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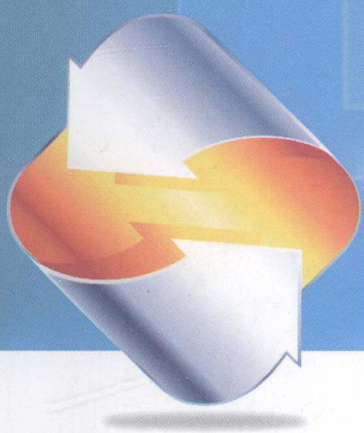

电子信息类专业ESP

秦获辉 编著

西安电子科技大学出版社
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内 容 简 介

本书由 15 个单元组成，内容涵盖了电子信息领域的主要方面，书中文章均摘自英美等国的原版教材。根据各校的具体情况，本书的参考学时可为 30～60 学时，建议在一个学期内学完，以便学生尽快地进入各自的专业阅读阶段。

本书的特点是：学生既能学习到地道的科技英语，又能通过每节的语法部分掌握系统的“科技英语核心语法”，使得阅读与语法相互支撑，最大程度地提高学生的阅读能力。这种安排在国内科技英语阅读书籍中是很少见的。

本书的注释详尽、练习实用，因此不仅可供在校大学生使用，同时也可供电子信息类的工程技术人员自学使用。

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前 言

本书主要是为已经学完了“大学英语”基础课程的电子信息类专业高年级本科学生而设计的，它作为从普通英语过渡到专业英语的一座“桥梁”，使大家初步接触到地道的科技英语，了解其文体特征和句子特征，同时学习英美科技人员所偏爱的一些句型，掌握一定量的科技词汇，为阅读各专业的英文原版科技书籍或实施双语教学打下一个初步且比较扎实的基础。

本书共 15 个单元，每个单元分为两大部分，第一部分是专业阅读材料和练习；第二部分是“科技英语核心语法”的内容及练习。阅读的基础是语法，特别是内容比较深奥的文章，句子都比较冗长，一定要搞清楚其句子的语法结构才能正确理解其确切的含义。此外，在科技英语写作中也必须掌握一定的语法知识。

本书内容涉及通信、电子、计算机、电视、软件、电子对抗、微波、半导体、激光、微电子、电子测量和信息等领域，语言上难易结合，注释详尽，练习实用，便于读者学习和教师教学。本书除适合在校大学生学习外，也非常适合喜欢学习科技英语的广大科技工作者使用。

每个单元需要两次课的时间(4 学时)，全书需要约 60 学时，最好在一个学期内学完，以便尽快进入自己所学专业的英语书籍的阅读阶段。每个单元第一次课讲课文及相应的练习和阅读材料，第二次课讲语法内容及相应的练习。如果安排的学时数比较少，则每个单元的第二部分可以自学。本书附有总词汇表(包括课文、英译汉短文练习和阅读材料中的生词)，列出的单词均为 2000 年 7 月版“大学英语教学大纲词汇表”中四级词汇(包括中学已学过的)以外的单词(共 1185 个)，因此每单元并没有专门列出“New Words”一项，以便让读者提高查阅单词的能力及速度；新出现的词组则列在“Notes”中。由于本书的所有文章均摘自不同的英文原版书籍，文中图题和公式序号保持了原著风格，因此各单元的排版方式有所不同。

本书能否达到编撰的目的，只有通过实践来检验，盼请读者提出宝贵的意见，以便今后再版时改进。如果需要本书课文和阅读材料的参考译文及所有练习的参考答案，请发 E-mail 到 qdh918@163.com。

编 者

2012 年 1 月于

西安电子科技大学科技英语研究中心

目　　录

Unit 1

Part One Text

Some Introductory Concepts

The operation of any electronic device, be[1] it as complicated as a television receiver or as simple as a flashlight, can be understood by determining the magnitude and direction of electric currents in all parts of its functional unit, the circuit①. In fact, it is not possible to appreciate how any given circuit functions without a detailed knowledge of the currents in its individual components.

Even the most complicated circuits can be examined in easy stages[2] by first considering each part separately and subsequently noting how the various subcircuits fit together[3]. Therefore, circuit analysis starts by treating elementary configurations under the simplest possible conditions[4]. Circuits in which the currents are steady and do not vary with[5] time are called direct current circuits. Such dc circuits, which are considered in this chapter, are important and relatively simple to understand[6].

Current, Voltage, and Resistance

The motion of electric charges (for example, electrons in a conducting material) constitutes an electric current. Specifically, the current I is the time rate at which charge Q passes a given point so that

$$I = \frac{\mathrm{d}Q}{\mathrm{d}t^{[7]}} \tag{1-1}$$

Electric current is measured in coulombs[8] per second, which is termed[9] an ampere (A) in honor of[10] the French scientist Andre Marie Ampère.

A number of materials, most notably metals such as copper and silver, contain many free electrons which move in response to electric fields originating from other, external, electric charges and, accordingly, such materials are capable of carrying an electric current. Each free electron in a metal wire carrying current is accelerated by the electric field until it loses its velocity as a result of a collision within the metal. It then accelerates again until it suffers a subsequent collision. The energy required to effect② the successive accelerations and move an electron from one point to another is called the electric potential difference[11] between the two points. The potential difference V is measured in terms of work per unit charge, or③

$$V = \frac{W}{Q} \tag{1-2}$$

Because potential difference is used so frequently in electric circuit analysis, work per unit charge is termed a volt (V) in recognition of the early worker in electricity, Alessandro Volta.

The resistance that each free electron encounters as a result of multiple collisions when moving in a conductor depends upon a material property called resistivity, ρ. The range of resistivities typical of several metals and alloys④ at[12] room temperatures is shown in Table 1-1. In addition to resistivity, the shape of the conductor is also important, so that the resistance, R of a wire L meters long and A square meters in cross sectional area[13] is given by[14]

$$R = \frac{\rho L}{A} \tag{1-3}$$

According to this expression[15], the resistance of long thin wire is greater than that of a short, thick wire of the same material.

The unit of resistance is labeled[16] the *ohm*, after[17] George Simon Ohm, who first discovered the relationship between current, voltage, and resistance discussed in the next section. The commonly accepted symbol for the resistance of a conductor in ohms is the Greek letter omega, Ω. It often proves convenient⑤ to describe the ability to conduct current in terms of the reciprocal of resistance, or *conductance*, which is measured in terms of reciprocal ohms, or *mhos*.

Table 1-1 Resistivities of metals and alloys

Material	Resistivity, $10^{-8}\ \Omega \cdot m$
Aluminum	2.6
Brass	6
Carbon	3.5×10^2
Constantan	50
Copper	1.7
Manganin	44
Nichrome	100
Silver	1.5
Tungsten	5.6

Ohm's Law

In order to maintain a large current in a conductor, more energy, hence a greater potential difference, is required than in the case of a small current in the same conductor. The constant of proportionality between current and potential difference is just the resistance of the conductor, or

$$V = RI \tag{1-4}$$

This equation is known as *Ohm's law*. According to Ohm's law, whenever a conductor of resistance R carries a current I, a potential difference, or *voltage* V, must be present across the ends of the conductor. This relation is fundamental to electric circuit analysis and is used repeatedly in subsequent sections.

Joule's Law

The kinetic energy of the electrons in a conductor, which results from⑥ acceleration by the electric field, is dissipated in inelastic collisions within the conductor and converted to heat energy. Consequently the temperature of a conductor carrying a current must increase slightly, and it is apparent that[18] electric power is expended in forcing a current through the resistance of the conductor[19].

The power P that must be supplied to the conductor is given by

$$P = \frac{\mathrm{d}W}{\mathrm{d}t} = V\frac{\mathrm{d}Q}{\mathrm{d}t} = VI \tag{1-5}$$

where[20] the definitions of potential difference, Eq. (1-2), and current, Eq. (1-1), have been used. This expression may be written in terms of the resistance of the conductor using Ohm's law[21]. The result,

$$P = I^2R \text{⑦} \tag{1-6}$$

is known as Joule's law, after Sir James Prescott Joule, who discovered experimentally that the rate of development of heat in a resistance is proportional to the square of the current.

According to Joule's law, electric power is dissipated in a conductor whenever it carries an electric current. This is put to use in incandescent lamps, where a thin metal filament is heated to white heat by the current, and also in electric fuses[22], in which the conductor melts when the current exceeds a predetermined value. On the other hand, the size of wires, and therefore their resistance, is selected so that[23] the power loss is small and the temperature rise negligible⑧ when the wire is carrying less than the maximum current. The joule heat in a conductor is commonly spoken of as the "*I*-squared-*R*" loss. As usual, the unit of power, according to Eq. (1-5), is a joule per second, which is called a watt (W), in honor of James Watt, developer[24] of the steam engine.

▲▲▲▲▲▲ *Notes to the Text*

[1] "be it…or…"是省去了让步状语从句引导词"whether"的情况，属于一种虚拟语气形式，本来是"whether it is/be…or…"，意为"无论它是……还是……"。当主语为复数时，其句型为"be they…or…"。(详见第 13 单元语法有关内容。)

[2] "in/by easy stages"意为"从容不迫地"。

[3] "fit together"意为"适配在一起"。

[4] "the simplest possible conditions"也可以写成"the simplest conditions possible"，意为"可能的最简情况"。

[5] "vary with…"意为"随……而变化"。一些表示变化的动词(如 vary, change, increase, decrease, rise, fall 等)与"with"连用时表示"随……而……"。

[6] "to understand"的逻辑宾语是句子的主语"Such dc circuits"，这种句型叫做"反射式

的不定式结构”，它在普通英语和科技英语中使用都非常普遍。又如：“This computer is easy to operate.”，它等效于“It is easy to operate this computer.”，只不过侧重点有所不同。(详见第 6 单元语法有关内容。)

[7] “$I=\frac{dQ}{dt}$”这个式子在此是“so that”引导的一个状语从句，其等号要读成“equals”或“is equal to”。有时候，一个式子等效于一个名词，如本文的等式(1-3)就是“by”的介词宾语。

[8] “in coulombs”意为“以库仑为单位”。又如本文后面的“in ohms”意为“以欧姆为单位”。

[9] 要表示“A 被叫做[称为]B”的话，主要有以下一些说法，它们经常交替使用(本文中原作者就用了 4 种)：

A is called B.
A is termed B.
A is named B.
A is known as B.
A is referred to as B.
A is spoken of as B.

需要特别注意的是，前三个不用“as”引出补足语，而后三个一定要带有介词“as”。

[10] “in honor of ...”与“in recognition of ...”是类同的，意为“为了纪念……”。

[11] “electric potential difference”意为“电位差”，简单地用“potential difference”表示。

[12] 表示“在……温度(temperature)，频率(frequency)，压力(pressure)，速率(rate)上/下”时，这些名词前要用介词“at”。

[13] “L meters long and A square meters in cross sectional area”意为“长为 L m、横截面积为 A m^2 的”，作后置定语，修饰其前面的名词“a wire”。

[14] “用……表示”经常写成“... given/expressed/denoted/represented by”。

[15] 在科技文中，“expression”意为“表达式”；“formula”意为“公式”；“equation”意为“方程式，等式”；“relation”意为“关系式”。

[16] “is labeled (as) ...”意为“被标记为……”。

[17] 这个“after”在此意为“按照……的名字(命名的)”。

[18] “it is apparent/clear/evident that ...”等效于“apparently/clearly/evidently”，意为“显然，很明显”，在科技文中很常见。

[19] “in forcing a current through the resistance of the conductor”意为“在迫使电流通过导体电阻的过程中[时候]”，这里“through ...”是动名词“forcing”要求的宾语补足语。

[20] “where”在此为关系副词，引导一个非限制性定语从句，修饰上面的表达式，它可以译成“式中，这里，其中”。

[21] 可看成在“using Ohm's law”前省去了介词“by”(这种用法在科技文中极为常见)，意为“(通过)利用欧姆定律”。

[22] “in electric fuses”是与前面“in incandescent lamps”并列的，其间被由关系副词“where”引导的非限制性定语从句分隔开了。

[23] “is selected so that ...” 要译成“把……选择得使……”。

[24] 当是世界上独一无二的人时，其前面一般不用定冠词“the”。

▲▲▲▲▲▲ *Exercises*

1. Choose the best answer for each of the following on the basis of the text you have just learnt.

(1) It is possible to understand the operation of a given circuit ________.

A. through a detailed knowledge of the currents in its individual components

B. without a detailed knowledge of the currents in its individual components

C. with the help of a rough idea of the currents in its individual components

D. by use of a detailed knowledge of the heat energy dissipated in its individual components

(2) The unit of current is termed an ampere in recognition of ________.

A. an American scientist　　B. a Greek scientist

C. a French scientist　　D. a British scientist

(3) Each free electron encounters resistance when moving in a conductor because of ________.

A. there being no potential difference in the conductor

B. many collisions

C. power loss

D. heat energy

(4) Ohm's law is ________ to circuit analysis.

A. of no use　　B. of no help

C. of very great importance　　D. of no significance

(5) Sir James Prescott Joule discovered Joule's law ________.

A. by careful calculations

B. by computer simulation

C. by solving mathematical equations

D. by doing experiments

2. Answer the following language questions.

(1) “the circuit”是什么语法成分？

(2) 这个“effect”是什么词类？什么词义？

(3) 这个“or”是什么意思？

(4) “typical of several metals and alloys”是什么语法成分，起什么语法作用？表示什么意思？

(5) 形容词“convenient”起什么语法作用？

(6) “results from”是什么意思？

(7) 等式“$P = I^2R$”是什么语法成分？

(8) “the temperature rise negligible”是什么语法成分？

3. Translate the following passage into Chinese:

Part of a Preface

In the ten years since this book was first published significant changes have been seen in the general world situation, as well as in metalworking. Efficiency of production remains, as always, a dominant industrial theme, but it is increasingly being interpreted in terms of social and environmental factors in addition to its strictly economic sense. This can have considerable repercussions on metalworking practice. For example, the noise produced by a drop hammer may now be unacceptable. It can, to some extent, be reduced at source and its transmission can be minimized, but thought is also being given to replacement of drop forging by inherently quieter processes where possible. Major changes in lubrication and cooling systems may be needed in some other processes, to avoid potential dangers to health by contact or ingestion, and to reduce disposal problems.

Superimposed upon these considerations is the need to conserve energy and material resources. More efficient utilization of direct and indirect energy supplies has become essential, and the temporary and permanent shortages of certain raw materials demand greater flexibility in plant operation, as well as calling for substitute materials.

The main theoretical development in this decade has been in the widespread use of digital computers, and in the recognition that material properties should be included in analytical models. A new chapter outlining the numerical methods for solution of metalworking problems has been written, with critical guidance on their relative merits and applicability.

I am indebted to many colleagues in metallurgy and engineering for helpful comments and discussion. Among these it is a pleasure to record particularly Professor W. Johnson and Dr. J. A. Newnham. Finally I wish to thank my wife and family for their forbearance during the preparation of the manuscript.

▲▲▲▲▲▲ *Reading Material*

Kirchhoff's Rules

It is not possible to reduce many of the networks important in electronics to[1] simple series-parallel combinations, so that[2] more powerful analytical methods must be used. Two simple extensions of Eqs. (1-8) and (1-12)[3], known as *Kirchhoff's rules*, are most helpful in this connection[4]. Consider first the simple parallel circuit, Fig. 1-9, redrawn as in Fig. 1-11[5] to illustrate the idea of a *branch point*[6], or *node*, of a circuit. A node is the point at which three (or more) conductors are joined. Kirchhoff's first rule is that the algebraic sum of the currents at any node is zero. Symbolically

$$\sum I = 0 \qquad (1\text{-}25)$$

[7]

Note that Eq. (1-25) is essentially a statement[8] of continuity of current; it may also be looked upon as[9] a result of the conservation of electric charge.

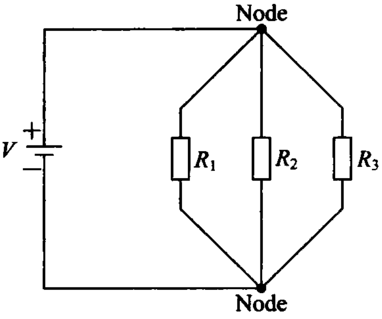

Fig. 1-11　Nodes in a simple parallel circuit.

Kirchhoff's second rule has already been applied implicitly in using Eq. (1-25) to calculate I_3 in Fig. 1-10*a*[10]. It states that the algebraic sum of the potential differences around any complete loop of a network is zero. Symbolically

$$\sum V = 0 \tag{1-26}$$

A loop of a network is understood to be any closed path[11] such as *abcda* in Fig. 1-10*a* which returns to the same point. Other examples of complete loops in the same network are *befgcb* and *daefgd*. Equation (1-26) is a consequence of the conservation of energy.

In applying Kirchhoff's rules to any network, the first step is to assign a current of arbitrary direction to each of the resistances in the network. The polarity of the potential difference across each resistor is then marked on the circuit diagram using the convention already noted that[12] the current enters the positive terminal of a resistance. The polarity of emf sources[13] are, of course, specified in advance from the circuit diagram itself. Kirchhoff's rules are then applied to the various nodes and circuit loops to obtain a sufficient number of simultaneous equations[14] to solve for[15] the total number of unknown currents.

It is true that[16] if a network contains m nodes and n unknown currents there are $m-1$ independent equations which result from Eq. (1-25). Similarly, there are total number of independent equations derived from Eq. (1-26). The total number of independent equations obtained from Kirchhoff's rules applied to any network is therefore $(m-1) + n- (m-1) = n$. This is just the number of unknown currents and the network solution is therefore completely determined. It is generally possible to write down more nodes and loop equations than are needed[17] but only n of them are truly independent.

The solution[18] of these independent equations often results in[19] certain of the currents being negative[20]. This means that the original arbitrarily assigned current direction is, in fact, incorrect and the current is actually in the opposite direction. Thus, it is not necessary to know the true current direction in advance. Once the various currents have been calculated, the *IR* drops in any portion of the circuit are determined using Ohm's law.

The technique[21] of applying Kirchhoff's rules to a network can best be illustrated with a few examples. Consider first the simple parallel-resistor circuit of Fig.1-12. The current direction in each resistor has been arbitrarily selected

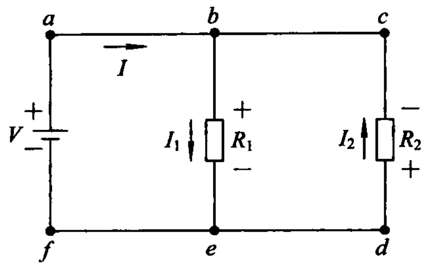

Fig. 1-12 A simple parallel-resistor circuit.

and the polarity of the *IR* drops marked[22] in accordance with these assigned directions. Note that this network has only two notes, one at *b* and the other at *e*. Therefore, there is only 2−1 = 1 independent node equation. Considering the branch point at *b*[23], Eq. (1-25) yields

$$I - I_1 + I_2 = 0^{[24]} \tag{1-27}$$

Notice[25] at branch point *e* the current equation is

$$-I + I_1 - I_2 = 0 \tag{1-28}$$

Clearly Eq. (1-28) is simply the negative of (1-27) and the two relations are therefore not independent. Either equation may be used in the solution of the network.

Consider now the loop *abed*. According to Eq. (1-26)

$$V - I_1R_1 = 0 \tag{1-29}$$

Similarly, around the loop *abcdef*

$$V + I_2R_2 = 0 \tag{1-30}$$

Since there are three unknown currents, there must be 3 − 2 + 1 = 2 independent loop equations and these are (1-29) and (1-30). Note, however, that around loop *bcde*

$$I_1R_1 + I_2R_2 = 0 \tag{1-31}$$

This is not an independent relation, as may be shown by subtracting Eq. (1-29) from (1-30)[26]. The result is Eq. (1-31). Thus these three loop equations are not independent, any two may be used in solving the network.

Choose Eqs. (1-27), (1-29), and (1-31) as[27] the three independent equations to solve for the three unknown currents. The solution is accomplished by first solving Eq. (1-29) for I_1,

$$I_1 = \frac{V}{R_1} \tag{1-32}$$

Next, I_2 is determined from (1-31),

$$I_2 = -\frac{I_1R_1}{R_2} \tag{1-33}$$

Substituting (1-33) into (1-27)[28],

$$I - I_1 - \frac{I_1R_1}{R_2} = 0 \tag{1-34}$$

Substituting from (1-32) for I_1,

$$I-\frac{V}{R_1}-\frac{VR_1}{R_1R_2}=1-V\left(\frac{1}{R_1}+\frac{1}{R_2}\right)=0 \tag{1-35}$$

The current I is therefore

$$I=V\left(\frac{1}{R_1}+\frac{1}{R_2}\right) \tag{1-36}$$

which is quite equivalent to[29] the solution corresponding to Eq. (1-13) arrived at[30] by considering parallel resistors.

Finally, I_2 is determined by substituting for I_1 in Eq. (1-33)[31],

$$I_2=-\frac{VR_1}{R_1R_2} \tag{1-37}$$

or

$$I_2=-\frac{V}{R_2} \tag{1-38}$$

According to the minus sign in Eq. (1-38), this current is actually in the opposite direction to[32] that assumed in Fig. 1-12. Correspondingly, the IR drops across R_2 has the opposite polarity from that shown on the circuit diagram.

More complicated networks require more than three equations, and it is usually desirable to employ the standard method of determinants[33] to solve the set of simultaneous equations[34]. This technique, illustrated in the following section, has the considerable advantage that[35] it is possible to solve directly for only those currents that are of interest[36]. Often, only one or two of the currents in a network are of direct concern[37], and in this case a complete solution for all the unknowns[38] is superfluous.

✦✦✦✦✦ Notes ✦✦✦✦✦

[1] 这个“to”是“reduce”要求的。“reduce A to B”意为“把 A 简化成 B”。

[2] “so that”在此引导结果状语从句，译成“因此，所以”。

[3] “Eqs. (1-8) and (1-12)”表示“式(1-8)和式(1-12)。”“Eqs.”是“Equations”复数的缩写形式。又如“Figs. = Figures”，“Chaps. = Chapters”，“Secs. = Sections”等；但是“page”的复数缩写形式是“pp.”，千万要注意。

[4] “in this connection”在此意为“在这一方面；在这种情况下”。

[5] “redrawn as in Fig. 1-11”是一个分词短语作后置定语，意为“被重新画成图 1-11 那样的”。

[6] “branch point”意为“支化点，分支(路)点”。