21世纪高等学校电子信息工程规划教材

电子信息工程专业英语导论

瞿少成　吴军其　编著

清华大学出版社

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内 容 简 介

本书旨在培养学生在专业英语方面的阅读、翻译、表达与写作能力，提高科技英语素养与国际学术交流能力。全书包括专业英语基础篇与提高篇两部分。4个基础篇精选国外教材中的经典文献，涵盖电工与电子基础、电子与通信器件、信号与系统、通信技术等领域；课后附有生词表、难点注释和练习题；每个单元补充了科技英语的特点、翻译要领、科技术语与常用数学公式的表达，并对查阅科技文献的方法与技巧做了简单介绍。提高篇系统地介绍了科技论文的结构、写作与投稿等问题，归纳了中国学生撰写英文科技论文中常见的错误，最后总结了常用应用文写作的要求与规范，并给出了一些实际的范例。

本书可以作为电子信息工程与通信工程专业的专业英语教材，同时适用于相关专业的本科生、研究生和工程技术人员。

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出 版 说 明

随着我国高等教育规模的扩大和产业结构调整的进一步完善，社会对高层次应用型人才的需求将更加迫切。各地高校紧密结合地方经济建设发展需要，科学运用市场调节机制，合理调整和配置教育资源，在改革和改造传统学科专业的基础上，加强工程型和应用型学科专业建设，积极设置主要面向地方支柱产业、高新技术产业、服务业的工程型和应用型学科专业，积极为地方经济建设输送各类应用型人才。各高校加大了使用信息科学等现代科学技术提升、改造传统学科专业的力度，从而实现传统学科专业向工程型和应用型学科专业的发展与转变。在发挥传统学科专业师资力量强、办学经验丰富、教学资源充裕等优势的同时，不断更新其教学内容、改革课程体系，使工程型和应用型学科专业教育与经济建设相适应。

为了配合高校工程型和应用型学科专业的建设和发展，急需出版一批内容新、体系新、方法新、手段新的高水平电子信息类专业课程教材。目前，工程型和应用型学科专业电子信息类专业课程教材的建设工作仍滞后于教学改革的实践，如现有的电子信息类专业教材中有不少内容陈旧（依然用传统专业电子信息教材代替工程型和应用型学科专业教材），重理论、轻实践，不能满足新的教学计划、课程设置的需要；一些课程的教材可供选择的品种太少；一些基础课的教材虽然品种较多，但低水平重复严重；有些教材内容庞杂，书越编越厚；专业课教材、教学辅助教材及教学参考书短缺，等等，都不利于学生能力的提高和素质的培养。为此，在教育部相关教学指导委员会专家的指导和建议下，清华大学出版社组织出版本系列教材，以满足工程型和应用型电子信息类专业课程教学的需要。本系列教材在规划过程中体现了如下一些基本原则和特点：

（1）系列教材主要是电子信息学科基础课程教材，面向工程技术应用培养。本系列教材在内容上坚持基本理论适度，反映基本理论和原理的综合应用，强调工程实践和应用环节。电子信息学科历经了一个多世纪的发展，已经形成了一个完整、科学的理论体系，这些理论是这一领域技术发展的强大源泉，基于理论的技术创新、开发与应用显得更为重要。

（2）系列教材体现了电子信息学科使用新的分析方法和手段解决工程实际问题。利用计算机强大功能和仿真设计软件，使得电子信息领域中大量复杂的理论计算、变换分析等变得快速简单。教材充分体现了利用计算机解决理论分析与解算实际工程电路的途径与方法。

（3）系列教材体现了新技术、新器件的开发应用实践。电子信息产业中仪器、设备、产品都已使用高集成化的模块，且不仅仅由硬件来实现，而是大量使用软件和硬件相结合方法，使得产品性价比很高，如何使学生掌握这些先进的技术、创造性地开发应用新技术是本系列教材的一个重要特点。

（4）以学生知识、能力、素质协调发展为宗旨，系列教材编写内容充分注意了学生创新能力和实践能力的培养，加强了实验实践环节，各门课程均配有独立的实验课程和课程设计。

（5）21 世纪是信息时代，学生获取知识可以是多种媒体形式和多种渠道的，而不再局限于课堂上，因而传授知识不再以教师为中心，以教材为唯一依托，而应该多为学生提供各类学习资料（如网络教材，CAI 课件，学习指导书等）。应创造一种新的学习环境（如讨论，自学，设计制作竞赛等），让学生成为学习主体。该系列教材以计算机、网络和实验室为载体，配有多种辅助学习资料，提高学生学习兴趣。

繁荣教材出版事业，提高教材质量的关键是教师。建立一支高水平的以老带新的教材编写队伍才能保证教材的编写质量和建设力度，希望有志于教材建设的教师能够加入到我们的编写队伍中来。

21 世纪高等学校电子信息工程规划教材编委会
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前　　言

电子技术与通信技术的飞速发展，促进了新技术、新产品与新设备的不断涌现，要迅速掌握这些新知识与新技能，从业人员就必须不断地提高专业英语水平。为进一步提高电子信息工程与通信工程专业高年级本科生和研究生的专业英语能力，促进人才的高层次培养，我们撰写了这本教材。选材的原则如下。

（1）语言的规范性与纯正性。本书中的课文选自美国最近出版的电子信息工程与通信工程专业方面的国际权威杂志或经典论文。

（2）专业知识的广泛性与先进性。选材综合考虑了电工与电子基础、电子与通信器件、信号与系统、通信技术，使读者在学习科技英语的同时也了解最新技术的发展。

（3）专业知识的全面性。本书不仅重点强调了科技文献的“读”，也对“写”与口头表达作了大量的尝试，同时还系统地阐述了科技论文的写作、投稿与应用文写作。

（4）专业知识的扩展性。作为知识更新极快的专业，必须了解本专业的最权威的期刊，掌握科技文献的查阅方法。

此外，针对同类型教材的不足，结合作者多年来的实际工作经验与学术交流的体会，补充了常用数学名词、数学符号与数学公式的英文表达。

学生学习本书后，能熟悉和掌握大量电子信息工程与通信工程及其相关专业的常用词汇和术语，提高阅读和理解原始专业英语文献的能力，了解本专业一些新的器件与技术，从而增强国际交流能力。

本书由瞿少成、吴军其、罗小巧、姚远和林毓涛编著。其中，姚远博士负责撰写 Part 2，罗小巧副教授负责撰写 Part 3，林毓涛博士负责撰写 Part4，吴军其博士负责撰写 Part 1 与应用文写作部分，瞿少成博士撰写了科技论文的结构与写作初步、投稿指南，以及部分单元中的 C 部分。

感谢王永骥教授、姚琼荟教授多年的教诲，感谢王继新教授、钱同惠教授多年来对我们工作的支持。此外，应用英语专业的双文庭教授为本书提出了许多宝贵的建议。

由于经验不足，加之作者的水平有限，书中的疏漏之处在所难免，敬请读者批评指正，以便进一步改进和充实我们的工作。

编　者

2008 年 1 月

目　　录

基 础 篇

PART 1

Electrotechnics and Electronics

UNIT 1

A. Text

Electricity and Electrons

You have a strong and wonderful helper. It is always ready to help you. It gives light to your room when you turn on a switch. It shows you TV pictures when you turn a knob. It carries your voice to others when you talk on the telephone. What is it? Yes, the name of this helper is electricity. We are so used to electric lights, radio, televisions, telephones and Internet that it is hard to imagine what life would be like without them [1]. In electricity's absence, people grope about in flickering candlelight, cars hesitate in the streets because there are no traffic lights to guide them, and food spoils in silent refrigerators, to talk over long distance we are left with smoke signals and postcards.

Many years ago, scientists had very vague ideas about electricity [2]. About 2000 years ago, Wang Chong, a Chinese philosopher, discovered that if one rubbed a piece of amber with a piece of fur or wood, he could always produce electricity. Scientists say today that the amber had become charged with electricity. Until the 19th century, no one knew much more about this. As the times went on, many of them thought of it as a sort of "fluid" that flowed through wires as water flows through pipes, but they could not understand what made it flow. Many of them felt that electricity was made up of tiny particles of some kind, but trying to separate electricity into individual particles baffled them.

Then, the great American scientist Millikan, in 1909, astounded the scientific world by actually weighing a single particle of electricity and calculating its electrical charge. This was probably one of the most delicate weighing jobs ever done by man[3], for a single electric particle weighs only about half of a millionth of a millionth of a millionth of a millionth of a pound. The particle is much smaller than you can imagine. To make up a pound it would take more of those particles than there are drops of water in the Pacific Ocean.

They are no strangers to us, these electric particles, for we know them as electrons. Every single thing you have ever seen is made up of thousands of hundreds of atoms, and every atom contains one or more electrons. When large numbers of electrons break away from their atoms and move through a wire, we describe this action by saying that electricity is "flowing" through the wire[4]. Yes, the electrical "fluid" that early scientists talked about is nothing more than electrons flowing along a wire!

But how can individual electrons be made to break away from atoms? The answer lies in the structure of the atoms themselves. In many materials, the electrons are tightly bound to the atoms. Wood, glass, plastic, ceramic, air, cotton ... These are all examples of materials in which electrons stick with their atoms. Because the electrons don't move, these materials cannot conduct electricity very well, if at all. These materials are electrical insulators.

But most metals have electrons that can detach from their atoms and move around[5]. These are called free electrons. Gold, silver, copper, aluminum, iron, etc., all have free electrons. The loose electrons make it easy for electricity to flow through these materials, so they are known as electrical conductors. They conduct electricity. The moving electrons transmit electrical energy from one point to another.

An atom of aluminum, for example, is continually losing an electron, regaining it (or another electron), and losing it again. An aluminum atom normally has 13 electrons, arranged in three different orbits around its nucleus[6]. The inside orbit has 2 electrons. The next larger orbit has 8. The third orbit has only 3 electrons. It is this outside electron that the aluminum atom is continually losing, for it is not very closely tied to the atom. It wanders off, replaced by another free roving electron, and then this second electron also wanders away.

Consequently, in an aluminum wire free electrons are floating around in all directions among the aluminum atoms. Thus, even though the aluminum wire looks quite motionless to your ordinary eye, there is a great deal of activity going on inside it.

If the wire were carrying electricity to an electric light or to some other electrical device, the electrons would not be moving around at random. Instead, many of them would be rushing in the same direction from one end of the wire to the other.

Thus, electricity needs a conductor in order to move. There also has to be something to make the electricity flow from one point to another through the conductor. One way to get electricity flowing is to use a generator. A generator uses a magnet to get electrons moving. Faraday and Henry discovered how magnets could be used to make electricity flow in a wire. Another way is chemical. Volta's voltaic pile, or battery, is a chemical device that makes electricity (or electrons) flow in wires.

New Words and Technical Terms

electricity	[iek'trisiti]	n. 电，电学
electronic	[iek'trɔnik]	n. 电子
switch	[switʃ]	n. 开关
flickering	['flikəriŋ]	adj. 闪烁的，摇曳的，忽隐忽现的
candlelight	['kænd(ə)llait]	n. 烛火，黄昏
refrigerator	[ri'fridʒəreitə]	n. 电冰箱，冷藏库
amber	['æbə]	n. 琥珀
rub	['rʌb]	v. 摩擦
vague	['veig]	adj. 含糊的
particles	['pa:tikəlz]	n. 粒子，微粒
sort	['sɔ:t]	n. 种类，类别
baffle	['bæfl]	v. 困惑，阻碍，为难
astound	[əs'taund]	v. 使震惊
delicate	['delikit]	adj. 精巧的，灵敏的，精密的
atom	['ætəm]	n. 原子
bound	[baund]	v. 绑定，限制
detach	[di'tætʃ]	v. 分开，分离
insulator	[insju'leitə]	n. 绝缘体
conductor	[kən'dʌktə]	n. 导体
wander	['wʌndə]	v. 溜达，闲逛
rove	['rəuv]	v. 漫游；n. 漫游，流浪，粗纱
motionless	['məuʃlis]	adj. 不动的，静止的
random	['rædəm]	adj. 偶然的，随意的
generator	['dʒenəreitə]	n. 发电机
battery	['bætəri]	n. 电池
magnetic	[mæg'netik]	adj. 磁的，有磁性的，有吸引力的
electrical charge		电荷
electrical energy		电能
electric light		电灯
electrical device		电器设备
electric wire		电线

Notes

[1] We are so used to electric lights, radio, televisions, and telephone that it is hard to imagine what life would be like without them.

我们对电灯、无线电广播、电视和电话是如此的熟悉，所以很难想象离开了它们，我们的生活将会是什么样子。

Be used to sth. 习惯于……；而 used to do sth. 则是表示过去常常做……。

[2] Many years ago, scientists had very vague ideas about electricity.

很多年以前，科学家们对电的概念还是很模糊的。

Have very vague ideas about sth. 对……不是很清楚，知之甚少。

[3] This was probably one of the most delicate weighing jobs ever done by man.

这可能是人类做过的最细致的计量工作之一。

Ever done by man 是过去分词作定语，修饰 weighing jobs。

[4] When large numbers of electrons break away from their atoms and move through a wire, we describe this action by saying that electricity is "flowing" through the wire.

当大量的电子脱离原子的"束缚"并通过导线运动时，这时我们就说电通过导线在"流动"。

We describe this action by saying that 我们就把这种行为描述为……；break away 摆脱，脱离……（的束缚）。

[5] But most metals have electrons that can detach from their atoms and move around.

但是很多金属的电子能够与它们的原子分离，到处漂移。

此处 that can detach from their atoms and move around 是一个定语从句，修饰先行词 electrons。

[6] An aluminum atom normally has 13 electrons, arranged in three different orbits around its nucleus.

一个铝原子通常有 13 个电子，它们排列在原子核周围三个不同的轨道上。此处的 orbit 是指轨道的意思，nucleus 是指核、核子。

Exercises

Ⅰ. Choose the one that best suits the sentence according to the text.

1. ________is the wonderful helper to our life according to the passage.

   A. radio　　B. television　　C. electricity　　D. Internet

2. The weight of an atom is ________.

   A. one pound　　B. half pound　　C. million pounds　　D. hard to imagine

3. The tiny particles are ________.

   A. atoms　　B. electrons　　C. electricity　　D. conductors

4. In normal situation, ceramic is ________.

   A. insulator　　B. conductor　　C. semi-conductor　　D. none of the above

5. There are ________ electrons in the second orbit of aluminum atom.

   A. 13　　B. 2　　C. 8　　D. 3

6. In order to make the electricity flow along one direction, we can use ________.

   A. generator　　B. battery　　C. Volta's voltaic pile　　D. All of the above

Ⅱ. Try to match the following columns.

Electricity	轨道
Electron	原子
Atoms	磁的
Orbit	电，电学
Electrical energy	电能
Magnetic	电子

B. Reading

How electricity is generated

Electricity is the flow of electrical power or charge. It is a secondary energy source which means that we get it from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called primary sources.

An electric generator is a device for converting mechanical energy into electrical energy. The process is based on the relationship between magnetism and electricity. When a wire or any other electrically conductive material moves across a magnetic field, an electric current occurs in the wire. The large generators used by the electric utility industry have a stationary conductor. A magnet attached to the end of a rotating shaft is positioned inside a stationary conducting ring that is wrapped with a long, continuous piece of wire. When the magnet rotates, it induces a small electric current in each section of wire as it passes. Each section of wire constitutes a small, separate electric conductor. All the small currents of individual sections add up to one current of considerable size. This current is what is used for electric power.

An electric utility power station uses either a turbine, engine, water wheel, or other similar machine to drive an electric generator or a device that converts mechanical or chemical energy to generate electricity. Steam turbines, internal-combustion engines, gas combustion turbines, water turbines, and wind turbines are the most common methods to generate electricity. Most power plants are about 35 percent efficient. That means that for every 100 units of energy that go into a plant, only 35 units are converted to usable electrical energy.

Most of the electricity in the United States is produced in steam turbines. A turbine converts the kinetic energy of a moving fluid (liquid or gas) to mechanical energy. Steam turbines have a series of blades mounted on a shaft against which steam is forced, thus rotating the shaft connected to the generator. In a fossil-fueled steam turbine, the fuel is burned in a furnace to heat water in a boiler to produce steam.

Coal, petroleum (oil), and natural gas are burned in large furnaces to heat water to make steam that in turn pushes on the blades of a turbine. Coal is the largest single primary source of energy used to generate electricity in the United States. In our country, more than half of the country's electricity used coal as its source of energy.

Natural gas, in addition to being burned to heat water for steam, can also be burned to produce hot combustion gases that pass directly through a turbine, spinning the blades of the turbine to generate electricity. Gas turbines are commonly used when electricity utility usage is in high demand. A part of the nation's electricity was fueled by natural gas.

Petroleum can also be used to make steam to turn a turbine. Residual fuel oil, a product refined from crude oil, is often the petroleum product used in electric plants that use petroleum to make steam. Petroleum was used to generate about three to four percent of all electricity generated in our country.

Nuclear power is a method in which steam is produced by heating water through a process called nuclear fission. In a nuclear power plant, a reactor contains a core of nuclear fuel, primarily enriched uranium. When atoms of uranium fuel are hit by neutrons they fission (split), releasing heat and more neutrons. Under controlled conditions, these other neutrons can strike more uranium atoms, splitting more atoms, and so on. Thereby, continuous fission can take place, forming a chain reaction releasing heat. The heat is used to turn water into steam, that, in turn, spins a turbine that generates electricity. Nuclear power was used to generate about 20% of all the country's electricity in 2005.

Hydropower, the source for almost 7% of electricity generation, is a process in which flowing water is used to spin a turbine connected to a generator. There are two basic types of hydroelectric systems that produce electricity. In the first system, flowing water accumulates in reservoirs created by the use of dams. The water falls through a pipe called a penstock and applies pressure against the turbine blades to drive the generator to produce electricity. In the second system, called run-of-river, the force of the river current (rather than falling water) applies pressure to the turbine blades to produce electricity.

Geothermal power comes from heat energy buried beneath the surface of the earth. In some areas of the country, enough heat rises close to the surface of the earth to heat underground water into steam, which can be tapped for use at steam-turbine plants. This energy source generated less than 1% of the electricity in the country in 2005.

Solar power is derived from the energy of the sun. However, the sun's energy is not available full-time and it is widely scattered. The processes used to produce electricity using the sun's energy have historically been more expensive than using conventional fossil fuels. Photovoltaic conversion generates electric power directly from the light of the sun in a photovoltaic (solar) cell. Solar-thermal electric generators use the radiant energy from the sun to produce steam to drive turbines. In 2005, less than 1% of the nation's electricity was based on solar power.

Wind power is derived from the conversion of the energy contained in wind into electricity. Wind power, less than 1% of the nation's electricity in 2005, is a rapidly growing source of electricity.

Biomass includes wood, municipal solid waste (garbage), and agricultural waste, such as corncobs and wheat straw. These are some other energy sources for producing electricity. These sources replace fossil fuels in the boiler. The combustion of wood and waste creates steam that is typically used in conventional steam-electric plants. Biomass accounts for about 2% of the electricity generated in the United States.

New Words and Technical Terms

nuclear	['nju:kliə]	adj. 核子的，原子的，核的，中心的
generator	['dʒenəreitə]	n. 发电机，发生器
magnetism	['mægnitizəm]	n. 磁力，吸引力，磁学
conductive	[kən'dʌktiv]	adj. 传导的
magnet	['mægnit]	n. 磁体，磁铁
shaft	['ʃa:ft]	n. 轴
stationary	['steiʃənəri]	adj. 固定的
considerable	[kən'sidərəbl]	adj. 相当大（或多）的，值得考虑的
convert	[kən'və:t]	v. 使转变，转换
plant	[plan:t]	n. 植物，庄稼，工厂，车间，设备
furnace	['fə:nis]	n. 炉子，熔炉
blades	[bleid]	n. 刀，刀片
utility	[ju:'tiliti]	n. 效用，有用
usage	['ju:zidʒi]	n. 使用，用法
refine	[ri'fain]	n. 精炼，精制
fission	['fiʃən]	n. 裂变
reactor	[ri'æktə]	n. 反应堆
split	['split]	v. 分裂，分离
biomass	['baiəumæs]	n.（单位面积或体积内的）生物量
combustion	[kəm 'bʌstʃən]	n. 燃烧
uranium	[j uə'reiniəm]	n. 铀
neutrons	['nju:trɔn]	n. 中子
photovoltaic	['fəutəuvɔi'teiik]	adj. 光电的
hydroelectric	['haidrəi'lektrik]	adj. 水力电气的
reservoir	['rezə:vwa:]	n. 水库，蓄水池
penstock	['penstɔk]	n. 水道，水渠，压力水管，水阀门
electric utility industry		电力工业
Steam turbines		蒸汽机
internal-combustion engines		内燃机
gas combustion turbines		燃气机
water turbines，wind turbines，kinetic		水轮，风轮，动能
Residual fuel oil		残余燃料油
crude oil		原油