普通高等教育“十二五”电气信息类规划教材

电气信息类科技英语教程

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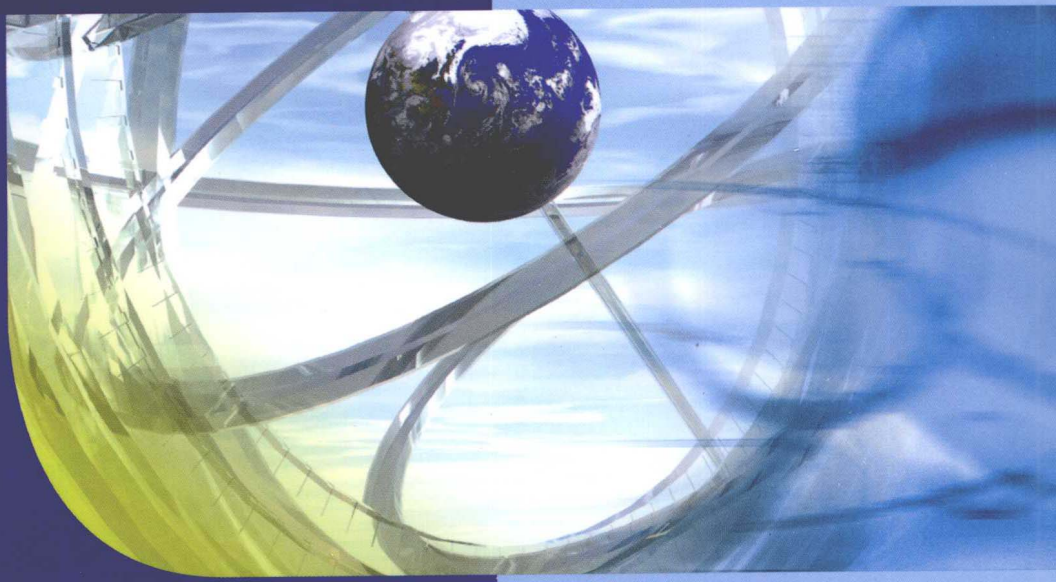

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普通高等教育“十二五”电气信息类规划教材

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主编　何　宏
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本书是为高等院校电气信息类专业学生编写的专业英语教材。全书采用了以科技语言翻译、写作技巧为主要学习内容，电气信息类专业阅读材料为辅助内容的方法编写，主要包括科技英语英译汉翻译技巧、写作和科技英语汉译英翻译技巧三部分。其中英译汉部分为基础部分，共13个单元，除了翻译方法外，还含有26篇科技阅读材料，内容涉及电子、通信、自动化、电气等多个领域。为增强学生专业英语听说的表达能力，这部分还包含有发音和演讲技巧的内容，并配有相应的听说练习。最后5单元汉译英和专业词汇为扩展部分，使用者可以根据需求灵活选择。本书的内容既有针对性，又适用范围较广，可选择性强，可以作为电子工程、通信工程、自动化和电气工程专业的本科或研究生专业英语课程教材，也可供相关科技人员学习和参考。

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前　言

随着我国信息产业的发展，对外交流日益增多，我国教育部已经要求各高等院校积极推广使用英语等外语进行专业课教学，为培养国际型复合人才奠定基础。而专业英语课作为目前我国大学非英语专业的专业必修课，是培养学生用英语表达科学技术能力的桥梁。

本书是根据国家普通高等院校本科生专业英语教学大纲的要求，在多年课程教学实践的基础上，针对电气信息类专业编写的专业英语教材。鉴于专业英语课依然是语言类课程，本书为了适应工业发展和社会的需求，着力改变现有专业英语教材阅读文章内含过多的公式、图表，没有汉译英技巧的相关理论和听说内容的缺点。本书完全改变了现有的教材以专业阅读材料为主线的编写模式，采用以语言翻译、写作技巧为主要学习内容，电气信息类的科普文章和专业文献作为辅助内容的方法编写。翻译技巧内容不仅包含英译汉的内容，还包含了汉译英的内容。此外，本书为增强学生专业英语听说的能力，还增加了发音技巧和演讲方法的内容，并配有相应的听说练习。本书共有英译汉方法 13 单元，汉译英方法 5 单元，写作 2 单元，阅读材料涵盖了电子工程、通信工程、自动化和电气工程四个专业，选材广泛，内容由浅入深。书中包括了英译汉精读和泛读文献各 13 篇，并给出电气信息类各专业领域的常用词汇，教材内容既有针对性，又适用于电气信息类多个专业的专业英语教学，应用范围广，可选择性强，还可供其他科技人员作为英文翻译的参考。

本书由上海师范大学何宏主编，上海师范大学张相芬和华东理工大学黎冰参加编写。全书的英译汉翻译技巧（Part Ⅰ Unit 1 A ~ Unit 13 A）、发音技巧（Part Ⅰ Unit 1 D ~ Unit 6 D）、演讲方法（Part Ⅰ Unit 7 D ~ Unit 13 D）和 Part Ⅲ汉译英翻译技巧由何宏编写。Part Ⅰ中前 6 单元阅读部分（Part Ⅰ Unit 1 B、C ~ Unit 6 B、C）和 Part Ⅱ写作部分由张相芬编写。Part Ⅰ中阅读部分（Part Ⅰ Unit 7 B、C ~ Unit 12 B、C）由黎冰编写。Part Ⅰ Unit 13 B、C 和附录中的自动化、电气工程和计算机专业词汇由何宏编写，附录中的通信工程和电子工程专业词汇由张相芬编写。全书由何宏统稿。此外，华东理工大学的硕士生李程凯和上海师范大学的硕士生刘鑫也参加了本书部分章节的文字输入工作，在此对他们表示诚挚的感谢。

本书有完整的翻译练习答案，并有听说部分的语音材料供大家使用，欢迎选用本书作教材的老师发邮件到 yaxin_w74@126.com 索取。由于编者水平有限，书中难免有不足之处，欢迎大家批评指正，我们将不胜感激。

编　者

目　录

PART I

Techniques of EST E-C Translation

(科技英语英译汉翻译技巧)

Unit 1

A An Introduction to EST (科技英语基础知识)

1. The Conception of EST (科技英语的概念)

英语是目前国际上的主要科技语言。为了提高科技专业人才的英语交际水平及非科技人员的科技英语理解水平，20 世纪 60～70 年代，特殊用途英语（English for Special Purposes，ESP）作为一门研究英语语言的学科，开始兴起并很快成为一种普遍趋势。特殊用途英语按其应用领域可以分为学术英语（English for Academic Purposes，EAP）、职业英语（English for Vocational or Occupational Purposes，EOP）和科技英语（English for Science and Technology，EST）。

（1）学术英语

学术英语（EAP）主要应用于以英语为交流语言的学术场合，使用者多数是在英国、美国或说英语国家的留学人员、研究人员或访问学者，他们在听学术讲座或进行学术研讨时需要用英语交流，尤其是面对来自不同国家的研究人员的场合。

例如：

Every term paper is a highly individualized piece of work. Nonetheless, there are some general rules and guidelines to follow in gathering, selecting, and recording information for the rough draft of a paper.

Different topics will require the use of different information sources, but there are a number of reference tools that every student should be able to use with ease.

（2）职业英语

职业英语（EOP）是职业人员如国际电话接线员、国际机场管理者、国际贸易商人、旅游服务人员等，在工作中必须具备的一项技能。

例如：某导游公司对导游培训的一段话

A wide variety of accommodation is available to the modern tourist. It varies from the guest house or tourist home with one or two rooms to grand luxury hotels with hundreds of rooms. A feature of Europe is the pension, a small establishment with perhaps ten to twenty guest rooms.

（3）科技英语

科技英语（EST）主要是科研工作者、技术人员和工程师等交换其专业意见、发明创造、信息数据、实验报告等而使用的语言。为了客观地记录自然现象发展过程和特点，科技英语在文体上应该精确、简明、严谨；内容上经常包含了数学公式、图表等；措辞上常使用典型的句式及大量的专业或半专业术语，因此科技英语与普通英语（Ordinary English）有很大区别。

根据内容上所涉及的专业知识的深浅不同，科技英语又可以分成专业科技英语（English for Specialized Science and Technology，ESST）和通俗科技英语（English for Common Science and Technology，ECST）。顾名思义，专业科技英语应用于科技专业领域，使用者一般是各专业领域中的科研技术人员。所以，若没有相关的专业知识，即便母语是英语的读者也不一定完全懂专业科技英语。

例如：Capacitors

Capacitors play a vital role in modern electronics. A capacitor is a device consisting of two conductors separated by vacuum or an insulating material. Capacitors are used in a wide variety of electric circuits and are a vital part of modern electronics. When charges of equal magnitude and opposite sign are placed on the conductors of a capacitor, an electric field is established in the region between them, with a corresponding potential difference between the conductors. The relations among charge, field, and potential can be analyzed by using the results of the two preceding chapters. For a given capacitor, the ratio of charge to potential difference is a constant, called the capacitance. Placing charges on the conductors requires an input of energy; this energy is stored in the capacitor and can be regarded as associated with the electric field in the space between conductors. When this space contains an insulating material (a dielectric) rather than vacuum, the capacitance is increased.

When we speak of a capacitor as having charge Q, we mean that the conductor at higher potential has a charge Q and the conductor at lower potential has a charge-Q (assuming Q is a positive quantity). This interpretation should be kept in mind in the following discussion and examples.

通俗科技英语涉及的是一些普及性的基本科技知识，也就是我们常说的科普文章。事实上，随着科学技术的飞速发展和全球化进程的不断加快，作为科学技术交流媒介的科普著作正起着越来越重要的作用。国际上有大量的期刊和书报都刊登了许多通俗的科技类文章。

例如：Computer Engineering

Computer engineering involves the development and application of computer system, which perform tasks, such as mathematical calculations or electronic communication, under the control of a set of instructions called a program. Programs usually reside within the computer and are retrieved and processed by the computer's electronics, and the program results are stored or routed to output devices, such as video display monitors or printers. Computers are used to perform a wide variety of activities with reliability, accuracy, and speed.

2. Basic Features of EST（科技英语的基本特点）

（1）科技英语的文体特点

文体的原始义是指“以文字修饰思想的一种特殊方式”，在古希腊被视为一种语言说服

的技巧。而现在文体是指一定的话语秩序所形成的文本体式，它折射出写作者独特的精神结构、体验方式、思维方式和社会历史文化精神。随着科学技术的不断发展，科技英语已形成了一种独立的英语文体，它与传统的新闻报刊文体、公文文体、描述和叙述文体及应用文体构成了当代六大英语文体。了解科技英语的文体特点有助于提高我们对科技英语篇章的理解能力，更快掌握科学技术的发展信息。

科技英语具有普通英语的共性，但也有别于普通英语目的性表述的个性化和特殊性。科技文章中的词、句、章在表述上具有科学性、规范性和简洁性。科学性是指客观而准确地阐述科技问题。规范性是指科技文章的表达方式是程式化的，例如使用公认的符号和公式，选用不会引起歧义的术语和源于拉丁语和法语的词汇，以及专业科技词汇，从而实现科学的、规范的阐述。简洁性是指使用精练的语言和准确朴实的语言表达。

例如：下面分别用普通英语和科技英语写成的“Natural and Synthetic Rubber”一文，普通英语具有简单、通俗、口语化等特征，相比较而言，科技英语则更加严肃客观，而且专业性强。

Natural and Synthetic Rubber

普通英语	科技英语
People **get** natural rubber from rubber trees as a white, milky liquid, **which is called** latex. They **mix it with** acid, and dry it, and **then they send it** to countries all over the world. As the rubber industry **grew**, people **needed** more and more rubber. They **started** rubber plantations in countries with hot, **wet weather conditions**, but these still could not **give enough** raw rubber **to meet the needs** of growing industry. It was **not satisfactory** for industry to depend on supplies, **which comes** from so far away from the industrial areas of Europe. It was always possible that wars or shipping trouble could stop supplies. For many years people **tried to make something to take its place**, but they **could not do it**. **In the end**, they **found a way** of making **artificial**, **man-made** rubber which is in many ways **better than** and in some ways **not as good as** natural rubber. They make artificial, man-made rubber in factories by a complicated chemical process. It is usually cheaper than natural rubber. **Today**, **the world needs so much rubber** that we use both natural and artificial rubber in large **amounts**.	Natural rubber **is obtained** from rubber trees as a white, milky liquid **known as** latex. This is **treated with** acid and dried **before being dispatched** to countries all over the world. As the rubber industry **developed**, more and more rubber was **required**. Rubber plantations were **established** in countries with a hot, **humid climate**, but these still could not **supply sufficient** raw rubber to **satisfy the requirements** of developing industry. It was **unsatisfactory** for industry to depend on supplies **coming** from so far away from the industrial areas of Europe. It was always possible that supplies could be stopped by wars or shipping trouble. For many years, **attempts were made to produce a substitute**, but they **were unsuccessful**. **Finally**, **a method was discovered** of producing **synthetic** rubber which is in many ways **superior** and in some ways **inferior to** natural rubber. Synthetic rubber is produced in factories by complicated chemical process. It is usually cheaper than natural rubber. **At present**, **the world requirements for rubber are so great** that both natural and synthetic rubber are used in **quantities**.

（2）科技英语的句法和修辞的特点

目前科技英语已经发展成为一种重要的英语文体。科技文体崇尚严谨周密，概念准确，逻辑性强，行文简练，重点突出，句式严整，少有变化，常用前置性陈述，即在句中将主要信息尽量前置，通过主语传递主要信息。与普通英语相比，科技英语具有自己突出的特点。

1）广泛使用被动语句

科技英语叙述的对象往往是事物、现象或过程，其注重的是其叙述的客观事实，强调的是所叙述的事物本身，而并不需要过多注意它的行为主体是什么。英语中的被动语态不仅比较客观，而且可使读者的注意力集中在所叙述的客体上。根据英国利兹大学约翰·斯韦尔斯（John Swales）的统计，科技英语中的谓语至少三分之一是被动态。这是因为第一、二人称使用过多，会造成主观臆断的印象。因此尽量使用第三人称叙述，采用被动语态，例如：

Example 1：Attention must be paid to the working temperature of the machine.

译文：应当注意机器的工作温度。

而很少说：You must pay attention to the working temperature of the machine.

译文：你们必须注意机器的工作温度。

此外，如前所述，科技文章将主要信息前置，放在主语部分。这也是广泛使用被动态的主要原因。

Example 2：This steel alloy is believed to be the best available here.

译文：人们认为这种合金钢是这里能提供的最好的合金钢。

Example 3：Computers may be classified as analog and digital.

译文：计算机可分为模拟计算机和数字计算机两种。

Example 4：The switching time of the new-type transistor is shortened three times.

译文：新型晶体管的开关时间缩短了三分之二。（或“缩短为三分之一”）

Example 5：The temperature of the liquid is raised by the application of heat.

译文：加热可以提高液体温度。

Example 6：Useful facts may be collected either by making careful observation or by setting up experiment.

译文：通过仔细的观察或做实验可以收集到有用的数据。

例5、6中的by短语表达的不是行为的发出者，而是方式、方法或手段。而在一般英语中，by短语大多数表达的是行为的发出者。

Example 7：It seems that these two branches of science are mutually dependent and interacting.

译文：看来这两个科学分支是相互依存、相互作用的。

Example 8：It has been proved that induced voltage causes a current to flow in opposition to the force producing it.

译文：已经证明，感应电压使电流的方向与产生电流的磁场力方向相反。

2）长句多，且句式变化少

在科技英语中表示某些复杂概念时用的长复合句大大多于一般英语。长句的特点是从句和短语多，同时兼有并列结构或省略、倒装语序，结构显得复杂。但长句所表达的科技内容严密性、准确性和逻辑性较强，这也是长句在科技英语常见的主要原因。从下面两个例句可以看出科技英语长句的特点。

Example 1：With the advent of the space shuttle, it will be possible to put an orbiting solar power plant in stationary orbit 24,000 miles from the earth that would collect solar energy almost continuously and convert this energy either directly to electricity via photovoltaic cells or indirectly

with flat-plate or focused collectors that would boil a carrying medium to produce steam that would drive a turbine that then in turn would generate electricity.

译文：随着航天飞机的出现，有可能把一个沿轨道运行的太阳能发电站送到离地球24 000英里（1英里=1.609千米）的一条定常轨道上去。这个太阳能发电站几乎不间断地获取太阳能。它还能够用光电池将太阳能直接转换成电能，或者用平板集热器或聚焦集热器将太阳能间接转换成电能，即集热器使热传导体汽化，驱动涡轮机发电。

上例中solar power plant带有一个距离较远的定语从句，该从句中又含有另外三个定语从句。这四个定语从句均由that引出，环环相套，层见叠出。尽管例句句子结构复杂，但关系清楚，逻辑性强。

Example 2: Only by studying such cases of human intelligence with all the details and by comparing the results of exact investigation with the solutions of AI (Artificial Intelligence) usually given in the elementary books on computer science can a computer engineer acquire a thorough understanding of theory and method in AI, develop intelligent computer programs that work in a human-like way, and apply them to solving more complex and difficult problems that present computer can't.

译文：只有很详细地研究这些人类智能情况，并把实际研究得出的结果与基础计算机科学书上给出的人工智能结论相比较，计算机工程师才能彻底地了解人工智能的理论和方法，开发出具有人类智能的计算机程序，并将其用于解决目前计算机不能解决的更复杂和更难的问题。

本句为复合句，一主一从。主句有一个主语，三个并列谓语。句子以“only + 状语”开头，主句主、谓语部分倒装，主语a computer engineer处于谓语之间，形成can a computer engineer acquire, develop and apply这样一种语序。过去分词given引导的短语做后置定语，修饰前面的solutions of AI。另外，长状语only... computer science修饰主句谓语can acquire, develop and apply。that引导了一个后置定语从句，修饰more complex and difficult problems。

3）非谓语动词多

如前所述，科技文章要求行文简练，结构紧凑，为此，往往使用分词短语（participle phrase）代替定语从句（attributive subordinate clause）或状语从句（adverbial subordinate clause）；使用分词独立结构代替状语从句或并列分句；使用不定式短语（infinitive phrase）代替各种从句；介词和动名词（gerund）短语代替定语从句或状语从句。这样可缩短句子，又比较醒目。试仔细阅读下列各例句。

Example 1: A direct current is a current flowing always in the same direction.

译文：直流电是一种总是沿同一方向流动的电流。

Example 2: Radiating from the earth, heat causes air currents to rise.

译文：热量由地球辐射出来时，使得气流上升。

Example 3: A body can move uniformly and in a straight line, there being no cause to change that motion.

译文：如果没有改变物体运动的原因，那么物体将做匀速直线运动。

Example 4: Vibrating objects produce sound waves, each vibration producing one sound wave.

译文：振动着的物体产生声波，每一次振动产生一个声波。

Example 5: Materials to be used for structural purposes are chosen so as to behave elastically in

the environmental conditions.

译文：用于结构目的的材料的选择应使其在外界条件中保持其弹性。

Example 6：There are different ways of changing energy from one form into another.

译文：将能量从一种形式转变成另一种形式有各种不同的方法。

Example 7：In making the radio waves correspond to each sound in turn, messages are carried from a broadcasting station to a receiving set.

译文：使无线电波依次对每一个声音作出相应变化时，信息就由广播电台传递到接收机。

4）时态运用有限

科技英语所运用的时态大都限于一般现在时、一般过去时、现在完成时、过去完成时和一般将来时这几种，其他时态运用很少。其中一般现在时给人以“无时间性”的概念，以排除任何与时间关联的误解，主要应用于对定义、定理、公式或图表进行科学解说，或者用于表述一些通常发生或并非时限的自然现象、过程和规则等。

Example 1：Common salt dissolves in water.

译文：食盐溶于水。

Example 2：Figure 2 shows the principal layout of an oil refinery.

译文：图 2 显示了炼油厂的总布置图。

一般过去时在科技英语中常用于叙述过去进行的研究情况。例如一个描述过去试验情况的句子。

Example 3：Rice grew better, under the other conditions of these tests, when ammonium sulphate was added to the soil.

译文：在这些试验的其他条件不变的情况下，当土壤里添加了硫酸铵时，稻子生长得较好。

若所描述事物与现在相关且影响较大，则用现在完成时。

Example 4：The reaction has already come to the end.

译文：反应已经终止。

Example 5：One of the most striking characteristics of modern science has been the increasing trend towards closer cooperation between scientists and scientific institutions all over the world.

译文：现代科学的最显著特点之一，就是全世界科学家及科学机构之间不断发展为更密切的合作趋势。

而在介绍过去曾经做过的工作时，用过去完成时。

Example 6：The data had no sooner been charted than analysis was started.

译文：资料刚在图上填完，分析就开始了。

当讨论进行中的项目研究时，科技英语常采用一般将来时，说明未来拟定的活动。

Example 7：The scientists and technicians will carry out a very important test next month.

译文：科学家和技术人员下月将进行一项非常重要的测试。

5）修辞手法单调

英语中通常有夸张（hyperbole）、明喻（metaphor）、借喻（metonymy）、拟人（personification）和对照（contrast）等修辞手法。这些手法在英语的文学文体中是常见的，但在科

技英语中却是很少见的。这是因为科技英语注重叙述事实和逻辑推理，若采用文学上的修辞法，会破坏科学的严肃性，反而弄巧成拙。

B Circuit Theory (电路理论)

1. The electrical circuit

An electrical circuit or electrical network is an array of interconnected elements wired so as to be capable of conducting current. ① The fundamental two-terminal elements of an electrical circuit are the resistor, the capacitor, the inductor, the voltage source, and the current source. The value of a resistor is known as its resistance R, and its units are ohms (Ω). For the capacitor, the capacitance C, has units of farads (F), the value of an inductor is its inductance L, the units of which are henries (H). In the case of the voltage sources, a constant, time invariant source of voltage, or battery, is distinguished from a voltage source that varies with time. The latter type of voltage source is often referred to as a time varying signal or simply, a signal. In either case, the value of the battery voltage E, and the time varying signal $v(t)$, is in units of volts (V). Finally, the current source has a value I, in units of amperes (A), which is typically abbreviated as amps.

Elements having three, four, or more than four terminals can also appear in practical electrical networks. The discrete component bipolar junction transistor (BJT), is an example of a three-terminal element, in which the three terminals are the collector, the base, and the emitter. On the other hand, the monolithic metal-oxide-semiconductor field-effect transistor (MOSFET) has four terminals: the drain, the gate, the source, and the bulk substrate.

Multi-terminal elements appearing in circuits identified for systematic mathematical analyses are routinely represented, or modeled, by equivalent sub-circuits formed of only interconnected two-terminal elements②.

2. Current, voltage, power

The current flow through an element that is capable of current conduction is the time rate of change of the transferred charge. The unit of charge is the coulomb, time t is measured in seconds, and the resultant current is measured in units of amperes.

The terminal voltage, $v(t)$, corresponding to the energy, $w(t)$, required to transfer an amount of charge, $q(t)$, across an arbitrary cross-section of the element is: $v(t)=\frac{dw(t)}{dq(t)}$. Here, $v(t)$ is in units of volts when $q(t)$ is expressed in coulombs, and $w(t)$ is specified in joules.

The time rate of change of the applied energy is the power, which is in units of watts. In electrical circuits, the power delivered to an element is simply the product of the voltage applied across the terminals of the element and the resultant current conducted by that element.

3. Circuit classifications

Electrical elements and circuits in which they are embedded are generally codified as linear or nonlinear, active or passive, time varying or time invariant, and lumped or distributed.

Linear vs. Nonlinear Circuits—A linear two-terminal circuit element is one for which the volt-

age developed across, and the current flowing through, are related to one another by a linear algebraic or a linear integro-differential equation. If the relationship between terminal voltage and corresponding current is nonlinear, the element is said to be nonlinear. A linear circuit contains only linear circuit elements, while a circuit is said to be nonlinear if at least one of its embedded electrical elements is nonlinear③.

Active vs. Passive Circuits—An electrical element or network is said to be passive if the power delivered to it, is positive. In contrast, an element or network to which the delivered power is negative is said to be active; that is, an active element or network generates power instead of dissipating it. Conventional two-terminal resistors, capacitors, and inductors are passive elements. It follows that networks formed of interconnected two-terminal resistors, capacitors, and inductors are passive networks. Two-terminal voltage and current sources generally behave as active elements. Multi-terminal configurations, whose models exploit dependent sources, can behave as either passive or active networks.

Time Varying vs. Time Invariant Circuits—The elements of a circuit are defined electrically by an identifying parameter, such as resistance, capacitance, inductance, and the gain factors associated with dependent voltage or current sources. An element whose identifying parameter changes as a function of time is said to be a time varying element. If said parameter is a constant over time, the element in question is time invariant. A network containing at least one time varying electrical element it is said to be a time varying network. Otherwise, the network is time invariant. Excluded from the list of elements whose electrical character establishes the time variance or time invariance of a considered network are externally applied voltage and current sources. Thus, for example, a network with internal elements that are exclusively time-invariant resistors, capacitors, inductors, and dependent sources, but which is excited by a sinusoidal signal source, is nonetheless a time-invariant network.

Lumped vs. Distributed Circuits—Electrons in conventional conductive elements are not transported instantaneously across elemental cross sections, but their transport velocities are very high. In fact, these velocities approach the speed of light. Electrons and holes in semiconductors are transported at somewhat slower speeds, but generally no less than an order of magnitude or so smaller than the speed of light. The time required to transport charge from one terminal of a two-terminal electrical element to its other terminal, compared with the time required to propagate energy uniformly through the element, determines whether an element is lumped or distributed④. In particular, if the time required to transport charge through an element is significantly smaller than the time required to propagate the energy through the element that is required to incur such charge transport, the element in question is said to be lumped. On the other hand, if the charge transport time is comparable to the energy propagation time, the element is said to be distributed.

4. Kirchhoff's Circuit Laws

Kirchhoff's Current Law (KCL) is one of two fundamental laws in electrical engineering, the other being Kirchhoff's Current Law (KCL). It states that the algebraic sum of currents in a network of conductors meeting at a point is identically zero at all instants of time.

Kirchhoff's Voltage Law (or Kirchhoff's Loop Rule, KVL) is a result of the electrostatic field being conservative. It states that the total voltage around a closed loop is identically zero at all instants of time.

5. Network theorems

Superposition theorem—The superposition theorem for electrical circuits states that the response (Voltage or Current) in any branch of a bilateral linear circuit having more than one independent source equals the algebraic sum of the responses caused by each independent source acting alone, while all other independent sources are replaced by their internal impedances.

Thevenin's theorem—It states that any combination of voltage sources, current sources, and resistors with two terminals is electrically equivalent to a single voltage source V and a single series resistor R.

Norton's theorem—Norton's theorem is an extension of Thévenin's theorem and was introduced in 1926 separately by two people: Hans Ferdinand Mayer and Edward Lawry Norton. It states that any collection of voltage sources, current sources, and resistors with two terminals is electrically equivalent to an ideal current source I, in parallel with a single resistor R.

New Words and Expressions

two-terminal element 二端组件
resistor *n.* 电阻，电阻器
capacitor *n.* 电容，电容器
inductor *n.* 电感，电感器
voltage source 电压源
resistance *n.* 阻力，电阻
capacitance *n.* 电容，电流容量
inductance *n.* 电感，感应系数，自感应
Ohm *n.* 欧姆（电阻单位）
Farad *n.* 法拉（电容单位）
Henry *n.* 亨利（电感单位）
Volt *n.* 伏特，电压
Ampere *n.* 安培（计算电流强度的标准单位）
bipolar junction transistor 双极面结型晶体管
collector *n.* 集电极
base *n.* 基极
emitter *n.* 发射极
monolithic *n.* 单集成电路，单片电路
active (passive) circuit 有（无）源电路
(non) linear circuit （非）线性电路
time invariant circuit 时不变电路
lumped (distributed) circuit 集总（分散）参数电路
superposition theorem 叠加定理
Thevenin's theorem 戴维南定理
Norton's theorem 诺顿定理
metal-oxide-semiconductor field-effect transistor 金属氧化物半导体场效应晶体管
Kirchhoff's current (voltage) law 基尔霍夫电流（压）定律

Notes:

(1) An electrical circuit or electrical network is an array of interconnected elements wired so as to be capable of conducting current.
电路或者电网络由一系列电子元件组成，这些元件通过导线连接起来以传导电流。

(2) Multi-terminal elements appearing in circuits identified for systematic mathematical analyses are routinely represented, or modeled, by equivalent sub-circuits formed of only interconnected

two-terminal elements.

为进行系统数学分析，电路中的多端元件一般用二端元件组成的子电路等效表示。

(3) A linear circuit contains only linear circuit elements, while a circuit is said to be nonlinear if at least one of its embedded electrical elements is nonlinear.

线性电路仅仅包含线性电路元件，而至少包含一个非线性电子元件的电路才称为非线性电路。

(4) The time required to transport charge from one terminal of a two-terminal electrical element to its other terminal, compared with the time required to propagate energy uniformly through the element, determines whether an element is lumped or distributed.

二端元件中电荷从元件一端转移到另一端所需时间和相应能量传输时间的相对关系决定了该元件是集总参数元件还是分散参数元件。

C Careers in Electronics Engineering（电子工程职业）

We are now in the midst of the technological revolution which started by the introduction of the microchip in the 1970s. More and more electronic goods are being sold, especially computers, radio telephones and leisure products. At the same time, new applications for electronics are being found. Most domestic appliances now have some form of electronic control. Petrol at the filling station is dispensed by electronic means. Electronic ignition and fuel management are standard on cars.

All these mean that career opportunities in electronics are growing. More engineers are needed to design, plan, manufacture and install. In addition, service engineers are particularly needed. In a word, the future for the college and university graduates in electronics is bright. We will list some of the employment areas below:

1. Avionics

Aircraft electronic equipment has to be maintained to a very high standard with rigorous checks at set intervals. Service engineers are required to maintain on-board equipment such as radio, radar and automatic flight path plotting equipment. Air traffic control equipment is maintained on ground.

2. Industrial Electronics

Industrial electronics started with transducers which allowed remote monitoring of processes, especially those which involved high temperatures or dangerous substances. Further developments allowed processes in a whole range of industries—from food and drink production to garbage recycling—to be fully automated.

The development of robotics has led to widespread application in the car industry in particular. Everything from assembling to spraying the completed car can now be done without human assistance. Tedious and unpleasant jobs have disappointed. Automation has led to savings for the manufactures but has also contributed to design and service industrial circuits, including control panels.