电气工程及自动化专业英语

（建筑电气类）

Special English for Architectural Electric Engineering and Automation

刘剑　主编

中国电力出版社
www.cepp.com.cn

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内容提要

本书按专业基础、专业知识、专业拓宽等层次划分为三部分，三十一个单元。每单元分为基本课文和阅读材料两部分，并配有相应的词汇学习、要点注释、练习等内容。主要包括电路、模拟电子技术、数字电子技术、电机拖动、计算机控制、自动控制、智能建筑、楼宇自动化、办公自动化、综合布线、系统集成、消防系统、电梯、电话、有线电视、供配电、电气设计、防雷、接地、电气照明、计算机网络、通信、多媒体技术、信息传输、网络协议、神经网络、模糊控制、现场总线、无线传感、蓝牙技术等方面的科技文献，共计 62 篇。同时，在附录中给出了科技英语学习要点，介绍了科技英语的特点、翻译方法、英语科技论文写作方法等科技英语学习中的实用基础知识。

本书选材广泛、内容丰富，实用性强，既可作为电气工程及自动化、建筑电气、通信工程、信息技术等相关专业本科生、研究生使用的专业英语教材，也可作为建筑智能化、楼宇控制、自动化、网络通信技术等相关专业工程技术人员的自学参考书。

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前言

随着科学技术的飞速发展，特别是我国全面迈向小康社会步伐的日益加快，急需既懂专业，又会英语的人才，专业英语水平已成为当今大学生基本素质和实际工作能力的重要组成部分，专业英语的学习已成为学生必修的重要课程之一。

教材是教学的基本要素之一。市面上现有的专业英语教材，大多是针对电力、电子、自动化等基础内容编写的，没有适用于建筑类院校电气工程及自动化专业的英语教材。为适应高等院校电气工程及自动化专业英语的教学需要，我们总结了多年专业英语的教学经验，编写了《电气工程及自动化专业英语》教材，可供电气工程及自动化、建筑电气、通信工程、自动化等专业本科生、研究生使用，也可作为相关专业工程技术人员的自学教材。

本教材分为三大部分，设为**专业基础篇、专业知识篇、专业拓宽篇**。

专业基础篇设有六个单元，主要涉及大学一、二年级所学的专业基础课，包括电路、模拟电子技术、数字电子技术、电机等内容；**专业知识篇**设有二十个单元，主要涉及大学三、四年级所学的专业课，包括智能建筑、楼宇自动化、综合布线、系统集成、消防、电梯、电话、有线电视、计算机控制、自动控制、供配电、电气设计、防雷、接地、照明、计算机网络、通信、多媒体技术、信息传输、网络协议等内容；**专业拓宽篇**设有五个单元，主要涉及专业前沿知识，包括神经网络、模糊控制、现场总线、无线传感、蓝牙技术等相关内容。在附录中增设了**学习要点篇**，介绍了科技英语特点、翻译方法、科技论文写作方法等科技英语学习中的实用基础知识。

每单元包括基本课文、词汇学习、要点注释、阅读材料、练习等内容。各篇课文之间、课文和阅读材料之间，既有一定的内在联系，又独立成章，课文和阅读材料共计 62 篇，均选自原版英文文献。在教学中，可根据不同层次的学生、不同教学时数灵活选用。

基本课文：从学生所学的专业课程学习进度出发，按科技专业词汇的通用性和复现率及句子结构的通用性角度精选课文。

词汇学习：每课文章后附有词汇，列出本课出现的新词及常用词组和表达式，使学生对科技书刊、书面语体中常用短语、习语及其组成规律有所掌握。

课文点拨：针对课文中的重点、难点做出解释；对课文相关的技术发展背景、专业知识要点做出提示。

阅读材料：提供与课文内容相关的文献，以进一步拓宽学生视野，提高阅读能力，训练阅读技能。

练习：每篇课文和阅读材料后均配备了多种类型的练习，帮助学生对文章进行正确理解，培养学生通篇浏览、查找信息、概括大意、快速获取知识的能力，以达到加深理解和巩固学习的目的。

本书选材广泛、内容丰富，根据专业学习的不同阶段，按基础知识、专业基础知识和专业拓宽知识来划分学习内容，具有很好的学习系统性；文章选材着重于电气工程及自动化领域的基础理论、设计方法和工程应用，突出了建筑电气工程及自动化的专业特点，具有鲜明

的实用性；课文及阅读材料的选择力求反映现代先进的专业发展水平，使学生既能从中提高科技英语的学习水平及应用技能，又能扩大视野，了解国内外专业领域的发展动态。本书不仅适合学生在校作为教材使用，而且可以作为具有一定英语基础的电气自动化、通信技术、自动化、智能建筑技术等相关专业人员的参考书。

本书由沈阳建筑大学刘剑教授主编。其中一至四、九、十四、十五、十八至二十二单元由沈阳建筑大学刘剑、侯静，大庆高等师范专科学校邹立君，南京建筑工程学院宋永江编写；五、十、十一、十二、十六、十七单元由重庆大学龙利编写，八、十三、二十三至三十一单元由沈阳建筑大学张颖、周悦、王晓哲、郭彤颖、吴成东、李梦歆编写；附录由沈阳建筑大学刘剑、张颖、周悦、郑海英、杨离离编写。全书的统稿由刘剑教授完成。

本书在编写过程中参考了大量国内外相关文献，很多同行提供了技术资料，在成书过程中，得到长安大学王娜老师的关心和帮助，在此向他们表示衷心的感谢。

由于编者水平有限，书中错误和不足之处在所难免，敬请读者批评指正。

编　者

2004年8月

于沈阳建筑大学

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Part Ⅰ: Specialized Basic

Unit One

Passage A

Text

Electric Circuit

The diagram of Fig 1.1 illustrates the essential parts of an electric circuit, which consists, in its simplest form, of an energy source and an interconnected energy dissipation or conversion device, known as the load.

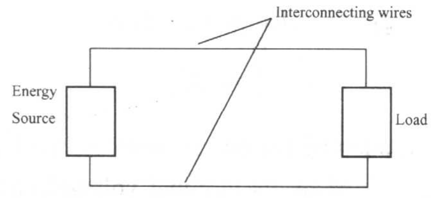

Fig 1.1 The electric circuit in its simplest form

A practical energy source may take one of many forms, depending, for example, on electro-chemical, electro-magnetic, thermo-electric, photo-electric etc., principles, but for the purpose of circuit analysis only two idealized forms are recognized, to one of which all practical sources approximate. These are: the voltage source and the current source.

The voltage source maintains a constant terminal voltage irrespective of the current supplied to the load. It is important to appreciate that the voltage may be a function of, for example, time, temperature, pressure etc. It is constant only with respect to variations of load.

The current source maintains a constant current in the load irrespective of the terminal voltage —which, in this case, is determined by the magnitude of the load. As with the voltage source, the generated current may depend on many other factors, but its one essential attribute is its independence of load.

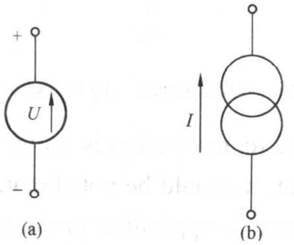

Fig 1.2 (a) A voltage source; (b) A current source

The symbols used for these active devices are illustrated in Fig 1.2(a) and (b). Also shown on the figure are the arbitrarily chosen positive directions of voltage and current. It should be noted that, conventionally, current flows through the source from the negative to the positive terminal.

The transformation from these idealized sources to simulate the characteristics of real sources can be simply effected.

The energy, w, expanded in moving a charge q through a potential difference (p.d.) u is given by

$$w = q\,u \tag{1.1}$$

hence

$$\mathrm{d}w/\mathrm{d}t = v\mathrm{d}q/\mathrm{d}t = ui \tag{1.2}$$

The rate of expenditure of energy is defined as the power p. Hence, in general the power is given by

$$p(t) = U(t)i(t) \tag{1.3}$$

and is measured in watts when u and i are in volts and amperes, respectively. If power $p(t)$ is expanded for time T, the total energy expanded (or stored) is

$$W = \int_0^T p(t)\mathrm{d}t \tag{1.4}$$

By a method similar to that adopted for energy sources, the load – or passive element of a circuit – may be idealized and defined by its terminal voltage/current relationship. All practical passive devices possess energy dissipative properties, often accompanied by energy-storage properties so that three distinct idealized types are possible.

(a) The resistance parameter:

A circuit, which dissipates energy but stores none is said to consist solely of resistance. The property is defined by the relationship

$$R = \frac{u(t)}{i(t)} \tag{1.5}$$

Where R is the resistance in ohms if $u(t)$ and $i(t)$ are in volts and amperes, respectively, and Eq. 1.5 is known as Ohm's Law.

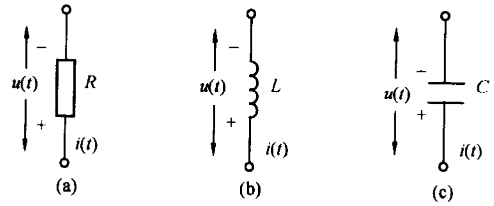

Fig 1.3 Symbols for (a) resistance; (b) inductance; (c) capacitance

The corresponding diagrammatic representation is shown in Fig 1.3(a), which also shows the positive directions of p.d. and current. It should be noted that, unlike an active element, a passive element develops a potential difference in opposition to the current flow so that there is a fall of potential through the element in the direction of the current flow. For this reason the terminal p.d. is called a potential drop – or voltage drop. The element which possesses resistance is termed a resistor.

The reciprocal of resistance is conductance designated by the symbol G. Thus,

$$G = 1/R \tag{1.6}$$

the units of G being siemens, or reciprocal ohms. Hence, an alternative form of Ohm's Law is:

$$i(t) = u(t)G \tag{1.7}$$

The power dissipated, $u(t)i(t)$, may be written in terms of resistance (or conductance) and voltage or current only; thus,

$$\begin{aligned} p(t) &= i(t)\, R\, i(t) = R\,[i(t)]^2 \\ &= u(t)\, u(t)/R \\ &= G\,[u(t)]^2 \end{aligned} \tag{1.8}$$

If, for example, the voltage applied is constant, i.e. $U(t)=U$, then $i(t)=I$ and the power

$$P = I^2R = U^2G \tag{1.9}$$

is also independent of time.

(b) The inductance parameter:

A circuit is said to possess inductance if it is able to store magnetic field energy. The property is defined by the relationship

$$u(t) = L\,\mathrm{d}i(t)/\mathrm{d}t \tag{1.10}$$

where L is the inductance, the units of which are henrys if u and i are in volts and amperes, respectively, and t is in seconds. A p.d. of 1V will, therefore, cause the current to change at the rate of 1A/sec in an inductance of 1H. The circuit representation of the inductance parameter is shown in Fig 1.3(b).

The eq.1.10 may also be written in general integral form:

$$i(t) = \frac{1}{L}\int u(t)\mathrm{d}t \tag{1.11}$$

The element which possesses inductance is termed an inductor.

The power, $u(t)i(t)$, may be written:

$$p(t) = L\, i(t)\, \mathrm{d}i(t)/\mathrm{d}t \tag{1.12}$$

and is non-zero only when $\mathrm{d}i(t)/\mathrm{d}(t)$ has a value. Hence for a steady current $i(t)=I$, $p(t)=0$, but for the current I to have been established, $p(t)$ has contributed to the stored energy:

$$W = \int_0^T p(t)\mathrm{d}t \tag{1.13}$$

Where T is the time taken for the current to build up to I.

Hence,

$$W = \frac{1}{2}LI^2 \tag{1.14}$$

(c) The capacitance parameter:

A circuit which is able to store electrostatic field energy is said to possess capacitance. The property is defined in terms of the electric charge stored per unit of potential difference at its terminals, according to the equation:

$$q(t) = Cu(t) \tag{1.15}$$

where C is the capacitance, the units of which are farads when u and q are in volts and coulombs, respectively. Hence, a capacitance of 1F stores a charge of 1C for a terminal p.d. of 1V. Combining

$i(t)$=dq/dt and Eq.1.15 gives

$$i(t)=C\mathrm{d}u(t)/\mathrm{d}(t) \tag{1.16}$$

with t in seconds.

Thus, a current of 1A flows into a capacitance of 1F when the terminal voltage changes at the rate of 1V/s.

Eq.1.16 may be rewritten in general integral form:

$$u(t) = \frac{1}{C}\int i(t)\mathrm{d}t \tag{1.17}$$

The element which possesses capacitance is termed a capacitor, and its circuit representation is illustrated in Fig 1.3(c).

The power, $u(t)i(t)$, may be written

$$p(t) = u(t)\ C\ \mathrm{d}u(t)/\mathrm{d}t \tag{1.18}$$

and is non-zero only when d$u(t)$/dt has a value. Hence, for a steady voltage $u(t) = U$, say, $p(t) = 0$, but for the voltage U to have built up on the capacitor, $p(t)$ has contributed to the stored energy

$$W = \int_0^T p(t)\mathrm{d}t \tag{1.19}$$

Where T is the time taken for the voltage to have built up to U.

Hence

$$W = \frac{1}{2}CU^2 \tag{1.20}$$

Eq.1.10 and Eq.1.16 show that step discontinuities are not possible in the current through inductance nor in the voltage across capacitance, since such steps would require, respectively, infinite voltage and infinite current. The ideas implicit in these restrictions are important in the analysis of circuits containing inductance and capacitance since they enable the initial conditions to be defined.

New Words & Special Terms

1. electric /i'lektrik/ *a.* 电的；用电的
2. circuit /'sə:kit/ *n.* 电路；回路；线路
3. illustrate /'iləstreit/ *v.* 说明；阐明；举例
4. essential /i'senʃəl/ *a.* 实质的；基本的；必要的
5. interconnect /ˌintə:kə'nekt/ *vt.* 使相互联系；使相互结合
6. dissipation /ˌdisi'peiʃən/ *n.* 驱散；消耗
7. conversion /kən'və:ʃən/ *n.* 转化；变换
8. load /ləud/ *n.* 负载
9. electro-chemical /i'lektrəu-'kemikəl/ *a.* 电化（学）的
10. electromagnetic /i'lektrəu'mægnitik/ *a.* 电磁的
11. thermo-electric /θə:mɔ'ilektrik/ *a.* 热电的
12. photo-electric /'fəutəu-i'lektrik/ *a.* 光电的
13. irrespective /ˌiris'pektiv/ *a.* 不考虑的；不顾的
14. magnitude /'mægnitju:d/ *n.* 大小；量值

15. active /'æktiv/ *a.* 主动的；有功的；有源的
16. power /'pauə/ *n.* 功率
17. watt /wɔt/ *n.* 瓦（特）
18. volt /vɔlt/ *n.* 伏特；伏
19. ampere /'æmpiər/ *n.* 安培
20. passive /'pæsiv/ *a.* 被动的；无源的
21. resistance /ri'zistəns/ *n.* 电阻；电抗；电阻器
22. resistor /ri'zistə/ *n.* 电阻器；电阻
23. conductance /kən'dʌktəns/ *n.* 电导；传导性；电导性
24. siemens /'simens/ *n.* 西门子（电导单位）
25. reciprocal /ri'siprəkəl/ *a.* 倒数的
26. inductance /in'dʌktəns/ *n.* 电感；感应系数
27. henry /'henri/ *n.* 亨；亨利（电导单位）
28. inductor /in'dʌktə/ *n.* 电感器；感应线圈
29. integral /'intigrəl/ *a.* 积分的；完整的 *n.* 积分
30. capacitance /kə'pæsitəns/ *n.* 电容；电容器
31. electrostatic /i'lektrəu'stætik/ *a.* 静电的；静电学的 *n.* 静电学
32. farad /'færəd/ *n.* 法拉（电容单位）
33. coulomb /'ku:lɔm/ *n.* 库仑（电量单位）
34. capacitor /kə'pæsitə/ *n.* 电容器
35. discontinuity /'dis,kɔnti'nju:iti/ *n.* 不连续性；间断
36. implicit /im'plisit/ *a.* 含蓄的；固有的
37. relationship /ri'leiʃənʃip/ *n.* 关系；联系
38. restriction /ris'trikʃən/ *n.* 限制；约束

Phrases & Expressions

1. voltage source 电压源
2. current source 电流源
3. potential difference(p.d.) 电势差
4. potential drop 电压降；电势降
5. voltage drop 电压降
6. in terms of 根据；从……方面说
7. Ohm's Law 欧姆定律

Notes

Also shown on the figure are the arbitrarily chose positive directions of voltage and current.

句中用分词短语 shown on the figure 作主语，而过去分词 chose 则作 positive directions 的定语。

Exercise A

I. Choose the best answer for each of the following:

1. The voltage source maintains a constant terminal voltage ______ the current supplied to the load.
   a. irrespective of　　b. related of　　c. interrelated
2 .The current source maintains a constant______.
   a. voltage　　b. current　　c. load
3. The units of the inductance are ______ if *U* and *I* are in volts and amperes respectively.
   a. simens　　b. ohms　　c. henrys
4. A circuit which is able to store electrostatic field energy is said to possess______.
   a. inductance　　b. capacitance　　c. resistance
5. As with voltage source, the generated current may independed on______.
   a. time　　b. temperature　　c. load

II. Answer the following questions:

1. What does an electric circuit consist of?
2. What is the load?
3. How many idealized forms are recognized for the purpose of the circuit analysis? What are they?
4. What is the inductance which a circuit possesses?
5. What is the capacitance which a circuit possesses?

III. Fill in blanks with the words or expressions given below, change the form where necessary.

Two ______of charge are known, arbitrarily designed positive and negative, which _____ characterized ______ the experimental observation that, ______static conditions, ______ like charges exert a mutual force of repulsion, ______ unlike charges, under similar conditions, exert a force of attraction. Under these conditions the field of force associated _____ charge is referred ______ as an electric filed. The potential at the point raised, electrons will flow ______ that point until all points of the conductor are again ______ the same potential.

to	under	with	while	towards
kind	separate	be	by	at

IV. Translate Chinese into English:

1. 电路由电源和与之相连的负载构成。
2. 电压源的电压可能只是时间、温度和压力等的函数，而与负载的大小无关。
3. 当电流和电压的单位分别是安培和伏特时，功率的单位是瓦特。
4. 只消耗电能而不储存电能的电路称为纯电阻电路。
5. 相应的图解表示示于图 5 中。

Passage B Reading Material
Potential and Current

Electric charge is as fundamental a constituent of our universe are mass and energy. Indeed, present physical theory supposes that all matter consists of particles, the principal attributes of which are mass and electric charge.

Two kinds of charge are known, arbitrarily designated positive and negative, which are characterized by the experimental observation that, under static conditions, separated like charges exert actual force of repulsion, whilst unlike charges, under similar conditions, exert a force of attraction. Under these conditions, the field of force associated with charge is referred to as an electric field.

The smallest known charge is that of a single electron, and, since this is much too small to adopt as a unit for all but a few special purposes, a unit, the coulomb, equal to 6.24×10^{18} electrons, has been chosen as the practical (S.I.) unit.

As a consequence of their mutual forces, any system of charges possesses potential energy, since, unless constrained the individual charges will move and energy will be released. As part of the theoretical structure this energy is ascribed to the electric field, and so it is possible to identify with every point in the field a level of energy, the magnitude of which is dependent upon the charges and their relative positions.

When one of the charges is of unit magnitude, and positive, the energy at the point defining its position is referred to as the potential at that point, and hence is measured (in S.I. units) in foules per coulomb (J/C) or volts. The potential difference between two points in a field is therefore the difference in energy, per unit charge, at the two points.

Observation shows that the force experienced by a charge — a measure of the electric field strength — varies with distance and diminishes to zero only at an infinite distance from the source charge (s). Therefore a point at infinity may be considered to be at zero potential.

In practice, however, we are generally concerned with a datum of potential that is not zero the most common being the earth's surface considered as an equipotential. Since most of our experiments are earth-bound there is no need to take into account the potential of the earth with respect to the true zero datum.

Problem: The potential energy of a charge of +4C at a point A in a field is 24J, and at a point B, 36J. Determine, in volts, the potential difference U_{AB}.

Solution: Energy difference $W_{AB}=24-36=-12$(J)

But this is for a charge of 4C. Hence, the potential difference (p. d.) or energy difference per unit charge=$-12/4$V=-3V (J/C).

The negative sign means that energy is required from an external source to move the charge from A to B. This energy is recoverable when the charge moves from B to A. Point B is said to be at a higher potential than point A. Hence, $U_{BA}=+3$V.

Note that, since energy is scalar, it is not necessary to know the path followed by the charge in