电气工程及自动化专业英语

（建筑电气类）

第二版

刘　剑　主编

Special English for Architectural Electric Engineering and Automation

中国电力出版社
CHINA ELECTRIC POWER PRESS

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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 60 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、英语论文写作方法等科技英语学习中的实用基础知识。

本书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、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

本书初版于2004年11月问世，五年间印刷了四次。为了适应新的形势发展，本书第二版应运而生。本版在第一版的基础上进行部分章节的修改调整，并在附录中增加了建筑电气专业常用英语词汇。

本书分为三篇，即专业基础篇、专业知识篇和专业拓宽篇。专业基础篇设有六个单元，涉及电气信息类的专业基础课，主要包括电路、模拟电子技术、数字电子技术、电机拖动基础、变压器、计算机基础等内容；专业知识篇设有二十个单元，涉及相关专业的专业课，主要包括计算机控制、自动控制、供配电、电气设计、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、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；专业拓宽篇设有四个单元，涉及专业前沿知识，主要包括模糊控制、现场总线、无线传感、蓝牙技术等相关内容。附录增设了科技英语学习要点，可作为读者学习科技英语中的实用基础知识和工具。

本书由刘剑教授主编，参加再版修订工作的有沈阳建筑大学李孟歆、张颖、侯静、许可。全书的统稿由刘剑教授完成。很多同行曾给以热情的支持和帮助，提供了技术资料。在此，表示由衷的感谢！

对于本版中存在的错误和不妥之处，继续恳请广大读者不吝指正。

编　者

2012年1月

于沈阳建筑大学

第一版前言

随着科学技术的飞速发展，特别是我国加入 WTO 后，国际间交流合作逐年增多，急需既懂专业，又会英语的人才，专业英语水平已成为当代科技工作者基本素质和实际工作能力的重要标志，专业英语成为专业技术人员最具实用价值的首选学习内容之一。

为了满足电气工程及自动化专业技术人员学习英语的需要，并适应不同层次读者的要求，本书在内容编排上力求层次清晰，内容丰富，分为专业基础篇、专业知识篇和专业拓宽篇三大部分。

专业基础篇主要包括电路、模拟电子技术、数字电子技术、电动机等电类专业的专业基础英语内容；专业知识篇主要包括计算机控制、自动控制、供配电、电气设计、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、防雷、接地、照明、计算机网络、通信、多媒体技术、信息传输、网络协议等电气工程及自动化相关专业的专业内容；专业拓宽篇主要包括神经网络、模糊控制、现场总线、无线传感、蓝牙技术等专业相关的前沿内容。附录中增设了专业英语学习实用要点篇，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。

本书构思新颖，选材广泛，逻辑性强。可根据不同层次读者的需要，灵活选用学习内容。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；文章均选自原版英文文献，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；书中各篇文章力求反映当代专业发展水平，使读者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。本书不仅适合于电气工程及其自动化、通信工程、智能建筑技术等相关专业本科生、研究生作为教材使用，而且可以作为具有一定英语基础的相关专业技术人员的学习参考书。

本书由沈阳建筑大学刘剑教授任主编，岳恒、徐未艾任副主编。其中第一至四、六、七、九、十四、十五、十八至二十二单元由沈阳建筑大学刘剑、侯静、东北大学岳恒、沈阳化工学院徐未艾、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；第五、十、十一、十二、十六、十七单元由重庆大学龙利编写，第八、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、李孟歆编写；附录由沈阳建筑大学刘剑、张颖、周悦编写。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。在成书过程中得到了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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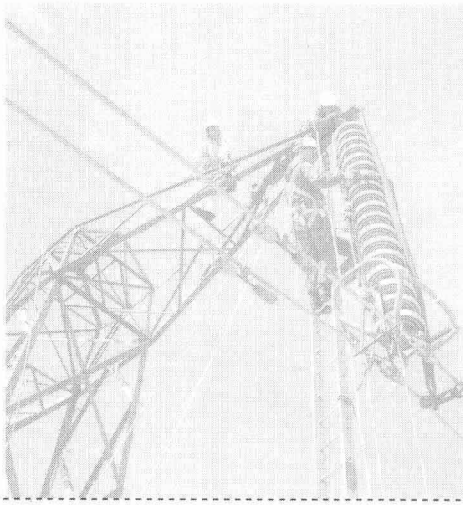

Part I

Specialized Basic

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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.

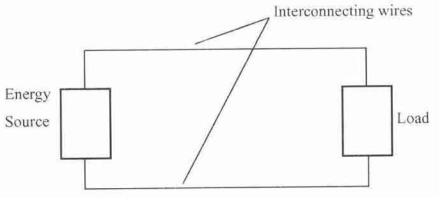

Fig 1.1 The electric circuit in its simplest form

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 without 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.

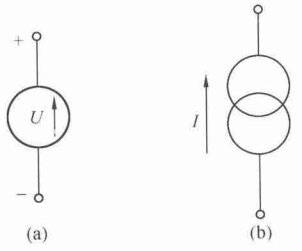

Fig 1.2 A Voltage source and A current source

(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

$$w = qu \tag{1.1}$$

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.

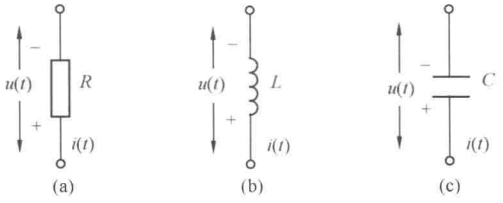

Fig 1.3 Symbols

(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 obedience 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

$i(t)=\mathrm{d}q/\mathrm{d}t$ 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 $\mathrm{d}u(t)/\mathrm{d}t$ 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:mə'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 /vəlt/ *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（电感单位）
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 chosen positive directions of voltage and current.

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