面向21世纪高等学校精品规划教材

· 电子信息类

DIANZIXINXI

ZHUANYEYINGYU

电子信息专业英语

主　编　王　菲　施亚齐

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内容简介

本书由电路基础篇、仪表使用篇、传感器篇、通信系统篇和新技术篇组成。电路基础篇内容包括电阻电容电感、二极管及其电路、三极管及其电路、逻辑门、集成电路和运算放大器；仪表使用篇内容包括万用表、示波器、信号发生器和直流电源；传感器篇内容包括电路元件和参数、电压/频率转换器、光学传感器、传感器认证插入测量和感温火灾探测器；通信系统篇内容包括时分复用、频分复用、脉冲编码调制、光纤通信和移动通信；新技术篇内容包括太阳能、电子纸、蓝牙技术和3G。

本书可作为高等院校电子信息专业的专业英语教材，也可供从事相关专业的工程技术人员参考使用。

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前　言

近年来，随着科学技术的迅猛发展，高等教育的教学思想和教学模式也在不断地发展，这就要求高等院校教材进行相应的调整，重新定位，以适应新的社会发展需求，培养新一代实用综合型人才。

电子信息是当今国内外发展最迅速、技术更新最快的工程领域之一，电子信息专业英语对学习电子信息新知识和新技术起着非常重要的作用。

本书是一本突出高等教育实用特点的电子信息专业英语教材，内容涉及电工电子基础、仪器仪表使用、传感器技术、通信技术等方面，基本覆盖了现代电子信息的各个领域，同时收录了一些电子信息新技术领域发展前沿方面的文章（如太阳能、电子纸、蓝牙技术和3G等）。课文内容丰富，题材广泛，通俗易懂，选择的文章实用性强并尽量保证学生能利用已有专业知识理解课文内容。每课课后有词汇、注释、练习及阅读等。在本书书后附有课文参考译文及部分练习参考答案，供读者参考对照。另外，书后还附有电子专业词汇和科技英语阅读与翻译技巧相关知识，供相关专业读者参考。

本书由王菲、施亚齐担任主编，并编写了第四、第五篇，董小琼编写了第一篇，王俊清编写了第二篇，邹淑云编写了第三篇。

由于编者水平有限，时间仓促，书中难免有纰漏和不足之处，请尊敬的教师、同学和广大学者批评指正。

目 录

Chapter 1　Fundamentals of Electronics

Text 1　Resistance, Capacitance and Inductance

Although resistors, capacitors and inductors form important elements in electronic circuitry, it is essential to know something about resistance, capacitance and inductance.

Resistance　A resistor is a two-terminal element. Between its terminals it exhibits a voltage drop which is directly proportional to the current passing through it. We specify the size of the resistor in ohms(Ω), which is the ratio of voltage to current. This relationship between voltage and current, called Ohm's Law, can be stated in an equation $V = IR$. Resistors may be classified as fixed or variable in their type and also as linear and nonlinear.

Resistance is the opposition to the flow of current and is represented by the letter symbol R. The unit of resistance is the ohm, expressed by using(Ω). One ohm is defined as that amount of resistance that will limit the current in a conductor to one ampere when the voltage applied to the conductor is one volt. Larger amount of resistance are commonly expressed in kilo-ohm(kΩ) and in mega-ohm(MΩ).

Capacitance　Electrical energy can be stored in an electric field. The device to be capable of doing this is called a capacitor or a condenser.

A simple condenser consists of two metallic plates separated by a dielectric. If a condenser is connected to a battery, the electrons will flow out of the negative terminal of the battery and accumulate on the condenser plate connected to that side. At the same time, the electrons will leave the plate connected to the positive terminal and flow into the battery to make the potential difference just the same as that of the battery[as shown in Fig. 1 - 1(a)]. Thus the condenser is said to be charged.

The capacitance is directly proportional to the dielectric constant of the material and to the area of the plates and inversely to the distance of the plates. It is measured in farads(F). When a change of one volt per second across it causes the current of one ampere to flow, the condenser is

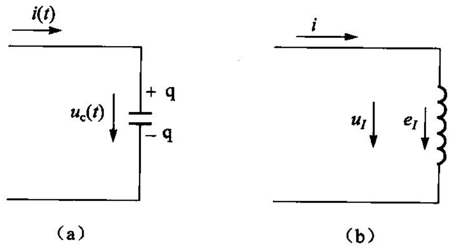


Fig. 1 – 1 Capacitance and Inductance

said to have the capacitance of one farad. However, farad is too large a unit to be used in radio calculation, so microfarad(one millionth of a farad) and the picofarad are generally used.

The amount of the stored energy of a charged condenser is proportional to the applied voltage and its capacitance. The capacitance of a condenser is determined by three important factors, namely, the area of the plate surface, the space between them and dielectric material.

One of the condensers to be used in radio receiver is a variable condenser, whose capacitance can be varied by turning the plates. It is used in the receiver for tuning and varying capacitance in the circuit so as to pick up the desired signals of different wavelengths.

Inductance It is well known that inductors are one of the main building blocks in electronic circuits. An inductor is simply a coil of wire with or without a magnetic core[as shown in Fig. 1 – 1 (b)].

All coils have inductance. Inductance is the property of opposing any change of current flowing through a coil. If a coil offers a large opposition to the current flowing through it at a certain frequency, it is said to have larger inductance.

When an e. m. f is applied to a coil, there is an induced e. m. f in it. The polarity of the induced e. m. f is always such as to oppose any change in the current in the circuit. This means that the property of inductance oppose an increase in current just as much as it opposes a decrease in current.

A coil of many turns will have more inductance than one of few turns. Also if a coil is placed on an iron core, its inductance will be greater than it was without the magnetic core. The unit of inductance is henry. A coil has an inductance of one henry if an induced e. m. f of one volt is induced in the coil when the current through it changes at the rate of one ampere per second. Values of inductance used in radio equipment vary over a wide range.

Technical Words and Expressions

resistor	*n.*	电阻器
capacitor	*n.*	电容器
inductor	*n.*	感应器
resistance	*n.*	电阻,阻抗
capacitance	*n.*	容量,电容
inductance	*n.*	电感,感应
terminal	*n.*	终端,接线端
voltage	*n.*	电压,伏特数
linear	*adj.*	线性的,线的
ohm	*n.*	欧姆
condenser	*n.*	电容器,冷凝器
dielectric	*n.*	电介质,绝缘体
variable	*adj.*	可变的
wavelength	*n.*	波长
accumulate	*v.*	聚集
charge	*v.*	充电
discharge	*v.*	放电
neutrality	*n.*	中性
frequency	*n.*	频率,周率
reactance	*n.*	电抗
proportional	*adj.*	成比例的
plate	*n.*	板
equation	*n.*	等式,相等
specify	*vt.*	指定,详细说明
farad	*n.*	法拉
mold	*n.*	模子,铸型
coil	*v.*	盘绕,圈
henry	*n.*	亨利(henries 复数)
be directly proportional to		与……成正比

be termed	把……称为,把……叫做
in the form of	用……的形式
voltage drop	电压降
Ohm's Law	欧姆定律
electromotive force(e. m. f)	电动势
building block	构件(标准组件)

Notes

1. Between its terminals it exhibits a voltage drop which is directly proportional to the current passing through it.
   在它的两端间所呈现的电压降和通过它的电流成正比。该句为复合句,关系代词 which 引导定语从句,passing through it 是现在分词短语作定语,修饰 the current,意为:流过它的电流。
2. At the same time, the electrons will leave the plate connected to the positive terminal and flow into the battery to make the potential difference just the same as that of the battery.
   同时,电子从与电池正极相连的金属平板流进电池,由此产生电位差,其值等于电池的电压值。
   at the same time 同时,相当于 meanwhile。
   不定式短语 to make... that of the battery 是结果状语,其中 that 指 the difference。
3. The capacitance is directly proportional to the dielectric constant of the material and to the area of the plates and inversely to the distance of the plates.
   电容器的电容量与介质的介电常数及平板的面积成正比,与平板间的距离成反比。
   be directly proportional to 与……成正比
   be inversely proportional to 与……成反比
4. When an e. m. f is applied to a coil, there is an induced e. m. f in it.
   当电动势加在线圈上时,线圈中就会产生感应电动势。
5. Values of inductance used in radio equipment vary over a wide range.
   用于无线电设备的电感值在很大范围内变化。
   used in radio equipment 是过去分词短语,作后置定语,修饰 values of inductance。

Exercises

I. Fill in the missing words according to the text.

1. Capacitor's basic function is to store ________ energy. A ________ is a device designed to have capacitance.
2. The capacitance of a ________ is determined by three important factors, namely, the area of the ________ surface, the space between them and dielectric material.
3. A small inductance would provide less ________ at the same frequency, and resistance offers an opposition to all current flow.
4. Also if a coil is placed on an ________ its inductance will be greater than it was without the ________ core.

II. Translate the following sentences into English.

1. 简单的电容器是由两块被介质隔开的金属平板构成的。
2. 充电电容器所储存的能量正比于外加电压和它的容量。
3. 电感的单位是亨利。

Reading

Resistor

A resistor is a two-terminal electronic component designed to oppose an electric current by producing a voltage drop between its terminals in proportion to the current, that is, in accordance with Ohm's Law: $V = IR$. The resistance R is equal to the voltage drop V across the resistor divided by the current I through the resistor.

Resistors are used as part of electrical networks and electronic circuits. Fig. 1 – 2 shows resistor symbols.

Units

The ohm (symbol: Ω) is the SI unit of electrical resistance, named after Georg Ohm. The most commonly used multiples and submultiples in electrical and electronic usage are the milliohm, ohm, kilohm, and megohm.

On circuit diagrams the value may be written in "SI Notation" with the multiplier replacing the decimal point, so "2k5" means 2.5 kilo ohms.

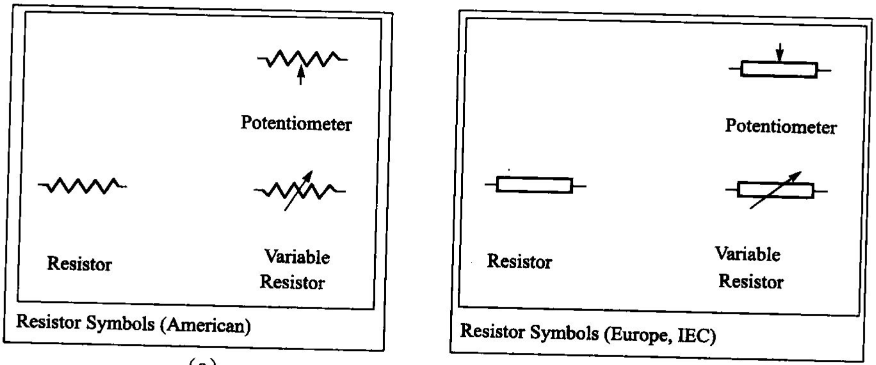


Fig. 1 - 2 Resistor Symbols

Power Dissipation

The power dissipated by a resistor is the voltage across the resistor multiplied by the current through the resistor:

$$P = I^2 R = IV = \frac{V^2}{R}$$

All three equations are equivalent. The first is derived from Joule's Law, and the other two are derived from that by Ohm's Law.

The total amount of heat energy released is the integral of the power over time:

$$W = \int_{t_1}^{t_2} v(t)i(t)\,\mathrm{d}t$$

If the average power dissipated is more than the resistor can safely dissipate, the resistor may depart from its nominal resistance, and may be damaged by overheating. Excessive power dissipation may raise the temperature of the resistor to a point where it burns out, which could cause a fire in adjacent components and materials.

Series and Parallel Resistors

Resistors in a parallel configuration each have the same potential difference (voltage) (Fig. 1 - 3). To find their total equivalent resistance (R_{eq}):

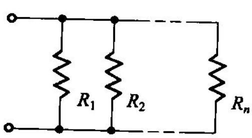


Fig. 1 - 3 In Parallel

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$$

The parallel property can be represented in equations by two vertical lines "∥" (as in geometry) to simplify equations. For two resistors,

$$R_{eq} = R_1 \parallel R_2 = \frac{R_1 R_2}{R_1 + R_2}$$

The current through resistors in series stays the same (Fig. 1-4), but the voltage across each resistor can be different. The sum of the potential differences (voltage) is equal to the total voltage. To find their total resistance:

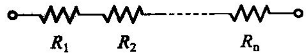


Fig. 1-4 In Series

$$R_{eq} = R_1 + R_2 + \cdots + R_n$$

A resistor network that is a combination of parallel and series can sometimes be broken up into smaller parts that are either one or the other (Fig. 1-5). For instance,

$$R_{eq} = (R_1 \parallel R_2) + R_3 = \frac{R_1 R_2}{R_1 + R_2} + R_3$$

Four-Band Resistors (Fig. 1-6)

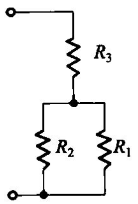


Fig. 1-5 Combination of Parallel and Series

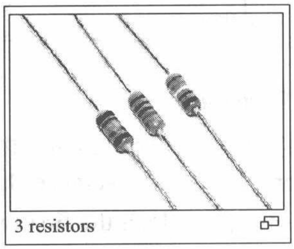


Fig. 1-6 Four-Band Resistors

Four-band identification is the most commonly used color-coding scheme on all resistors. It consists of four colored bands that are painted around the body of the resistor. The first two bands encode the first two significant digits of the resistance value, the third is a power-of-ten multiplier or number-of-zeroes, and the fourth is the tolerance accuracy, or acceptable error, of the value. Sometimes a fifth band identifies the thermal coefficient, but this must be distinguished from the true 5-color system, with 3 significant digits.

For example, green-blue-yellow-red is $56 \times 10^4\ \Omega \pm 2\% = 560\ \text{k}\Omega \pm 2\%$. An easier description can be as follows: The first band, green, has a value of 5 and the second band, blue, has a value of 6, and is counted as 56. The third band, yellow, has a value of 10^4, which adds four 0's to the end, creating 560 000 Ω at ±2% tolerance accuracy. 560 000 Ω changes to 560 kΩ ±2% (as a kilo is 10^3).

Each color corresponds to a certain digit, progressing from darker to lighter colors, as shown in the chart below.

Color	1st band	2nd band	3rd band (multiplier)	4th band (tolerance)	Temp. Coefficient
Black	0	0	$\times 10^0$		
Brown	1	1	$\times 10^1$	±1% (F)	100 ppm
Red	2	2	$\times 10^2$	±2% (G)	50 ppm
Orange	3	3	$\times 10^3$		15 ppm
Yellow	4	4	$\times 10^4$		25 ppm
Green	5	5	$\times 10^5$	±0.5% (D)	
Blue	6	6	$\times 10^6$	±0.25% (C)	
Violet	7	7	$\times 10^7$	±0.1% (B)	
Gray	8	8	$\times 10^8$	±0.05% (A)	
White	9	9	$\times 10^9$		
Gold			$\times 10^{-1}$	±5% (J)	
Silver			$\times 10^{-2}$	±10% (K)	
None				±20% (M)	

SMT Resistors

Surface mounted resistors are printed with numerical values in a code related to that used on axial resistors. Standard tolerance Surface Mount Technology (SMT) resistors are marked with a three-digit code, in which the first two digits are the first two significant digits of the value and the third digit is the power of ten (the number of zeroes). For example:

"334" = 33 × 10,000 ohms = 330 kilohms
"222" = 22 × 100 ohms = 2.2 kilohms
"473" = 47 × 1,000 ohms = 47 kilohms
"105" = 10 × 1,000,000 ohms = 1 megohm

Resistances less than 100 ohms are written: 100, 220, 470. The final zero represents ten to the power zero, which is 1. For example:

"100" = 10 × 1 ohm = 10 ohms
"220" = 22 × 1 ohm = 22 ohms

Sometimes these values are marked as "10" or "22" to prevent a mistake.

Resistances less than 10 ohms have "R" to indicate the position of the decimal point (radix point). For example:

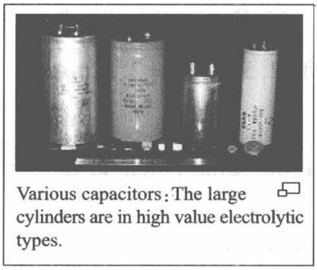
"4R7" = 4.7 ohms
"0R22" = 0.22 ohms
"0R01" = 0.01 ohms

Precision resistors are marked with a four-digit code, in which the first three digits are the significant figures and the fourth is the power of ten. For example:

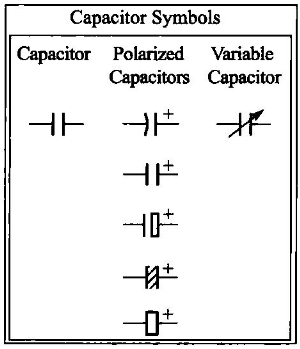
"1001" $= 100 \times 10$ ohms $= 1$ kilohm
"4992" $= 499 \times 100$ ohms $= 49.9$ kilohms
"1000" $= 100 \times 1$ ohms $= 100$ ohms

Capacitor

A capacitor is a passive electrical component that can store energy in the electric field between a pair of conductors (called "plates"). A capacitor's ability to store charge is measured by its capacitance, in units of farads. Fig. 1 – 7 shows various capacitor examples and circuit symbol.



(a)



(b)

Fig. 1 – 7 Various Capacitor Examples and Circuit Symbol

(a) Various Capacitor Examples; (b) Circuit Symbol

Capacitors are often used in electric and electronic circuits as energy storage devices. They can also be used to differentiate between high-frequency and low-frequency signals. This property makes them useful in electronic filters.

Capacitance

A capacitor's ability to store charge is measured by its capacitance C, the ratio of the amount of charge stored on each plate to the voltage:

$$q = Cv$$

For an ideal parallel plate capacitor with a plate area A and a plate d separation:

$$C = \frac{\varepsilon A}{d}$$