项目引领 任务驱动

示范性高等职业院校课改规划教材

船电专业英语

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哈尔滨工程大学出版社

船电专业英语

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内容简介

本书由五个部分组成，主要介绍了电工基础知识、电机控制技术、造船工程、电气设备的维修与保养和船电英语的专业词汇等内容。正文共有20个单元，列举了工作过程中常用的英语口语和专业词汇，突出了贴近企业，贴近岗位，具有通俗性和较强的针对性、实用性。

本书是高职高专专业阶段的英语教材，旨在满足船舶电气自动化专业、船舶电子电气技术专业及相关专业学生和行业人员参考和学习专业英语的需要。

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前　言

随着改革开放的不断深入，我国造船工业得到极大的发展，正大踏步地进入国际市场，这使得船电专业人才的需求急剧增加。对于船电专业的学生而言，掌握相关的专业英语知识，提高运用专业英语的能力，是职业生涯中不可或缺的。近几年来船电专业英语的相关教材极少，而且内容大多与专业要求有一定的差距。为此，我们编写了《船电专业英语》，奉献给即将投身于我国造船事业的广大船电专业学生。

编者在收集了大量电类专业英语相关资料的基础上，结合以前船电专业英语教材的特点，突出船舶特色，大胆创新，最后形成了此书。本书分为五个部分，涉及电子基础、电子检测元件、传感器、电机原理及控制、造船工业、电气维修口语练习、造船生产常用英语、船舶电气专业英语等内容。本书的主要特点如下：

(1)充分涵盖电气自动化专业的主体内容，知识面较广；

(2)在船电基础知识完整的前提下，吸收了船电行业的新知识、新内容；

(3)融入了船厂和航海实用会话英语和相关专业词汇，充分体现了实用性。

希望读者在阅读本书的同时，能理论联系实际，提高专业英语翻译能力和口语表达能力，从而提高船电专业英语水平。

本书由武汉船舶职业技术学院冯常奇任主编，黄金花教授为主审，唐依明、林秀玲、关业伟为副主编，全书由冯常奇统稿。武汉船舶职业技术学院的周民、宋谦、祝福副教授在百忙中审阅了全书并提出了宝贵的修改意见，在此深表感谢。

由于编者水平和经验有限，书中难免存在不足和疏漏之处，敬请读者批评指正，我们将不胜感激。

编　者

2013 年 12 月

目　　录

PART Ⅰ Basic Knowledge of Electrics

电工基础

Lesson 1 Electric Circuit

电 路

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 interconnected energy dissipation or conversion device, known as the load.

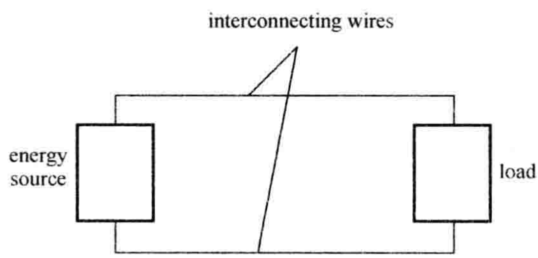

Fig. 1. 1 The electric circuit in its simplest form

A practical energy source may take one of many forms, for example, depending on electrochemical, electromagnetic, thermoelectric and photoelectric etc. In principle, 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 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.

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.

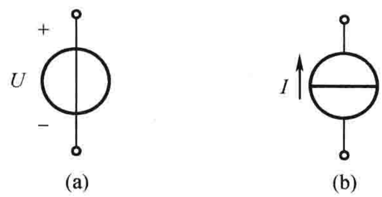

Fig. 1.2 Symbols used for active devices

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

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

$$W = q \cdot u \tag{1.1}$$

Hence

$$\frac{\mathrm{d}W}{\mathrm{d}t} = u\frac{\mathrm{d}q}{\mathrm{d}t} = ui \tag{1.2}$$

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

$$P(t) = u(t) \cdot i(t) \tag{1.3}$$

and is measured in Watts when u and i are in Volts and Amperes, respectively. If power $P(t)$ is expended for time T, the total energy expended (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.

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

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. The corresponding diagrammatic representation is Fig. 1.3(a), which also shows the positive directions of p. d. and current.

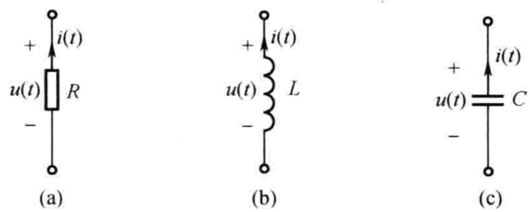

Fig. 1.3 Symbols of passive devices

(a) Resistance; (b) Inductance; (c) Capacitance

(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

$$u(t) = L \cdot \frac{\mathrm{d}i(t)}{\mathrm{d}t} \tag{1.6}$$

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

(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

$$q(t) = Cu(t) \tag{1.7}$$

where C is the capacitance, the units of which are Farads when u and q are in Volts and Coulombs, respectively, with t in seconds, hence, a capacitance of 1 F stores a charge of 1 C for a terminal p. d. of 1 V. Combining $i(t) = \mathrm{d}q/\mathrm{d}t$ and Eq. 1.7 gives

$$i(t) = C\mathrm{d}u(t)/\mathrm{d}t \tag{1.8}$$

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

New Words and Expressions

Ampere	*n.* 安培（电流单位）
capacitance	*n.* 电容，电容量
electrochemical	*adj.* 电化学的
electromagnetic	*adj.* 电磁的
Henry	*n.* 亨利(电感单位)
inductance	*n.* 电感，自感应
Ohm's Law	欧姆定律
photoelectric	*adj.* 光电的
thermoelectric	*adj.* 热电的
Volt	*n.* 伏特(电压单位)
Farad	*n.* 法拉(电容单位)
Coulomb	*n.* 库仑(电量单位)
electrostatic field	静电场

potential difference(亦作 p. d.)	电势差
active device	有源器件
passive element	无源元件

Notes to the Text

1. A practical energy source may take one of many forms, for example, depending on electrochemical, electromagnetic, thermoelectric and photoelectric etc. In principle, 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.

实际的电源有许多形式,如电化学的、电磁学的、热电的、光电的等。原则上,为了分析方便,大约只有两种公认的电源:即电压源和电流源。

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

电压源提供给负载与电流无关的恒定端电压。注意到电压源的电压可能是时间、温度和压力等的函数,而与负载的变化无关,认识到这一点是很重要的。

Lesson 2 Thevenin's & Norton's Theorem

戴维宁定理和诺顿定理

Thevenin's Theorem states that a two-terminal network can be replaced by an equivalent circuit of an EMF in series with a resistance. The value of the EMF is equal to the open-circuit voltage of the original circuit. The series resistance is the resistance value measured back into the original circuit with all sources replaced by their internal resistances.

The two-terminal network of Fig. 2. 1(a) has a particular voltage measured across their terminals when the load is disconnected. When the load resistance, R_L, is connected to the terminals, the load voltage is different from the no load voltage. We also find that the load voltage changes for different values of load. We can compute values for this circuit easily if we form an equivalent circuit for this two-terminal network. The equivalent circuit is not necessarily the actual internal circuit of the two-terminal network. We do not need to know the actual contents of the two-terminal network.

A load resistance placed across the terminals of the equivalent circuit must yield the same current and voltage values obtained when this load resistance is placed across the terminals of the original circuit.

Let us assume that the actual internal circuit of the two-terminal network of Fig. 2. 1(a) is the circuit shown in Fig. 2. 1(b).

Thevenin's Theorem states that this active network, containing an EMF, may be replaced by an equivalent circuit Fig. 2. 1(c) comprised of an EMF, E in series with a resistance R. The EMF, E, of this equivalent circuit is the open-circuit voltage of the original circuit measured when the load, R_L, is disconnected. The resistance, R, is the resistance of the original circuit looking back into the circuit with the source of EMF set to zero. If this EMF has an internal resistance, the internal resistance must be included in this calculation of R.

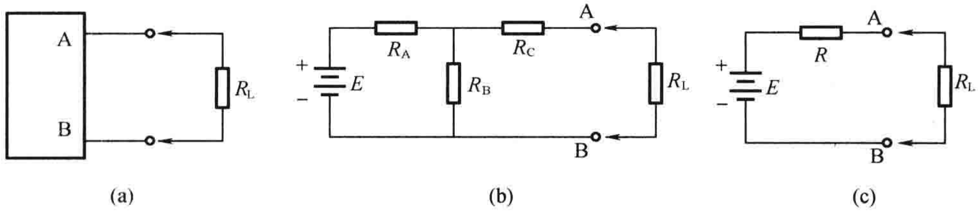

Fig. 2.1 Thevenin's Theorem

(a) Two-terminal network with a load;

(b) Actual internal circuit of the two-terminal network;

(c) Equivalent circuit

Norton's Theorem states that a two-terminal network can be replaced by an equivalent circuit of constant-current source in parallel with a resistance. The value of the constant-current source is the short circuit current developed when the terminals of the original network are shorted. The parallel resistance is the resistance value measured back into the original network. The usual constant-current source considered in network theory has the form shown in Fig. 2.2 the constant-current source delivers an output current, in this case, of 2 A at all times. Its internal resistance of 10 Ω is in parallel with the constant-current source.

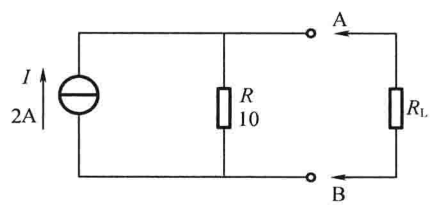

Fig. 2.2 Constant-current source

If there is no physical loading across the terminals A and B, then the current flows through this parallel resistance. By Ohm's Law, the open-circuit voltage (the no load terminal voltage) is 2×10, or 20 V. When an external load is placed across the terminals A and B, the constant current divides between the two parallel resistances. For example, if the load R_L is 10 Ω, the 2 A source current divides equally, giving a load current of 1 A. The circuit voltage is now 10 V. If R_L is zero, that is, if a short-circuit is placed across A and B, the full current of 2 A is the current in the short-circuit. Now the load voltage is zero.

This discussion suggests that this model of a constant-current source has a correspondence to the equivalent circuit by Thevenin's Theorem. Fig. 2. 3(a) shows a constant-current source, I in parallel with an internal resistance, R. The no load voltage across the terminals is E, given by IR. When the terminals are shorted, the short-circuit current is I. Examine the equivalent circuit by Thevenin's Theorem using these values of E and R in Fig. 2. 3(b). The no load open-circuit voltage is E, and the short circuit current is E/R, which is the same value as the constant-current source.

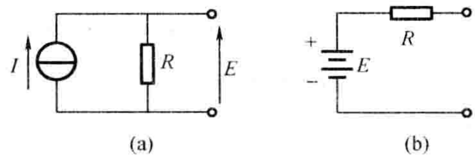

Fig. 2. 3 Equivalent of network theorem

(a) Norton's Theorem; (b) Thevenin's Theorem

New Words and Expressions

two-terminal network	二端网络
equivalent circuit	等效电路
EMF	abbr. 电动势(electromotive force)
load voltage	负载电压；工作电压
output current	输出电流
in parallel with	与……并联
in series with	与……串联
short-circuit	*vt.* 使短路，缩短
internal resistance	内阻

Notes to the Text

1. Thevenin's Theorem states that a two-terminal network can be replaced by an equivalent circuit of an EMF in series with a resistance. The value of the EMF is equal to the open-circuit voltage of the original circuit. The series resistance is the resistance value measured back into the original circuit with all sources replaced by their internal resistances.

戴维宁定理指出:一个二端网络可由一个电动势和与之串联的电阻电路来替代。电动势的值等于原电路的开路电压。串联电阻的值等于原电路除去所有电源后从端子看进去的等效电阻值。

2. Norton's Theorem states that a two-terminal network can be replaced by an equivalent circuit of constant-current source in parallel with a resistance. The value of the constant-current source is the short circuit current developed when the terminals of the original network are shorted. The parallel resistance is the resistance value measured back into the original network.

诺顿定理指出:一个二端网络可由一个恒流源和与之并联的电阻电路来替代。恒流源的值等于原二端网络的短路电流。并联电阻的值可从原网络中测量得到。

Lesson 3 Three-phase Electric Power

三相交流电

Three-phase electric power is a common method of alternating-current electric power generation, transmission, and distribution. It is a type of polyphase system and is the most common method used by grids worldwide to transfer power. It is also used to power large motors and other heavy loads. A three-phase system is generally more economical than others because it uses less conductor material to transmit electric power than equivalent single-phase or two-phase systems at the same voltage.

In a three-phase system, three circuit conductors carry three alternating currents (of the same frequency) which reach their instantaneous peak values at different times. Taking one conductor as the reference, the other two currents are delayed in time by one-third and two-thirds of one cycle of the electric current. This delay between phases has the effect of giving constant power transfer over each cycle of the current and also makes it possible to produce a rotating magnetic field in an electric motor.

Three-phase system may have a neutral wire. A neutral wire allows the three-phase system to use a higher voltage while still supporting lower-voltage single-phase appliances. In high-voltage distribution situations, it is common not to have a neutral wire as the loads can simply be connected between phases (phase-phase connection).

Single-phase loads may be connected to a three-phase system in two ways. Either a load may be connected across two of the live conductors, or a load can be connected from a live phase conductor to the neutral conductor. Single-phase loads should be distributed evenly between the phases of the three-phase system for efficient use of the supply transformer and supply conductors.

The most important class of three-phase load is the electric motor. A three-phase induction motor has a simple design, inherently high starting torque and high efficiency. Such motors are applied in industry for pumps, fans, blowers, compressors, conveyor drives, electric vehicles and many other kinds of motor-driven equipment.

New Words and Expressions

three phase	三相
alternating-current	*n.* 交流电流
polyphase system	多相系统;多相制
three-phase system	三相系;三相制
instantaneous peak value	瞬时峰值;幅值
rotating magnetic field	旋转磁场
electric motor	电动马达,电动机
neutral wire	中线
single-phase	*adj.* 单相的
three-phase induction	三相感应
inherently	*adv.* 固有地
starting torque	启动力矩,启动转矩,启动扭矩
blower	*n.* 风箱,电话
compressor	*n.* 压气机; 压缩机
conveyor	*n.* 输送机
electric vehicle	电动车辆
motor-driven	电动的;电动机拖动的;电机驱动的

Notes to the Text

1. Three-phase electric power is a common method of alternating-current electric power generation, transmission, and distribution.

三相电是交流电发电、传输和分配的一种普通方法。

2. In a three-phase system, three circuit conductors carry three alternating currents (of the same frequency) which reach their instantaneous peak values at different times.

在三相系统中,三个导体产生相同频率的交流电,它们将在不同的时刻达到峰值。