等。

本教材构思独特，选材新颖，内容丰富，知识性强，语言规范。每单元的练习都给出了参考答案以便于教学。写作部分选材具有很强的实用性和针对性，范文规范，操作性强，便于学生模仿，做到学以致用。

图书在版编目（CIP）数据

电气工程与自动化专业英语 / 龚育尔等编著. —北京：机械工业出版社，2012.9

普通高等教育电子信息类规划教材

ISBN 978-7-111-39787-8

Ⅰ. ① 电… Ⅱ. ① 龚… Ⅲ. ① 电气工程－英语－高等学校—教材 ② 自动化技术－英语－高等学校－教材 Ⅳ. ① H31

中国版本图书馆 CIP 数据核字（2012）第 221816 号

机械工业出版社（北京市百万庄大街 22 号　邮政编码 100037）

责任编辑：李馨馨

责任印制：张　楠

北京四季青印刷厂印刷

2012 年 11 月第 1 版 · 第 1 次印刷

184mm × 260mm · 16.75 印张 · 412 千字

0001—2500 册

标准书号：ISBN 978-7-111-39787-8

定价：35.00 元

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前　　言

本书主要作为高等院校电气工程及自动化专业英语课程教学使用，开课时间一般为本、专科第三或第四学年；也可供相关领域从业人员学习英语和实用文体的英文写作时使用。

全书共 10 个单元，每个单元由三个部分组成。

Section A 为该单元阅读和翻译教学的重点，旨在培养学生阅读和翻译电气工程及自动化专业的英文资料。本部分收集的文章专业性强，涉及当代电气工程及自动化领域的最新研究成果和理念，主要包括电气工程简介、电路、晶体管、控制系统中的直流电机、DC-DC 开关式变流器、开环控制系统、转差功率控制驱动、可编程序逻辑控制器、FACTS 装置及应用、变速永磁同步风力发电机的控制。该部分配有适当的阅读理解、词汇和翻译等练习。

Section B 为写作指导，旨在培养学生英文写作的能力。主要包括以下方面：求职信、个人简历、学术会议邀请及回复信函、学术论文写作的基本知识、作者与编辑的往来信函、会议主持词、会议日程、课题进展报告、电子邮件、备忘录、便条和通知等实用文体写作。此部分不但提供了相应的标准范文，而且还总结了一些惯用英文句型，供学生练习模仿使用。

Section C 为该单元辅助阅读部分，供学生自学时阅读，以进一步提高其阅读和翻译的能力。该部分收集的大多数文章也有较强的专业性，内容涉及电气工程及自动化专业的主要领域，包括数字电子电路、交流电机驱动、AC-DC 开关式逆变器、自动控制系统简介、太阳能电站的自动控制等。该部分也配有少量的阅读理解和翻译练习。

本教材构思独特，选材新颖，内容丰富，知识性强，语言规范。各单元的练习都给出了参考答案，以便于教学。写作部分选材具有很强的实用性和针对性，范文规范，操作性强，便于学生模仿，做到学以致用。

本书 Unit 1～3 由代小艳编写；Unit 4～5 由钱平编写；Unit 6～7 由徐岚编写、Unit 8～10 由龚育尔编写；写作部分由刘燕芹、代小艳负责编写。本书在编写过程中得到了淮海工学院电子工程学院周渊深教授和许炜副教授的悉心指导，在此对他们深表感谢。

限于编者水平，加之时间仓促，书中难免有疏漏和不妥之处，恳请读者指正。

编　者

目　　录

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Unit 1

Section A

Text

A General Introduction to Electrical Engineering

Electrical engineering is the profession concerned with systems that **produce, transmit, and measure electric signals.** Electrical engineering combines the physicist's models of natural phenomena with the mathematician's tools for manipulating those models to produce systems that meet practical needs.

Communication systems are electrical systems that generate, transmit, and distribute information. Well-known examples include television equipment, such as cameras, transmitters, receivers, and VCRs; radio telescopes, used to explore the universe; satellite systems, which return images of other planets and our own; radar systems, used to coordinate plane flights; and telephone systems.

Computer systems use electric signals to process information ranging from word processing to mathematical computations. Systems range in size and power from pocket calculators to personal computers to supercomputers that perform such complex tasks as processing weather data and modeling chemical interactions of complex organic molecules. These systems include networks of microcircuits, or integrated circuits-postage-stampsized assemblies of hundreds, thousands, or millions of electrical components that often operate at speeds and power levels close to fundamental physical limits, including the speed of light and the thermo-dynamic laws.

Control systems use electric signals to regulate processes. Examples include the control of temperatures, pressures, and flow rates in an oil refinery; the fuel-air mixture in a fuel-injected automobile engine; mechanisms such as the motors, doors, and lights in elevators; and the locks in the Panama Canal. The autopilot and autolanding systems that help to fly and land airplanes are also familiar control systems.

Power systems generate and distribute electric power. Electric power, which is the foundation of our technology-based society, usually is generated in large quantities by nuclear, hydroelectric, and thermal (coal-, oil-, or gas-fired) generators. Power is distributed by a grid of conductors that crisscross the country. A major challenge in designing and operating such a system is to provide sufficient redundancy and control so that failure of any piece of equipment does not leave a city, state, or region completely without power[1].

Signal-processing systems act on electric signals that represent information. They transform the signals and the information contained in them into a more suitable form. There are many different ways to process the signals and their information. For example, image-processing systems gather massive quantities of data from orbiting weather satellites, reduce the amount of data to a manageable level, and transform the remaining data into a video image for the evening news broadcast. A computerized tomography (CT) scan is another example of an image-processing system. It takes signals generated by a special X-ray machine and transforms them into an image. Although the original X-ray signals are of little use to a physician, once they are processed into a recognizable image the information they contain can be used in the diagnosis of disease and injury.

Circuit Theory

In a field as diverse as electrical engineering, you might well ask whether all of its branches have anything in common. The answer is yes–electric circuits. An **electric circuit** is a mathematical model that approximates the behavior of an actual electrical system. As such, it provides an important foundation for learning–in your later courses and as a practicing engineer–the details of how to design and operate systems such as those just described. The models, the mathematical techniques, and the language of circuit theory will form the intellectual framework for your future engineering endeavors.

Note that the term *electric circuit* is commonly used to refer to an actual electrical system as well as to the model that represents it. In this text, when we talk about an electric circuit, we always mean a model, unless otherwise stated. It is the modeling aspect of circuit theory that has broad applications across engineering disciplines.

Circuit theory is a special case of electromagnetic field theory: the study of static and moving electric charges. Although generalized field theory might seem to be an appropriate starting point for investigating electric signals, its application is not only cumbersome but also requires the use of advanced mathematics.

Three basic assumptions permit us to use circuit theory, rather than electromagnetic field theory, to study a physical system represented by an eclectic circuit. These assumptions are as follows:

1. *Electrical effects happen instantaneously throughout a system.* We can make this assumption because we know that electric signals travel at or near the speed of light. Thus, if the system is physically small, electric signals move through it so quickly that we can consider them to affect every point in the system simultaneously. A system that is small enough so that we can make this assumption is called a **lumped-parameter system.**

2. *The net charge on every component in the system is always zero.* Thus no component can collect a net excess of charge, although some components, as you will learn later, can hold equal but opposite separated charges.

3. *There is no magnetic coupling between the components in a system.* As we demonstrate

later, magnetic coupling can occur within a component.

That's it; there are no other assumptions. Using circuit theory provides simple solutions (of sufficient accuracy) to problems that would become hopelessly complicated if we were to use electromagnetic field theory. These benefits are so great that engineers sometimes specifically design electrical systems to ensure that these assumptions are met. The importance of assumptions 2 and 3 becomes apparent after we introduce the basic circuit elements and the rules for analyzing interconnected elements.

However, we need to take a closer look at assumption 1. The question is, "How small does a physical system have to be to qualify as a lumped-parameter system?" We can get a quantitative handle on the question by noting that electric signals propagate by wave phenomena. If the wavelength of the signal is large compared to the physical dimensions of the system, we have a lumped-parameter system. The wavelength λ is the velocity divided by the repetition rate, or **frequency**, of the signal; that is, $\lambda = c/f$. The frequency f is measured in Hertz (Hz). For example, power systems in the United States operate at 60 Hz. If we use the speed of light ($c=3\times10^8$ m/s) as the velocity of propagation, the wavelength is 5×10^6 m. If the power system of interest is physically smaller than this wavelength, we can represent it as a lumped-parameter system and use circuit theory to analyze its behavior. How do we define smaller? A good rule is the *rule of 1/10th*: if the dimension of the system is 1/10th (or smaller) of the dimension of the wavelength, you have a lumped-parameter system. Thus, as long as the physical dimension of the power system is less than 5×10^5m, we can treat it as a lumped-parameter system.

On the other hand, the propagation frequency of radio signals is on the order of 10^9 Hz. Thus the wavelength is 0.3 m. Using the rule of 1/10th, the relevant dimensions of a communication system that sends or receives radio signals must be less than 3 cm to qualify as a lumped-parameter system. Whenever any of the pertinent physical dimensions of a system under study approaches the wavelength of its signals, we must use electromagnetic field theory to analyze that system.

Problem Solving

As a practicing engineer, you will not be asked to solve problems that have already been solved. Whether you are trying to improve the performance of an existing system or creating a new system, you will be working on unsolved problems. As a student, however, you will devote much of your attention to the discussion of problems already solved. By reading about and discussing how these problems were solved in the past, and by solving related homework and exam problems on your own, you will begin to develop the skills to successfully attack the unsolved problems you'll face as a practicing engineer[2].

Some general problem-solving procedures are presented here. Many of them pertain to thinking about and organizing your solution strategy before proceeding with calculations.

1. *Identify what's given and what's to be found.* In problem solving, you need to know your destination before you can select a route for getting there. What is the problem asking you to solve or find? Sometimes the goal of the problem is obvious; other times you may need to paraphrase or

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make lists or tables of known and unknown information to see your objective. The problem statement may contain extraneous information that you need to weed out before proceeding. On the other hand, it may offer incomplete information or more complexities than can be handled given the solution methods at your disposal. In that case, you'll need to make assumptions to fill in the missing information or simplify the problem context. Be prepared to circle back and reconsider supposedly extraneous information and/or your assumptions if your calculations get bogged down or produce an answer that doesn't seem to make sense.

2. *Sketch a circuit diagram or other visual model.* Translating a verbal problem description into a visual model is often a useful step in the solution process. If a circuit diagram is already provided, you may need to add information to it, such as labels, values, or reference directions. You may also want to redraw the circuit in a simpler, but equivalent form[3]. Later in this text you will learn the methods for developing such simplified equivalent circuits.

3. *Think of several solution methods and decide on a way of choosing among them.* This course will help you build a collection of analytical tools, several of which may work on a given problem. But one method may produce fewer equations to be solved than another, or it may require only algebra instead of calculus to reach a solution. Such efficiencies, if you can anticipate them, can streamline your calculations considerably. Having an alternative method in mind also gives you a path to pursue if your first solution attempt bogs down.

4. *Calculate a solution.* Your planning up to this point should have helped you identify a good analytical method and the correct equations for the problem. Now comes the solution of those equations. Paper-and-pencil, calculator, and computer methods are all available for performing the actual calculations of circuit analysis. Efficiency and your instructor's preferences will dictate which tools you should use.

5. *Use your creativity.* If you suspect that your answer is off base or if the calculations seem to go on and on without moving you toward a solution, you should pause and consider alternatives. You may need to revisit your assumptions or select a different solution method. Or, you may need to take a less-conventional problem-solving approach, such as working backward from a solution. This is text provides answers to all of the Assessment Problems and many of the Chapter Problems so that you may work backward when you get stuck. In the real world, you won't be given answers in advance, but you may have a desired problem outcome in mind from which you can work backward. Other creative approaches include allowing yourself to see parallels with other types of problems you've successfully solved, following your intuition or hunches about how to proceed, and simply setting the problem aside temporarily and coming back to it later[4].

6. *Test your solution.* Ask yourself whether the solution you've obtained makes sense. Does the magnitude of the answer seem reasonable? Is the solution physically realizable? You may want to go further and rework the problem via an alternative method. Doing so will not only test the validity of your original answer, but also help you develop your intuition about the most efficient solution methods for various kinds of problems[5]. In the real world, safety- critical designs are always checked by several independent means. Getting into the habit of checking your answers will

benefit you as a student and as a practicing engineer.

These problem-solving steps cannot be used as a recipe to solve every problem in this or any other course. You may need to skip, change the order of, or elaborate on certain steps to solve a particular problem. Use these steps as a guideline to develop a problem-solving style that works for you.

Notes

[1] A major challenge in designing and operating such a system is to provide sufficient redundancy and control so that failure of any piece of equipment does not leave a city, state, or region completely without power.

设计和运行这样一个系统面临的主要挑战是提供足够的余量和控制，以便万一某个设备出现故障时，不至于使整个城市、州或地区完全处于停电状态。

[2] By reading about and discussing how these problems were solved in the past, and by solving related homework and exam problems on your own, you will begin to develop the skills to successfully attack the unsolved problems you'll face as a practicing engineer.

通过查阅和讨论这些问题过去的解决方法，同时独立完成相关的练习和解答考题，你就会逐渐掌握攻克作为执业工程师将面临的那些有待解决的难题的技巧。

[3] If a circuit diagram is already provided, you may need to add information to it, such as labels, values, or reference directions. You may also want to redraw the circuit in a simpler, but equivalent form.

如果已经提供了一个电路图，你可能需要对它添加信息，如标签、数值或参考说明。你也可能想重画一个更简单而其功能相同的电路图。

[4] Other creative approaches include allowing yourself to see parallels with other types of problems you've successfully solved, following your intuition or hunches about how to proceed, and simply setting the problem aside temporarily and coming back to it later.

其他创造性的方法包括：搞明白该问题与先前成功解决的问题的相似之处，凭直觉来处理问题，或者是把该问题暂时搁置一边，稍后再解决。

[5] Doing so will not only test the validity of your original answer, but also help you develop your intuition about the most efficient solution methods for various kinds of problems.

这么做不仅能检测你原有方案的有效性，也有助于你培养解决各类问题的最佳方法的直觉。

New Words

manipulate	[mə'nɪpjʊleɪt]	*vt.* 操作，使用(机器等)，操纵
computation	[ˌkɒmpjʊ'teɪʃ(ə)n]	*n.* 计算，估计
transmitter	[trænz'mɪtə(r)]	*n.* 传导物，发报机，送话器
interaction	[ˌɪntər'ækʃ(ə)n]	*n.* 交互作用，交感
molecule	['mɒlɪˌkjuːl]	*n.* 分子，微小的颗粒
microcircuit	['maɪkrəusɜːkɪt]	*n.* [电子]微电路
assembly	[ə'semblɪ]	*n.* 装配，汇编
refinery	[rɪ'faɪnərɪ]	*n.* 精炼厂

hydroelectric	[ˌhaɪdrəʊ'ɪlektrɪk]	*adj.* 水力电气的
redundancy	[rɪ'dʌndənsɪ]	*n.* 复制或重复，冗余
tomography	[tə'mɒgrəfɪ]	*n.* [医]X 射线断层摄影术
recognizable	['rekəgˌnaɪzəb(ə)l]	*adj.* 可辨认的，可公认的，可认知的
prerequisite	[priː'rekwəzɪt]	*n.* 先决条件
electromagnetic	[ɪˌlektrəʊmæg'netɪk]	*adj.* 电磁的
instantaneously	[ˌɪnstən'teɪnjəslɪ]	*adv.* 瞬间地，即时地
lumped	[lʌmpt]	*adj.* 集总[中]的
parameter	[pə'ræmɪtə(r)]	*n.* 参数，参量
magnetic	[mæg'netɪk]	*adj.* 磁的，有磁性的
cumbersome	['kʌmbə(r)s(ə)m]	*adj.* 笨重的，麻烦的
coupling	['kʌp(ə)lɪŋ]	*n.* 联结，结合，耦合
interconnect	[ˌɪntə(r)kə'nekt]	*vt.* 使互相连接
quantitative	['kwɒntɪtətɪv]	*adj.* 数量的，定量的
propagate	['prɒpəgeɪt]	*v.* 传播，繁殖，宣传
velocity	[və'lɒsətɪ]	*n.* 速度，速率，周转率
propagation	[ˌprɒpə'geɪʃən]	*n.*（声波，电磁辐射等）传播
extraneous	[ɪk'streɪnɪəs]	*adj.* 外来的，外部裂化的，新异反射的
hunch	[hʌntʃ]	*n.* 直觉，预感
magnitude	['mægnɪtjuːd]	*n.* 大小，数量，巨大

Exercises

Exercise I Answer the following questions.

1. According to paragraph one, which two subjects are closely related to electrical engineering?
2. What are the five major classifications of electrical systems?
3. What is the function of signal-processing systems?
4. What is an electrical circuit?
5. How many problem-solving steps have been discussed in the text? And what are they?
6. Can the above-mentioned problem-solving steps be used to solve any relevant problem?

Exercise II Fill in the blanks with the words given below. Change the form where necessary.

prerequisite	velocity	magnitude	extraneous	electromagnetic	assembly	propagate
microcircuit	hydroelectric	computation				

1. Mr. Brown is said to have been working on an ___________ line for years.
2. I want to know the __________ of this equipment.
3. This course is a _________ to more advanced studies.
4. We are expected not only to learn knowledge but also to _________ it.
5. The___________ force is the one responsible for practically all the phenomena one

encounters in daily life, with the exception of gravity.

6. In physics, _________ is the measurement of the rate and direction of change in position of an object.
7. Nowadays there are many __________ power stations, providing around 20% of the world's electricity.
8. Variables are undesirable variables that influence the relationship between the variables that an experimenter is examining.
9. _________ is a general term for any type of process, algorithm or measurement; this often includes but is not limited to digital data.
10. In __________, the supporting material upon which or within which an integrated circuit is fabricated, or to which an integrated circuit is attached.

Exercise III Match the explanations in Column B with words in Column A.

A	B
assumption	having similar or identical effects
alternative	a constituent element, as of a system
simultaneously	a branch of knowledge or teaching
equivalent	supposition
component	the choice between two mutually exclusive possibilities
discipline	at the same time

Exercise IV Complete the following passage with words or phrases chosen from the text.

Electrical engineering is a field of engineering that generally deals with the study and a_______of electricity, electronics and electromagnetism. The field first became an identifiable occupation in the late nineteenth century after commercialization of the electric telegraph and e________ power supply. It now covers a r______ of subtopics including power, electronics, c_______ systems, signal p_______ and telecommunications.
Electrical engineering may include electronic e________ . Where a distinction is made, usually outside of the United States, electrical engineering is considered to deal with the problems associated with large-scale electrical s________ such as power transmission and m_______ control, whereas electronic engineering deals with the study of small-scale electronic systems including computers and i_________ circuits Alternatively, electrical engineers are usually concerned with using electricity to t________ energy, while electronic engineers are concerned with using electricity to process information. More recently, the distinction has become blurred by the growth of power electronics.

Exercise V Fill in each of the blanks with a suitable preposition or adverb.

Electrical engineers typically possess an academic degree_________a major______electrical engineering. The length of study for such a degree is usually four______five years and the completed degree may be designated________a Bachelor of Engineering, Bachelor of Science, Bachelor of Technology or Bachelor of Applied Science depending_______the university. The degree generally includes units covering physics, mathematics, computer science, project management and specific topics in electrical engineering. Initially such topics cover most, if not all, of the sub-disciplines of electrical engineering. Students then choose to specialize______one or more sub-disciplines________the end of the degree. Some electrical engineers _______choose to pursue a postgraduate degree______as a Master of Engineering/Master of Science (M.Eng./M.Sc.), a Master of Engineering Management, a Doctor of Philosophy (Ph.D.) in Engineering, an Engineering Doctorate (Eng.D.),_________an Engineer's degree.

Exercise VI Translate the following sentences into Chinese.

1. There are many different ways to process the signals and their information.
2. The autopilot and auto-landing systems that help to fly and land airplanes are also familiar control systems.
3. Electric power, which is the foundation of our technology-based society, usually is generated in large quantities by nuclear, hydroelectric, and thermal generators.
4. As a student, however, you will devote much of your attention to the discussion of problems already solved.
5. Getting into the habit of checking your answers will benefit you as a student and as a practicing engineer.

Section B

Practical Writing

Job Application Letters

求职信又称“自荐信”或“自荐书”，是求职者向用人单位介绍自己情况以求被录用的专用性文书。通过求职信，求职者可以展示才干、能力、资格，突出其专长、技能等优势，以达到求职目的。因此，求职者在求职信里必须充分扬长避短，突出自身优势，以便在众多的求职者中崭露头角，以自己的某些特长、优势、技能等吸引用人单位。求职信篇幅不宜过长，一般一页 A4 纸即可，其格式如下。

Address
Addresser's name
City, State, Zip Code
Phone Number
Email Address
Date

Employer Contact Information (if you have it)

Name
Company
Address
City, State, Zip Code

Salutation

Dear Mr./Ms. Last Name, (leave out if you don't have a contact)

Body of Application Letter

The body of your application letter lets the employer know what position you are applying for, why the employer should select you for an interview, and how you will follow-up.

First Paragraph

The first paragraph of your letter should include information on why you are writing. Mention the job you are applying for and where you found the job listing. Include the name of a mutual contact, if you have one.

Middle Paragraph(s)

The next section of your application letter should describe what you have to offer the employer. Mention specifically how your qualifications match the job you are applying for. Remember, you are interpreting your resume, not repeating it.

Final Paragraph

Conclude your application letter by thanking the employer for considering you for the position. Include information on how you will follow-up.

Complimentary Close

Sincerely,
Signature

[Sample 1]

Richard Anderson,
87 Main Street
Springfield, Kansas 68075
Date: 1st October, 2010

Mr. John Smith,
National Electrical,
257, Park Avenue South,
New York, NY 1235-6789.

Dear Mr. Smith,

I am enclosing my resume in hopes that your company may assist me in locating a position as

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