

自动控制英语

English for Automatic Control

《自动控制英语》教材编写组 编



高等教育出版社 Higher Education Press



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内容提要



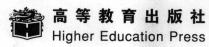
English for Automatic Control

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内容提要



专门用途英语系列教材是教育部规划的高等学校(包括高等专科院校和高等职业院校)专业英语阶段的英语教材,也可供电大、各类成人院校以及广大专业人员学习专业英语、提高涉外业务交际能力使用。

《自动控制专业英语》系专门用途英语系列教材中的一种,旨在提高自动控制类专业的学生和自动控制行业从业人员在其行业中的涉外业务英语交际能力,包括专业阅读、翻译、写作和口头交际的能力。教材选题新颖、内容丰富、语言规范。全书共10个单元,内容涉及自动控制技术的各个方面。每单元包括专业文献阅读、翻译技巧训练、实际应用文写作练习和口语对话练习。书后附有参考答案、参考译文和词汇表等。本书附有MP3并配有录音带。

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定

专门用途英语系列教材是教育部规划的高等院校专业英语阶段的英语教材。本系列教材从高等 技术应用型人才培养的总体目标出发,结合学生毕业后的工作实际,力求向学生提供其未来工作岗 位所需要的专业英语知识技能,培养学生使用涉外业务英语的能力。

本系列教材主要供高等院校(包括高等专科院校和高等职业院校)专业英语教学使用,也可供 电大、各类成人院校及广大专业人员学习专业英语、提高涉外业务交际能力使用。

《自动控制英语》系专门用途英语系列教材中的一种,旨在提高自动控制类专业的学生和自动控制行业从业人员在其行业中涉外业务英语的交际能力,包括专业阅读、翻译、写作和口头交际的能力。

《自动控制英语》共10个单元,每单元分为4个部分:

- 1. 第一部分为"阅读理解" (Reading Comprehension), 旨在培养学生阅读自动控制类专业英语的能力。本部由A、B两篇文章组成,内容包括:控制系统的发展过程、控制系统的未来前景、自动控制系统在电力、交通、通讯等各方面的应用、自动控制系统的先进技术及设备等。
- 2. 第二部分为"翻译技巧"(Translation Skills), 旨在帮助学生掌握基本的翻译技巧,以提高英译汉的翻译能力。
- 3. 第三部分为"实用写作"(Practical Writing),旨在培养学生参照范例用英语拟写和翻译商业信件、涉外合同、产品广告等应用文的能力。
- 4. 第四部分为"交际会话"(Communicative Speaking), 旨在培养学生的口语交际能力。本部分的内容涉及应聘面试、接待外宾、参观访问、协议洽谈等。

本书内容新颖,知识面广,突出强调了自动控制技术在实际中的应用。本书语言规范,练习的设计具有实用性和针对性。书后附有练习答案和参考译文,便于学生使用。

沈阳工程学院刘然教授担任本书的主编,并编写了全书的第二、第三和第四部分,以及词汇表。副主编于轶编写了第3和第9单元的第一部分,副主编郭南对全书的译文进行了全面的改稿和润色,并配置了每单元的插图。金品卓编写第1单元的第一部分,刘岩编写第2单元的第一部分,曹艳春编写第4单元的第一部分,冯威编写第6和第8单元的第一部分,冯冬惠编写第7和第10单元的第一部分,李岱菊编写第5单元的第一部分。

由于编者水平有限,有疏忽和不妥之处,恳请广大读者批评指正。

编 者 2007年12月

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Part I

Reading Comprehension of the best of the b vices. This has led to many innovative methods in manufacturing methods, such

■ Reading A

Control System notice is a principle of the control of the control

The desire to control the forces of nature has been with man since early civilizations. Although many examples of control systems existed in early times, it was not until the mid-eighteenth century that several steam-operated control devices appeared1. This was the time of the steam engine, and perhaps the most noteworthy invention was the speed-control flyball governor invented by James Watt.

值得关注的

Around the beginning of the twentieth century much of the work in control systems was being done in the power generation and the chemical processing industry. Also by this time, concept of the autopilot for airplanes had been fairly ical, etc., the complete description of the entire system requires the understand bequieved liew

自动驾驶仪

The period beginning about twenty-five years before World War Two saw rapid advances in electronics and especially in circuit theory, aided by the now classical work of Nyquist in the area of stability theory2. The requirements of sophisticated weapon systems, submarines, aircrafts and the like gave new impetus to the work in control systems before and after the war. The advent of

推动; 出现 模拟

the analog computer coupled with advances in electronics saw the beginning of the establishment of control systems as a science. By the mid-fifties, the progress in digital computers had given the engineers a new tool that greatly enhanced their capability to study large and complex systems. The availability of computers also opened the era of datalogging, computer control, and the state space or modern method of analysis. Now not suppose of the second of the second space of the second space



The sputnik began the space race and large governmental expenditures in the space as well as military effort. During this time, circuits became miniaturized and large sophisticated systems could be put together very compactly, which brought a computational and control advantage coupled with systems of small physical dimensions. We are now capable of designing and flying minicomputers and landing men on the moon3. The post sputnik age saw much effort in system optimization and adaptive systems.

Finally, the *refinement* of the chip and related computer development has created an explosion in computational capability and computer-controlled devices. This has led to many innovative methods in manufacturing methods, such as computer-aided design and manufacturing, and the possibility of unprecedented increases in industrial productivity via the use of computer-controlled machinery, manipulators and robotics.

Today control systems, a science with art, are still playing an important role. Much mathematical sophistication has been achieved with considerable interest in optimal control systems. The modern approach, having been established as a science, is being applied not only to the traditional control systems, but to newer problems like urban analysis, econometrics, transportation, biomedical problems, energy analysis, and a host of similar problems that affect appeared. This was the time of the steam engine, and perhaps the most notewormodern man.

Because control systems occur so frequently in our lives, their study is quite important. Generally, a control system is composed of several subsystems connected in such a way as to yield the proper cause-effect relationship4. Since the various subsystems can be electrical, mechanical, pneumatic, biological, etc., the complete description of the entire system requires the understanding of fundamental relationships in many different disciplines. Fortunately, the similarity in the dynamic behavior of different physical systems makes this task easier and more interesting.

Desired Valves and Spacecraft Comparator dynamics attitude on poleste off gas jet attitude vances in electronics saw Sensor on spacecraft

Figure 1-1 Control of satellite attitude

As an example of a control system, the simplified version of the attitude of books and a system of the attitude of books and a system of the attitude of books and a system of the attitude of control of a spacecraft is illustrated in Figure 1-1. We wish the satellite to have some specific attitude relative to an inertial coordinate system. The actual atti- 惯性的,协调的 tude is measured by an attitude sensor on board the satellite. If the desired and actual attitudes are not the same, the comparator would send a signal to the

前苏联人造地球卫 星

优化 精致

空前的

操作装置; 机 器人技术

最佳的

经济计量学 生物医学的

子系统

气动的

传感器

valves which open and cause gas jet firings. These jet firings give the necessary corrective signal to the satellite dynamics so that the satellite can be under control. A control system represented this way is said to be represented by block diagrams⁵. Such a representation is helpful in the *partitioning* of a large system into subsystems and therefore, we can study one subsystem at a time.

修正的

分割

If we have many inputs and outputs that are monitored and controlled, the block diagram appears as illustrated in Figure 1-2. Systems where several variables are monitored and controlled are called multivariable systems⁶. Examples of multivariable systems are found in chemical processing, guidance and control of vehicles, the national economy, urban housing growth patterns, the postal service, and a host of other social and urban problems.

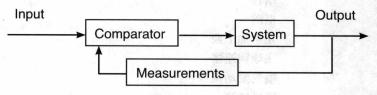


Figure 1-2 Representation of a multivariable system

NEW WORDS AND USEFUL EXPRESSIONS

advent / advent/n. analog / enəlog/n. autopilot /'o:təparlət/n. biomedical / barau medikal/a. comparator /'kpmpareita/n. coordinate /kəu'ə:dineit/a. corrective /kp'rektry/a. data-logging /'dertə login/n. econometrics /I,kpnp'metriks/n. impetus / impitas/n. inertial /I'n3: [əl/a. manipulator /məˈnɪpjuleɪtə/ n. multivariable / maltiveariabl/a. noteworthy / noutwa:ði/a. optimal /'optimal/a. optimization / pptimar zeifən/n. partitioning /pa: tifanin/ n. pneumatic /nju: mætik/a. refinement /ri fainment/ n

出现 模拟 自动驾驶仪 生物医学的 比较器 协调的 修正的 数据记录 经济计量学 推动 惯性的 操作装置 多变量的 值得关注的 最佳的 优化 分割 气动的 精致



sputnik/sputnik/n.

subsystem /'sab, sistim/n.

unprecedented /An'presidentid/a.

a host of

analog computer

apply to

at a time

be capable of doing

be composed of

be coupled with

block diagram

chemical processing industry

flyball governor

gas jet

national economy

on board

power generation

stability theory

state space

steam engine

机器人技术

传感器

前苏联人造地球卫星

子系统

空前的

大量的

模拟计算机

将…应用于

每次

能够做

由…组成

结合

框图

化学加工业

飞球调速器

喷气发动机

国民经济

在船上, 在飞机上

电力生产

稳定理论

状态空间

蒸汽机

NOTES

- 1 it was not until...that....此句型意为"直到…才"。例如: It was not until yesterday that I noticed it. (直到昨天我才注意到这件事。)此句可翻译为: 虽然在早期进行过多种控制系统的尝试,但直到18世纪中叶才出现一些蒸汽驱动控制装置。
- 2 此句中 see 的意思为"经历,目睹",一般用时间作它的主语。例如: The 19th century saw many changes.(许多变革发生于19世纪。)此句可翻译为:大约在二战前25年,借助于稳定理论领域中奈奎斯特的古典理论,电子工业特别是电路理论的发展取得飞速进展。
- 3 此句中 be capable of 的意思为"能够",指人时常表示"有…的能力,有…的倾向";指物时常表示"易于;有…的余地;可以…"。例如:He is capable of judging art. (他具有鉴赏艺术的能力。)



- connected...为后置定语,修饰 subsystems; such...as to do...表示到达某种程度。例 如: We are not such fools as to believe him. (我们不会那么蠢, 竟会相信他。) 此 句可翻译为: 总的说来, 一个控制系统是由若干存在一定因果关系的子系统组 成的。
- 此句中有两个 represented, 但意义不同。represented this way 为后置定语,修饰 system, 在此, represent 意为"表现"; 而 to be represented by block diagrams 为主 语补足语, represent 意为"描绘"。此句可翻译为: 下面用框图描述一个用这 种方法所表现的控制系统。
- 在此句中, where several variables are monitored and controlled 为定语从句,修饰 systems。此句可翻译为: 检测和控制若干变量的系统, 称作多变量系统。

aboard the new aircraft are very sophisticated.

Fx	-	-	-	-	-	4
P-W	82	r	-		-	

Translate the following p	ohrases	into	Chinese.
---------------------------	---------	------	----------

- 1) control system beliggs need and vgolondoel 2) the area of stability theory and to epartness and place and stability theory and the stabilit 3) sophisticated weapon system 4) open the era of data-logging 5) unprecedented increases 图 Reading 6) multivariable systems 7) cause-effect relationship 8) biomedical problem 12/2 lontrol local violation and annual state of the state of
- 9) industrial productivity 10) circuit theory bangiseb ad tsum maters a erawhrent to specia to published and of roing

ture of the design process. In general, when we design a control system, we do

Exercise 2

Translate the following phrases into English, oneg and of bergomon are sizulans and to affuse and to

- are desired for the proposed system. The accuracy of the results dependent on the proposed system. The accuracy of the results dependent of the proposed system. 2) 飞机的自动驾驶仪 if selding and a selding a selding and a selding a selding
- 3) 现代分析方法 if ad of bereight of then may be considered to be the started as a conceptual design. The objective then may be considered to be the started as a conceptual design. The objective then may be considered to be the started as a conceptual design. The objective then may be considered to be the started as a conceptual design. The objective theory the objective the obj
- 4) 数字计算机
- 5) 自适应系统 6) 许多革新的方法 190700 ella ew villadificação illumita lametxe vd beliaxe nerio estoques an
- with the speed of response or transient response, the accuracy or steady stal 计设值静刻 (7
- 8) 国民经济
- 9) 发出修正信号 imiting values. The relative weight given to any speciel 300 (8)
- 10) 卫星上的传感器 and selection application for example, the dependent upon the specific application.



Exercise 3

Fill in the blanks with the proper words given below, changing the form where necessary.

	sophisticated	machinery	electrical	electronics	energy
	operate	chemical	monitor	simplify	generate
	by block diapterts, S. E.	bemsanger so o			Lift smeleys
1)	The workers have bee	n told to impro	ve their	level.	
2)	When coal burns, it	hea	ıt.		
3)	Thein	the factory cor	nsists of severa	al different kinds o	of machines.
4)	We have been	the	enemy's radio	o broadcasts to tr	y to find out their secre
	plans.				
5)	The system isn't worki	ng because of	a(n)	fault.	
6)	The English in this spe	cification has	been	to make it	easier to understand.
7)	The ab	oard the new	aircraft are ver	y sophisticated.	Reroise 1
8)	A(n) cha	ange takes pla	ce in any subs	tance when it burr	Franslate the followi.ac
9)	The latest and most _		technology ha	as been applied to	the new machines.
10)	Each year Americans	consume a hig	h percentage o	of the world's	2) the a rea of sta
				veapon system	
					4) open the era o

Reading B

Design, Modeling and Analysis of Control System (8)

Prior to the building of a piece of hardware, a system must be designed, (1991) Jugnio (01 modeled, and analyzed. Actually the analysis is an important and essential feature of the design process. In general, when we design a control system, we do so conceptually. Then we generate a mathematical model which is analyzed. The results of this analysis are compared to the performance specifications that are desired for the proposed system. The accuracy of the results depends upon the quality of the original model of the proposed design. For example, the Sun Tracker is a conceptual design. The objective then may be considered to be the prediction, prior to construction, of the dynamic behavior that a physical system exhibits, i.e. its natural motion when disturbed from an equilibrium position and its response when excited by external stimuli. Specifically we are concerned with the speed of response or transient response, the accuracy or steady state response, and the stability. By stability we mean that the output remains within certain reasonable limiting values. The relative weight given to any special requirement is dependent upon the specific application¹. For example, the air conditioning of the interior of a building may be maintained to ±1°C and satisfy

概念地

平衡 激励 瞬时的



the occupants. However, the temperature control in certain cryogenic sys- 居住者; 低温学的 tems requires that the temperature be controlled to within a fraction of a degree. doing and of aldsoldes The requirements of speed, accuracy, and stability are quite often contradictory and and speed. and some compromises must be made. For example, increasing the accuracy collections and some compromises must be made. generally makes for poor transient response. If the damping is decreased, the 阻尼 图尼 that there are only a few basic concepts and analytical tools that are pivotal to state value.

It is important to remember that all real control systems are nonlinear; 非线性的 being entitled however, many can be approximated within a useful though limited range as a of belique bits even linear systems2. Generally, this is an acceptable first approximation. A very 近似值 3 vilides important benefit to be derived by assuming linearity is that superposition 。线形;重叠 od of theorem applies³. If we obtain the response due to two different inputs, the response due to the combined input is equal to the sum of the individual response⁴. Another benefit is that operational mathematics can be used in the analysis of linear systems. The operational method allows us to transform ordinary differential equations into algebraic equations, which are much simpler to handle5.

Traditionally, control systems were represented by higher-order linear differential equations and the techniques of operational mathematics were employed to study these equations. Such an approach is referred to as the classical method and is particularly useful for analyzing systems characterized by a single input and a single output. As systems began to become more complex, it became increasingly necessary to use a digital computer. The work on a computer can be advantageously carried out if the system under consideration is represented by a set of first-order differential equations and the analysis is carried out via matrix theory. This is in essence what is referred to as the state space or state variable approach. This method, although applicable to single input-output systems, finds important applications in the multivariable system6. Another very attractive benefit is that it enables the control system engineers to study variables inside a system.

We must note that although the easier route is to initially begin with the classical viewpoint, it is the state approach that is more natural for the more complex and interesting problems. At this level, a thorough study should necessarily include both viewpoints.

Regardless of the approach used in the design and analysis of a control system, we must at least follow the following steps:

- 1. Postulate a control system and state the system specifications to be satisfied.
- 2. Generate a functional block diagram and obtain a mathematical representation of the system.

定理

微分的; 方程; 代 数的

方便地

矩阵 变量

3. Analyze the system using any of the analytical or graphical methods 绘画的 was en applicable to the problem. De controlled to within a fraction of a deg. meldon to the temperature be controlled to within a fraction of a deg.

4. Check the performance (speed, accuracy, stability, or other criterion) to a lo sine mentioner and see if the specifications are met. In some seems and some seems are met.

5. Finally, optimize the system parameters so that the first step is satisfied. 使最优化。

Whatever the physical system or specific arrangement it is, we shall see a specific arrangement it is, we shall see a specific arrangement it is, we shall see that there are only a few basic concepts and analytical tools that are pivotal to the prediction of system behavior. The fundamental concepts that are learned an about a state of the prediction of system behavior. here and applied to a few examples have therefore a much wider range of applied neo vnem peyework cability7. The real range will only be clear when you start working with the ideas and cameleye useful important benefit to be derived by assuming linearity is that superposition send begoleveb ed of

关键的 autev atala

NEW WORDS AND USEFUL EXPRESSIONS

advantageously /, ædvən teid 3 əsli/ ad. algebraic / æld31 bre11k/a. approximation /ə,proksi'meifən/n. conceptually /kən'sept fuəli/ ad. cryogenic / kraiou dzenik/ a. damping /'dæmpɪŋ/n. differential /diforenfol/a. equation /I'kweifan/n. equilibrium /,i:kwi'libriəm/ n. graphical / græfikəl/a. linearity / lini'æriti/n. matrix / mertriks/n. nonlinear /nʌŋ'lɪnɪə/ a. occupant / pkjupent/n. optimize / optimaiz/ v. oscillation /psi'leifan/n. pivotal / prvətl/a. postulate / postjulert/ v. stimuli / stimjulai/n. superposition / sju:pəpə zı sən/n. theorem /'Ouerem/n. transient / trænzient/a. variable /'vearrabl/n.

a fraction of a range of

方便地 代数的 近似值 概念地 低温学的 阻尼 微分的 方程 平衡 绘画的 线形 矩阵 非线性的 居住者 使最优化 摆动 关键的 设定 激励 重叠 定理 瞬时的

变量

一小部分

一系列,一批,一套

be dependent upon

be equal to

be referred to as

carry out

differential equation

due to

first-order differential equations

higher-order

in essence

linear system

make for

mathematical representation

multivariable system

operational mathematics

prior to

regardless of

relative weight

state approach

superposition theorem

依靠; 取决于

等于 nmoleOn asserting realists privated and ribital

被称为

完成, 实现, 贯彻, 执行

微分方程

由于

一阶的微分方程

序列高阶

实质上

线性系统

有助于,倾向于

数学表达式

多变量系统

算子数学

在…之前

不管,不顾

稳定裕量

状态空间方法

叠加定理



However, the temperature control in certain cryogenic systems requires that the temperature ZaTON

- 1 此句中 given to any special requirement 为后置定语,修饰句子主语 the relative weight。全句可翻译为: 就任何特殊要求提出的稳定裕量取决于其具体应用要求。
- 2 此句中 within the range 意为 "在···范围内", though 表示转折, 含义相当于 but 。可翻译为: ··· 但 有许多系统可以在一个有限但却有用的范围内接近于线性系统。
- 3 此句中 to be derived by assuming linearity 为后置定语,修饰句子主语 benefit; that superposition theorem applies 为表语从句。全句可翻译为:由假定线性得出的一个很重要的优点是可应用叠加定理。
- 4 此句中 due to two different inputs 为后置定语,修饰条件从句宾语 response; due to the combined input 也是后置定语,修饰主句主语 response。全句可翻译为:如果是由两个不同的输入得到一种响应、则该响应相等于单个响应之合。
- 5 此句中 which are much simpler to handle 为非限制性定语从句,修饰 algebraic equations。由于定语从句较短,可按限制性定语从句的规则来翻译。全句可翻译为:这种运算方法可以使我们将普通的微分方程转为更容易处理的代数方程。
- 6 此句中 although applicable to single input-output systems 可看做插入语,表示转折。全句可翻译为:这种方法不仅适用于单个输入一输出系统,亦可在多变量系统中起重要作用。
- 7 在 that 引导的定语从句中, are learned 和 applied to 为并列谓语。全句可翻译为: 因此,这里研究的和在几个事例中使用的基本概念有很广泛的应用范围。

Exercise 1

Match the following English phrases in Column A with their Chinese equivalents in Column B.

- 1) generate a mathematical model
- 2) a conceptual design
- 3) remain within certain reasonable limiting values
- 4) reach some steady state value
- 5) equal to the sum of the individual response
- 6) the analysis of linear systems
- 7) state variable approach
- 8) classical viewpoint
- 9) a few basic concepts
- 10), a set of first-order differential equations

- A) 保持在一个合理的限定数值内
- B) 达到一定的稳定状态值
- C) 得出数学模型
- D) 等于单个响应之合
- E) 一个概念性的设计
- F) 一组一阶的微分方程
- G) 古典的观点
- H) 几个基本概念
- 1) 状态变量方法
- J) 线性系统的分析

Exercise 2

Translate the following sentences into Chinese.

1)	Prior to the building of a piece of hardware, a system must be designed, modeled, and analyzed.
2)	However, the temperature control in certain cryogenic systems requires that the temperature be controlled to within a fraction of a degree.
3)	For example, increasing the accuracy generally makes for poor transient response.
4)	Regardless of the approach used in the design and analysis of a control system, we must at least follow the following steps.
	应。明弦响应相等于单个响应之合。
5)	Such an approach is referred to as the classical method and is particularly useful for analyzing systems characterized by a single input and a single output.

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