全国高等职业教育规划教材

自动化专业英语

徐存善 主编

机械工业出版社
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全国高等职业教育规划教材

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本书由 3 部分组成，即电力电子技术基础篇、楼宇智能化技术篇、电气自动控制技术篇。基本涵盖了电力电子技术基础、仪器仪表使用与维护、电能输送、电力系统监控、继电器工作原理、可编程逻辑控制器、传感器技术、自动化控制技术等内容。课文内容丰富、题材广泛、语言通俗地道，能满足不同层次的学习对象对专业英语的学习需求。本书共 24 个单元，每个单元包括课文、生词、专业术语、长难句解析、翻译技巧和阅读材料。在本书的最后 5 个单元的实用英语中，分别用相当篇幅介绍了怎样阅读英语招聘广告、怎样用英文写个人简历、如何写英文求职信等应用文体，以及面试过程中的常用句型和技巧，目的是为了使毕业生在外资或合资企业的就业竞争中能胜人一筹。

本书适合高职高专（含成人教育学院）电气自动化、生产过程自动化、电力系统自动化和电气控制技术类专业的学生使用，也可供相关专业的工程技术人员参考学习。

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出 版 说 明

根据《教育部关于以就业为导向深化高等职业教育改革的若干意见》中提出的高等职业院校必须把培养学生动手能力、实践能力和可持续发展能力放在突出的地位，促进学生技能的培养，以及教材内容要紧密结合生产实际，并注意及时跟踪先进技术的发展等指导精神，机械工业出版社组织全国近60所高等职业院校的骨干教师对在2001年出版的“面向21世纪高职高专系列教材”进行了全面的修订和增补，并更名为“全国高等职业教育规划教材”。

本系列教材是由高职高专计算机专业、电子类专业和机电类专业教材编委会分别会同各高职高专院校的一线骨干教师，针对相关专业的课程设置，融合教学中的实践经验，同时吸收高等职业教育改革的成果而编写完成的，具有“定位准确、注重能力、内容创新、结构合理和叙述通俗”的编写特色。在几年的教学实践中，本系列教材获得了较高的评价，并有多个品种被评为普通高等教育“十一五”国家级规划教材。在修订和增补过程中，除了保持原有特色外，针对课程的不同性质采取了不同的优化措施。其中，核心基础课的教材在保持扎实的理论基础的同时，增加实训和习题；实践性较强的课程强调理论与实训紧密结合；涉及实用技术的课程则在教材中引入了最新的知识、技术、工艺和方法。同时，根据实际教学的需要对部分课程进行了整合。

归纳起来，本系列教材具有以下特点：

1）围绕培养学生的职业技能这条主线来设计教材的结构、内容和形式。

2）合理安排基础知识和实践知识的比例。基础知识以“必需、够用”为度，强调专业技术应用能力的训练，适当增加实训环节。

3）符合高职学生的学习特点和认知规律。对基本理论和方法的论述要容易理解、清晰简洁，多用图表来表达信息；增加相关技术在生产中的应用实例，引导学生主动学习。

4）教材内容紧随技术和经济的发展而更新，及时将新知识、新技术、新工艺和新案例等引入教材。同时注重吸收最新的教学理念，并积极支持新专业的教材建设。

5）注重立体化教材建设。通过主教材、电子教案、配套素材光盘、实训指导和习题及解答等教学资源的有机结合，提高教学服务水平，为高素质技能型人才的培养创造良好的条件。

由于我国高等职业教育改革和发展的速度很快，加之我们的水平和经验有限，因此在教材的编写和出版过程中难免出现问题和错误。我们恳请使用这套教材的师生及时向我们反馈质量信息，以利于我们今后不断提高教材的出版质量，为广大师生提供更多、更适用的教材。

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前　言

随着科技的进步和社会的发展，我国对专业人才英语能力的要求越来越高，自动化专业是当今世界发展最迅速、技术更新最活跃的领域之一。我国在该领域注重引进世界先进技术和设备，同时要发展和创造外向型经济，因此导致该领域对具有专业英语能力人才的需求比以往任何时候都更加迫切。为了更好地培养学生的专业外语能力，促进具有国际竞争力的人才培养，我们在追求通俗易懂、简明扼要、便于教学和自学的指导思想下编写了这本书。

全书由 3 部分组成，即电力电子技术基础篇、楼宇智能化技术篇、电气自动控制技术篇。本书内容基本涵盖了电力电子技术基础、仪器仪表使用与维护、电能输送、电力系统监控、继电器工作原理、楼宇智能化、办公自动化、可编程逻辑控制器、传感器技术、自动化控制技术等。本书内容丰富、题材广泛，语言通俗地道，能满足不同层次对象对专业英语的学习需求。

本书共 24 个单元，每个单元包括课文、生词、专业术语、长难句解析、翻译技巧和阅读材料。在本书的最后 5 个单元的实用英语中，用相当篇幅分别介绍了怎样阅读英语招聘广告、怎样用英文写个人简历、如何写英文求职信等应用文体，以及英语面试过程中的常用技巧，目的是为了使毕业生在外资或合资企业的就业竞争中能胜人一筹。附录部分汇编了职业现场的交际对话、各单元的参考译文与部分习题答案（为了培养学生的独立阅读能力，部分阅读材料的参考译文将只在电子教案中给出）以及生词表等内容。

本书可作为高职高专电气自动化、生产过程自动化、电力系统自动化、楼宇智能化以及电子电气控制技术类专业的英语教材。每单元参考学时为 2～3 学时。建议教师根据学生的接受能力和本校学时情况选用本书 15～20 个单元的内容，同时配合生动活泼、灵活多样的互动式教学与课后练习讨论，多方位培养学生的专业英语兴趣与应用能力。对教师在授课中没有选入的单元，学生可根据自己的学习兴趣自学，以拓宽专业英语的知识面。

本书由河南工业职业技术学院徐存善副教授任主编，编写分工为：徐存善编写第 1～4 单元和附录 C，魏万平编写第 5 单元和附录 A，张超英编写第 6～8 单元，许丰田编写第 9～11 单元，吴会敏编写第 12～14 单元，申一歌编写第 15～16 单元，肖凡编写第 17 单元，高杨编写第 18 单元，尚姝钰编写第 19～21 单元，黄靓编写第 22～24 单元，附录 B 中各单元参考译文和习题答案分别由相应作者提供。

本书的编审工作得到了编者所在院校领导的高度重视与大力支持。齐智英教授、胡英占主任为本书的编写提出了宝贵意见，在此表示衷心的感谢。

由于时间仓促，加上编者水平有限，书中难免有不足之处，恳请广大读者批评指正。

编　者

目　　录

出版说明
前言

Chapter Ⅰ　The Base of Power Electronics

Unit 1　Linear Circuit Analysis ······ 1
Translating Skills: 科技英语翻译的标准与方法 ······ 5
Reading: Thevenin's Theorem ······ 6
Unit 2　Resistor, Capacitor and Inductor ······ 9
Translating Skills: 词义的确定 ······ 12
Reading: How to Use a Tester ······ 13
Unit 3　Integrated Circuit ······ 16
Translating Skills: 引申译法 ······ 18
Reading: Digital Circuit ······ 19
Unit 4　Operational Amplifier ······ 22
Translating Skills: 词性转换 ······ 25
Reading: Oscillator ······ 26
Unit 5　Multimeters and Oscilloscopes ······ 28
Translating Skills: 增词译法 ······ 32
Reading: How Does an Oscilloscope Work ······ 33
Unit 6　Generators and Motors ······ 36
Translating Skills: 减词译法 ······ 39
Reading: Typical System Layout ······ 40
Unit 7　Power System ······ 42
Translating Skills: 数量增减的翻译 ······ 45
Reading: Transformers ······ 46
Unit 8　Basic Relay Types ······ 49
Translating Skills: 科技英语词汇的结构特征（I） ······ 53
Reading: Fault-Clearing Protective Relays ······ 55
Unit 9　Electric Power System Monitoring ······ 57
Translating Skills: 科技英语词汇的结构特征（II） ······ 60
Reading: Distribution Automation Increases Reliability ······ 61
Unit10　Fundamental of Single-Chip Microcomputers ······ 65
Translating Skills: 被动语态的译法 ······ 69
Reading: Chip and Chip Holders ······ 70

Chapter II　Intelligent Building Technology

Unit 11　Intelligent Building ········· 72
Translating Skills: 非谓语动词 V-ing 的用法 ········· 75
Reading: Intelligent Hotel ········· 76
Unit 12　Structured Cabling System ········· 79
Translating Skills: 非谓语动词 V-ed, to V 的用法 ········· 82
Reading: Solutions of Home Structured Cabling System ········· 83
Unit 13　Office Automation System ········· 85
Translating Skills: 虚拟语气 ········· 87
Reading: The Development of Office Automation ········· 89
Unit 14　Security System ········· 92
Translating Skills: 科技英语中一些常用的结构与表达 ········· 94
Reading: Building Security ········· 95

Chapter III　Automatic Control Technology

Unit 15　Introduction to Control Engineering ········· 99
Translating Skills: And 引导的句型的译法 ········· 102
Reading: Closed-Loop Control System ········· 103
Unit 16　Programmable Logic Controller（PLC） ········· 105
Translating Skills: 介词的译法 ········· 107
Reading: PLC Programming ········· 109
Unit 17　Electronic Measuring Instruments ········· 112
Translating Skills: 定语从句的翻译 ········· 115
Reading: Flip-flop ········· 116
Unit 18　Introductions to Sensors ········· 118
Translating Skills: 反译法 ········· 123
Reading: Digital Control Systems ········· 124
Unit 19　Process Control Fundamentals ········· 127
Translating Skills: 长难句的翻译 ········· 131
Reading: A Temperature Control System for Lubricating Oil ········· 132
Unit 20　Automation ········· 135
Practical English: 怎样阅读英文招聘广告 ········· 139
Reading: VFD system ········· 140
Unit 21　Adaptive Control Systems ········· 143
Practical English: 怎样用英文写个人简历 ········· 146
Reading: Control System Components ········· 148
Unit 22　Automatic Control System ········· 150
Practical English: 如何写英文求职信 ········· 154

Reading: Automating the Analysis of Faults and Power Quality …… 155
Unit 23 The Three-Phase Induction Motors …… 158
Practical English: 英文求职信样例 …… 162
Reading: Dc Motors …… 163
Unit 24 Electronic Design Application …… 166
Practical English: 面试技巧 …… 170
Reading: Power Systems CAD …… 173
Appendix …… 176
Appendix A The communication skills training for careers …… 176
Appendix B 参考译文与部分习题答案 …… 187
Appendix C New Words List …… 236
参考文献 …… 256

Chapter Ⅰ The Base of Power Electronics

Unit 1 Linear Circuit Analysis

Text

1. Ohm's Law

Suppose that some material is connected to the terminals of an ideal voltage source $u(t)$ as shown in Fig. 1-1. Suppose that $u(t)$=1V, then the electric potential at the top of the material is 1 V above the potential at the bottom. Since an electron has a negative charge, electrons in the material will tend to flow from bottom to top. Therefore, we say that a current tends to go from top to bottom through the material. Hence, for the given polarity, when $u(t)$ is a positive number, $i(t)$ will be a positive number with the direction indicated in Fig. 1-1. If $u(t)$ =2V, again the potential at the top is greater 2V than at the bottom, so $i(t)$ will again be positive. However, because the potential is now twice as large as before, the current $i(t)$ will be greater (If the material is a "linear" element, the current will be twice as great). If the resulting current $i(t)$ is always directly proportional to the voltage for any function $u(t)$, the material is called a linear resistor.

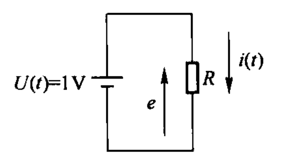

Fig. 1-1 connection to an ideal voltage source

To a linear resistor, we have:

$$R=\frac{u(t)}{i(t)} \qquad \text{and} \qquad i(t)=\frac{u(t)}{R}$$

The unit of resistance (volts per ampere) is referred to as Ohms and is denoted by the capital Greek letter omega Ω. Both equations above are also referred to as Ohm's law.

2. Kirchhoff's Current Law

It is a consequence of the work of the German physicist Gustav Kirchhoff[1] (1824—1887) that enables us to analyze an interconnection of any number of elements (voltage sources, current sources and resistors), as well as other electronic devices. We will refer to any such interconnection as a circuit or a network.

For a given circuit a connection of two or more elements shall be called a node. We now present the first of Kirchhoff's two laws, his current law (KCL), which is essentially the law of conservation of electric charge:

$$\sum i_{\text{in}} = \sum i_{\text{out}}$$

At any node of a circuit, at every instant of time, the sum of the currents into the node is equal to the sum of the currents out of the node.

An alternative, but equivalent, form of KCL can be obtained by considering currents directed into a node to be positive in sense and currents directed out of a node to be negative in sense. Under this circumstance, the alternative form of KCL can be stated as follows:

$$\sum i = 0$$

At any node of a circuit, the currents algebraically sum to zero.

3. Kirchhoff's Voltage Law

We now present the second Kirchhoff's laws—the voltage law. To do this, we must introduce the concept of a "loop". Starting at any node *n* in a circuit, we form a loop by traversing through elements and returning to the starting node *n*, and never encountering any other node more than once. Kirchhoff's voltage law (KVL) is:

$$\sum u_{+} = \sum u_{-}$$

In traversing any loop in any circuit, at every instant of time, the sum of the voltages having one polarity equals the sum of the voltages having the opposite polarity.

An alternative statement of KVL can be obtained by considering voltages across elements that are traversed from plus to minus to be positive in sense and voltages across elements that are traversed from minus to plus to be negative in sense (or vice versa)[2]. Under this circumstance, KVL has the following alternative form.

$$\sum u = 0$$

Around any loop in a circuit, the voltages algebraically sum to zero.

4. Circuit Analysis Techniques

The process by which we determine a variable (either voltage or current) of a circuit is called analysis. Though some simple single-stage amplifier circuits can be quite useful. We have already come across some simple single-stage amplifier circuits whose analysis was accomplished by applying the basic principles converted to data—Ohm's law, KCL and KVL. Nonetheless, we must also be able to analyze more complicated circuits—those in which it is simply not possible to conveniently write and solve a set of linear algebraic equations.

There are several distinct approaches that we can take. In one we write a set of simultaneous equations in which the variables are voltage, this is known as nodal analysis. In another we write a set of simultaneous equations in which the variables are currents, this is known as mesh analysis. Although nodal analysis can be used to all circuits, this is not the case for mesh analysis. A class of circuits known as "nonplanar" networks cannot be handled with mesh analysis. However, a similar approach—loop analysis—can be used. Here the variables are also current.

5. Sinusoidal Circuits

Step and impulse functions are useful in determining the responses of circuits when they are first turned on or when sudden or irregular changes occur in the input. This is called transient analysis. However, to see how a circuit responds to[3] a regular or repetitive input—the steady-state analysis—function that is by far the most useful is the sinusoid.

The sinusoid is an extremely important and ubiquitous function. To begin with the shape of ordinary household voltage is sinusoidal, consumer radio transmissions are either amplitude modulation (AM), in which the amplitude of a sinusoid is changed or modulated according some information signal, or frequency modulation (FM), in which the frequency of a sinusoid is modulated.

We have the following conclusions about the sinusoid.

1) If the input of a linear, time-invariant[4] circuit is a sinusoid, then the response is sinusoid of the same frequency.

2) Finding the magnitude and phase angle of a sinusoidal steady-state response can be accomplished with either real or complex sinusoids.

3) If the output of a sinusoidal circuit reaches its peak before the input, the circuit is a lead network. Conversely, it is a lag network.

4) Using the concepts of phasor and impedance, sinusoidal circuits can be analyzed in the frequency domain in a manner analogous to resistive circuits by using the phasor versions of KCL, KVL, nodal analysis, mesh analysis and loop analysis.

New Words and Phrases

admittance [əd'mitəns] *n.* 进入，入场权，通道，导纳（即电阻的倒数）
algebraical [ˌældʒi'breiikəl] *adj.* 代数学的
consequence ['kɔnsikwəns] *n.* 结果，推理，推论，重要的地位
polarity [pəu'lærəti] *n.* 两极，极性，对立
depict [di'pikt] *vt.* 描画，描述
interconnection [ˌintəkə'nekʃən] *n.* 互相连络，互连
single-stage ['siŋgl'steidʒ] *adj.* 单级，单级的
node [nəud] *n.* 节点，瘤（nodal *adj.* 节的，波节的）
nonplanar ['nɔn'pleinə] *adj.* 非平面的，空间的（曲线的）
impulse ['impʌls] *n.* 冲动，脉冲，刺激，神经冲动，*vt.* 推动
transient ['trænziənt] *adj.* 短暂的，路过的，*n.* 瞬变现象，候鸟
function ['fʌŋkʃən] *n.* 功能，函数，盛大的集会，*vi.* 行使职责，运行
omega ['əumigə] *n.* 希腊字母的最后一个字，终了，最后
conservation [ˌkɔnsə'veiʃən] *n.* 保存，保持，保护守恒
encounter [in'kauntə] *vt.* 遭遇，邂逅，遇到，*n.* 遭遇，偶然碰见
traverse ['trævəs] *n.* 横木，穿过，*vt.* 穿过，详细研究，*vi.* 横越，旋转
impedance [im'pi:dəns] *n.* 阻抗（包括电阻与电抗）
loop [lu:p] *vi.* 打环，翻筋斗，*n.* 环，圈，（闭合）回路
mesh [meʃ] *n.* 网络，网眼，网丝，圈套，*vi.* 相啮合，*vt.* 以网捕捉
ubiquitous [ju:'bikwitəs] *adj.* 普遍存在的，无所不在的

modulate ['mɔdjuleit] *vt.* 调节，调整，（信号）调制，*vi.* 转调
domain [dəu'mein] *n.* 领域，产业，地产，域名
phasor ['feizə(r)] *n.* 相量，相量图
sinusoid ['sainəsɔid] *n.* 正弦曲线，正弦
refer to as 提到……，作为……，把……称为
analogous to 类似于……

Technical Terms

amplitude modulation （AM）调幅
frequency modulation （FM）调频
lag network 滞后网络
lead network 超前网络
transient analysis 暂态分析

Notes

[1] Gustav Kirchhoff，人名，德国物理学家（1824—1887），他给出了电路分析的两个基本定律。

[2] vice versa 表示"反之亦然，反过来也一样"，如：

Ultimately, it is the individual stocks those determine the market, not vice versa. 说到底，是一支支股票决定了股市的走向，而反之亦然。

[3] respond to 表示"对……响应，对……作出反应，响应，回答"，如：

People respond to your warmth and curiosity now, and your world only gets better and better. 人们将会对你的热情和好奇心给予回报，你的世界将会变得越来越好！

[4] time-invariant adj. 不变时的，不随时间改变的，*n.* 时间不变量

time-invariant circuit 时不变电路（稳态电路），linear time-invariant systems 线性非时变系统

We start with time-invariant filters and basic wavelets. 从时不变滤波器和基本小波开始课程。

Exercises

I. Answer the following questions according to the text.

1. What is Kirchhoff's Current Law?
2. What is Kirchhoff's Voltage Law?
3. What is called a circuit analysis?
4. Why the sinusoid is an extremely important function?

II. Translate the following phrases into Chinese.

1. be directly proportional to the voltage　　2. percentage of modulation
3. introduce the concept of a "loop"　　4. the phasor versions of KCL
5. present the second of Kirchhoff's laws　　6. time-invariant circuit
7. sinusoidal steady-state response　　8. ordinary household voltage

Ⅲ. Translate the following sentences into English.

1. 在复杂电路中直接列出并求解线性代数方程组并不容易。
2. 沿着电路的任一闭合电路，每一瞬时的正电压和等于负电压和。
3. 我们必须学会分析比较复杂的电路。
4. 回路电流法却可以适用于任何电路。
5. 每一瞬时流入节点的电流和总是等于流出节点的电流和。

Translating Skills

科技英语翻译的标准与方法

翻译是一种再创造，即译者根据原作者的思想，用另一种语言表达出原作者的意思。这就是要求译者必须确切理解和掌握原作的内容与含意，在确切理解的基础上，很好地运用译文语言把原文的内涵通顺流畅地再现给读者。

1. 翻译的标准

科技英语的翻译标准可概括为“忠实、通顺”四个字。

忠实，首先指忠实于原文内容，译者必须把原作的内容完整而准确的表达出来，不得任意发挥或增删；忠实还指保持原作风格，尽量表现其本来面目。

通顺，即指译文语言必须通俗易懂，符合规范。

忠实与通顺是相辅相成的，缺一不可。忠实而不通顺，读者会看不懂；通顺而不忠实，脱离原作的内容与风格，通顺就失去了意义。例如：

The electric resistance is measured in Ohms.

误译：电的反抗是用欧姆测量的。

正译：电阻的测量单位是欧姆。

All metals do not conduct electricity equally well.

误译：全部金属不导电得相等好。

正译：并非所有的金属都同样好地导电。

The moment the circuit is completed, a current will start flowing the coil.

正译：电路一旦接通，电流开始流向线圈。

Some special alloy steels should be used for such parts because the alloying elements make them tougher, stronger, or harder than carbon steels.

正译：对这类零件可采用某些特殊的合金钢，因为合金元素能提高钢的韧性、强度、硬度。

从以上例句可以清楚的看到，不能任意删改，并不是逐词死译；汉语译文规范化，并非是离开原文随意发挥。此外，还应注意通用术语的译法。比如，例 1 中的“电阻”已成为固定词组，不能用别的译法。

2. 翻译的方法

翻译的方法一般来说有直译（literal translation）和意译（free translation）。直译，即指“既忠实于原文内容，又忠实于原文的形式”的翻译；意译，就是指忠实于原文的内容，但不拘泥于原文的形式。

翻译应灵活运用上述两种方法，能直译的就直译，需要意译的就意译。对同一个句子

来说，有时并非只能用一种方法，可以交替使用或同时并用以上两种方法。

请看下面的例子。

Milky Way，应译为“银河”（意译），不可直译为“牛奶路”。

bull's eye，应译为“靶心”（意译），不可直译为“牛眼睛”。

New uses have been found for old metals, and new alloys have been made to satisfy new demands. 老的金属有了新用途，新的金属被冶炼出来，以满足新的需要（本句前半部分用了意译法，后半部分用了直译法）。

The ability to program these devices will make a student an invaluable asset to the growing electronic industry. 编程这些器件的能力将使学生成为日益增长的电子工业领域中的无价人才（这里 asset 原意为“资产”，根据上下文意译成“人才”）。

3. 翻译中的专业性特点

专业英语要求英语与专业内容相互配合，相互一致，这就决定了专业英语与普通英语有很大的差异。专业英语以其独特的语体，明确表达作者在其专业方面的见解，其表达方式直截了当，用词简练。即使同一个词，在不同学科的专业英语中，其含义也是不同的。例如：

The computer took over an immense range of tasks from workers muscles and brains.

误译：计算机代替了工人大量的肌肉和大脑。

正译：计算机取代了工人大量的体力和脑力劳动。

（这里 muscles and brains 引申为“体力和脑力劳动”。）

In any case work doesn't include time, but power does.

正译：在任何情况下，功不包括时间，但功率包括时间。

（这里 work，power 在物理专业分别译为“功”、“功率”。）

Like charges repel each other while opposite charges attracted.

正译：同性电荷相排斥，异性电荷相吸引。

（charge 含义有“负载、充电、充气、电荷”，按专业知识理解为“电荷”。）

从以上例句可知，专业英语专业性强，逻辑性强，翻译要力求准确、精练、正式。这不仅要求我们能熟练地运用汉语表达方式，还要求具有较高的专业水平。

Reading

Thevenin's Theorem

Suppose that a load resistor R_L is connected to an arbitrary (in the sense that it contains only linear elements) circuit as shown in Fig. 1-2a.What value of the load R_L will absorb the maximum amount of power? Knowing the particular circuit, we can use nodal or mesh analysis to obtain an expression for the power absorbed by R_L, then take the derivative of this expression to determine what value of R_L results in maximum power. The effort required for such an approach can be quite great. Fortunately, though, a remarkable and important circuit theory concept states that as far as R_L is concerned, the arbitrary circuit shown in Fig. 1-2a behaves as though it is a single independent voltage source in series with a single resistance (Fig. 1-2c).

Once we determine the values of this source and this resistance, we simply apply the results on maximum power transfer.

Suppose we are given an arbitrary circuit containing any or all of the following elements resistors, voltage sources and current sources. The sources can be dependent as well as independent. Let us identify a pair of nodes, say node a and node b, so that the circuit can be partitioned into two pars as shown in Fig. 1-2b. Furthermore suppose that circuit A contains no dependent source that independent on a variable in circuit B, and vice versa. Then we can replace circuit A by an appropriate independent voltage source, call it u_{OC}, in series with an appropriate resistance, call it R_O, and the effect on circuit B is the same as that produced by circuit A. This voltage source and resistance series combination is called the Thevenin equivalent of the circuit A. In other words, circuit A in Fig. 1-2a and the circuit in the left box in Fig. 1-2c have the same effect on the circuit B. This result is known as Thevenin's theorem, and is one of the more useful and significant concepts in circuit theory.

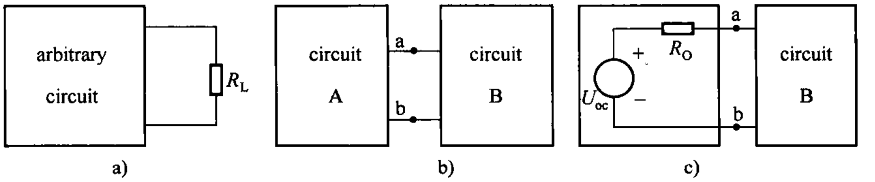

Fig. 1-2 The circuit of the Thevenin's theorem

a) Arbitrary circuit and its associated load b) Circuit partitioned into two parts c) Application of Thevenin's

To obtain the voltage u_{OC} which is called the open-circuit voltage, remove circuit B from circuit A, and determine the voltage between nodes a and b. This voltage, as shown in Fig. 1-3a, is u_{OC}.

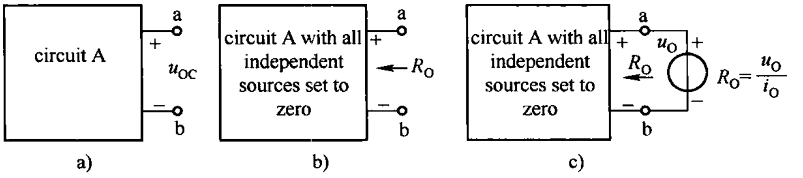

Fig. 1-3 The Thevenin's theorem

a) Determination of open-circuit voltage b) Determination of Thevenin equivalent(output) resistance c) Determination of output resistance

To obtain the resistance R_O Which is called the Thevenin equivalent resistance or the output resistance of circuit A, again remove circuit B from circuit A. Next, set all independent sources in circuit A to zero. Leave the dependent sources as is! (A zero voltage source is equivalent a short-circuit, and a zero current source is equivalent to an open-circuit.) Now determine the resistance between nodes a and b—this is R_O as shown in Fig. 1-3b.

If circuit A contains no dependent sources, when all independent sources are set to zero, the result may be simply a series-parallel resistive network in this case. However, R_O can be found by applying an independent source between nodes a and b and then by taking the ratio of voltage to current. This procedure is depicted in Fig. 1-3c, for the most part it doesn't matter whether u_O is applied and i_O is calculated or vice versa.

New Words and Phrases

theorem ['θiərəm] *n.* 定理，法则，定律
arbitrary ['ɑ:bitrəri] *adj.* 任意的，武断的，*n.* 任意角度/形状
partition [pɑ:'tiʃən] *n.* 分割，划分，分开，隔墙，*vt.* 区分，分隔
derivative [di'rivətiv] *n.* 衍生物，派生物，*adj.* 引出的，派生的
resistive [ri'zistiv] *adj.* 有抵抗力的，抵抗的，*n.* 电阻式
depict [di'pikt] *vt.* 描画，描述，描写，叙述

Exercises

I. Translate the following phrases into English.

1. 暂态分析过程
2. 重要的电路理论概念
3. 消耗最大功率
4. 串并联电阻网络
5. 元件两端的电压
6. 电荷守恒定律
7. 用节点电压分析法或网孔电流分析法
8. 频域

II. Translate the last paragraph into Chinese.