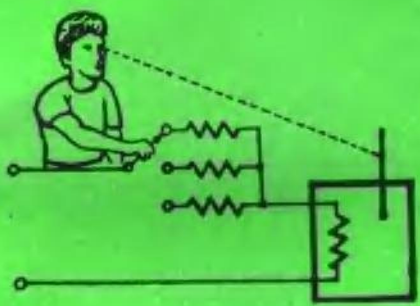
王贵堂 陈纬 编

机械工业出版社



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机械工业出版社出版（北京阜成门外百万庄南里一号）
（北京市书刊出版业营业许可证出字第117号）
中国铁道出版社印刷厂印刷
新华书店北京发行所发行·新华书店经售

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开本 787×1092　1/32·印张 6·字数 129 千字
1989 年 9 月北京第一版·1989 年 9 月北京第一次印刷
印数　0,001—2,600·定价：5.20 元

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ISBN 7-111-00617-8/H·11

前　言

本书系专业阅读教材，文章全部选自原文书刊，在“基础英语”阶段结束后使用。通过本阶段的学习，学生能较快地提高阅读自动化和自动控制专业英语书刊的能力。

全书共有文章三十篇，阅读量约11万印刷符号，词汇和词组量约930个。书末附有参考译文。

本书供具有一定英语基础的高等学校自动化和自动控制专业高年级学生为进一步提高专业英语阅读能力使用，也可供具有一定英语水平的该专业科技人员自学使用。

Contents

参 考 译 文

1. The Basic Problems of Automation in Production Process

Automation makes possible an increase in the productivity of labour and a growth in the abundance of material wealth. The principal advantages of automation may be listed as:

1) an increase in the productivity of technological equipment resulting from more accurate observation of the correct technical conditions;

2) a reduction in wear of the equipment and an increase in the length of time between overhauls resulting from the greater stability of the operating conditions under automation;

3) an improvement in the quality of the manufactured product;

4) a reduction in production losses and a lowering in the coefficient of consumption, i. e., a reduction in the consumption of raw materials;

5) a reduction in the consumption of thermal and electrical energy;

6) the possibility of intensification of the process and of the application of progressive technological methods;

7) a reduction in the size of the factory building and an economy in construction works and materials resulting from a more rational partnership between technological and auxiliary equipment;

8) an improvement in the working conditions of the production workers, especially those engaged in processes which are dangerous or harmful to health;

9) a reduction in the number of maintenance personnel;

10) an improvement in the organization of production;

11) an improvement in the coordination of production control and an increase in the reliability of operation of the process, to-

gether with reduction or avoidance of faults.

Apart from the general effects of the introduction of automation enumerated above, each case may reveal other effects. The numerous subsidiary effects of automation are mutually interconnected. However, it would be inexpedient to consider them as all present simultaneously and to the same degree. For each process to be automated, it is necessary, on the basis of a detailed analysis, to determine the more important basic problems of automation and to commence the solution of these problems by the technical means of automation. The number of these basic problems should not be large, so that time is not wasted on their solution.

For example, any of the following may be cited as a typical problem of automation:

1)the maximum increase in productivity of the technological equipment;

2)a guarantee of the finest possible quality of the finished product;

3)a reduction in the consumption of raw materials;

4)a reduction in the consumption of thermal and electrical energy;

5)an increase in safety and an improvement in the working conditions of the production personnel;

6)the maximum reduction in maintenance personnel;

7)a guarantee of maximum output of production per worker etc.

The correct choice of the basic automation problems permits effects to be obtained, which are best adapted to a particular type of production, and in addition, avoid overloading the system of automation.

New Words and Expressions

abundance [ə'bʌndəns]*n*. 丰富，充裕

wealth	[welθ]*n.*	资源
overhaul	[ˈəuvəhɔːl]*n.*	大修
intensification	[inˈtensifiˈkeiʃən]*n.*	增强，强化
progressive	[prəˈgresiv]*adj.*	先进的
partnership	[ˈpɑːtnəʃip]*n.*	合作，协作
auxiliary	[ɔːgˈziljəri]*adj.*	辅助的
engage	[inˈgeidʒ]*vt.*，*vi.*	从事，忙于，参加
harmful	[ˈhɑːmful]*adj.*	有害的，有害于…
maintenance	[ˈmeintinəns]*n.*	维修，保养
organization	[ɔːgənaiˈzeiʃən]*n.*	组织；编制；团体
coordination	[kəuɔːdiˈneiʃən]*n.*	调整，配置；协调
avoidance	[əˈvɔidəns]*n.*	避免
fault	[fɔːlt]*n.*	故障，毛病
enumerate	[iˈnjuːməreit]*vt.*	列举，计数，点数
reveal	[riˈviːl]*vt.*	显示，展现；揭露
subsidiary	[səbˈsidjəri]*adj.*	次要的，辅助的
mutually	[ˈmjuːtjuəli]*adv.*	相互
inexpedient	[iniksˈpiːdjənt]*adj.*	不适当的
commence	[kəˈmens]*vt.*，*vi.*	开始(做)；倡导
cite	[sait]*vt.*	引用，引证，举例
guarantee	[gærənˈtiː]*n.*	保证
adapt	[əˈdæpt]*vt.*	使…适应于

an abundance of	丰富的，充裕，许许多多的
result from	由…引起，起因于…，由于…
i. e. [拉丁语]id est 的缩写(＝that is)	即，也就是
be engaged in	从事于…，参加…，忙于…
apart from	除了…以外
to the same degree	在相同程度上
be adapted to	适合于…，适应于…

2. Applications of Automatic Control

Although the scope of automatic control is virtually unlimited, we will limit this discussion to examples which are commonplace in modern industry.

1)Servomechanisms

Although a servomechanism is not a control application per se, this device is commonplace in automatic control. A servomechanism, or "servo" for short, is a closed-loop control system in which the controlled variable is mechanical position or motion. It is designed so that the output will quickly and precisely respond to a change in the output command. Thus we may think of a servomechanism as a following device.

Another form of servomechanism in which the rate of change or velocity of the output is controlled is known as a rate or velocity servomechanism.

2)Process control

Process control is a term applied to the control of variables in a manufacturing process. Chemical plants, oil refineries, foodprocessing plants, blast furnaces, and steel mill are examples of production processes to which automatic control is applied. Process control is concerned with maintaining at a desired value such process variables as temperature, pressure, flow rate, liquid level, viscosity, density, and composition.

Much current work in process control involves extending the use of the digital computer to provide direct digital control (DDC) of the process variables. In direct digital control the computer calculates the values of the manipulated variables directly from the values of the set points and the measurements of the process variables. The decisions of the computer are applied to digital actuators in the process. Since the computer duplicates the analog controller action, these conventional controller are no longer needed.

3)Power generation

The electric power industry is primarily concerned with energy conversion and distribution. Large modern power plants which may exceed several hundred megawatts of generation require complex control systems to account for the interrelationship of the many variables and provide optimum power prodution. Control of power generation may be generally regarded as an application of process control, and it is common to have as many as 100 manipulated variables under computer control.

Automatic control has also been extensively applied to the distribution of electric power. Power systems are commonly made up of a number of generating plants. As load requirements fluctuate, the generation and transmission of power is controlled to achieve minimum cost of system operation. In addition, most large power systems are interconnected with each other, and the flow of power between systems is controlled.

4)Numerical control

There are many manufacturing operations such as boring, drilling, milling, and welding which must be performed with high precision on a repetitive basis. Numerical control (N/C) is a system that uses predetermined instructions called a program to control a sequence of such operations. The instructions to accomplish a desired operation are coded and stored on some medium such as punched paper tape, magnetic tape, or punched cards. These instructions are usually stored in the form of numbers-hence the name numerical control. The instructions identify what tool is to be used, in what way (e. g., cutting speed), and the path of the tool movement (position, direction, velocity, etc.).

5)Transportation

To provide mass transportation systems for modern urban areas, large, complex control systems are needed. Several automatic transportation systems now in operation have high-speed trains running at several-minute intervals. Automatic control is necessary to maintain a constant flow of trains and to provide comfortable acceleration and braking at station stops.

Aircraft flight control is another important application in the transportation field. This has been proven to be one of the most complex control applications due to the wide range of system parameters and the interaction between controls. Aircraft control systems are frequently adaptive in nature; that is, the operation adapts itself to the surrounding conditions. For examples, since the behavior of an aircraft may differ radically at low and high altitudes the control system must be modified as a function of altitude.

Ship-steering and roll-stabilization controls are similar to flight control but generally require far highter powers and involve lower speeds of response.

New Words and Expressions

scope	[skəup]*n.*	范围,显示器
virtually	['və:tjuəli]*adv.*	实际上
commonplace	['kɔmənpleis]*adj.*	平常的
servomechanism	['sə:vəu'mekənizəm]*n.*	伺服机构,伺服机械
per se	[pə:'si:][拉丁语]	本身,自身,本质上
servo	['sə:vəu]*n.*	伺服机构,伺服机械
closed-loop	['kləuzd'lu:p]*n.*	闭合回路,闭合环路,闭环
variable	['vεəriəbl]*n.*	变量,变数
precisely	[pri'saisli]*adv.*	精确地
respond	[ris'pɔnd]*vi.*, *vt.*	响应,起反应,回答,应答
viscosity	[vis'kɔsiti]*n.*	粘度,粘性
manipulate	[mə'nipjuleit]*vt.*	操作,操纵,控制,处理
measurement	['meʒəmənt]*n.*	测量,度量;测量结

		果;度量制
decision	[di'siʒən]n.	决定,判定,判断
actuator	['æktjueitə]n.	启动器,致动器,执行器,传动装置
duplicate	['dju:plikeit]vt.	加倍,重复,复制
megawatt	['megəwɔt]n.	兆瓦,百万瓦(特)
optimum	['ɔptiməm]adj.	最佳的,最优的
fluctuate	['flʌktjueit]vi. ,vt.	波动,起伏
boring	['bɔ:riŋ]n.	镗孔
milling	['miliŋ]n.	铣削
predetermine	['pri:di'tə:min]vt.	预先规定…,预定,先定
instruction	[in'strʌkʃən]n.	指令
code	[kəud]vt.	编码,译码
	n.	数码,代码,电码
identify	[ai'dentifai]vt.	辨认,识别,标志
parameter	[pə'ræmitə]n.	参数,参量
adaptive	[ə'dæptiv]adj.	(自)适应的
radically	['rædikəli]adv.	根本上
altitude	['æltitju:d]n.	高度
modify	['mɔdifai]vt.	修改,修正,变更
steering	['stiəriŋ]n.	驾驶,转向,操舵
roll	[rəul]n.	颠簸,摇晃
response	[ris'pɔns]n.	响应,反应,应答

closed-loop control system	闭环控制系统
following device	随动装置
respond to	响应…,对…起反应
liquid level	液位
direct digital control (DDC)	直接数字控制
manipulated variable	操纵变量
set point	设定点
digital actuator	数字启动器
analog controller	模拟控制器
no longer	不再
account for	说明

be regarded as	被认为是…
numerical control	数字控制，数控
punched paper tape	穿孔纸带
punched card	穿孔卡片
ship-steering	船舶转向

3. Open-loop and Closed-loop Control

If we examine the word control, we find several meanings given in the dictionary, e.g., command, direct, govern, and regulate. Thus, a control system may be regarded as a group of physical components arranged to direct the flow of energy to a machine or process in such a manner as to achieve the desired performance.

The word automatic means self-moving or self-acting; thus an automatic control system is a self-acting control system.

An important distinction applied to control systems, whether automatic or otherwise, is that between open-loop and closed-loop operation. Automatic control, including this distinction, can perhaps be best introduced by means of a simple example.

Assume that the oven shown in Fig. 1 is heated by an electric heater controlled by a switch that provides several levels of current to the heating element. The setting of the switch represents the input quantity since it activates the system to produce the output. The temperature of the oven is the output or controlled quantity. Since the current to the heater is the quantity being altered, we can think of it as the manipulated quantity.

For a given setting of the control switch the oven temperature will reach a value related to the heater current and heat losses through the oven walls. If the temperature is unsatisfactory, this fact by itself can in no way alter the input to the oven control. Thus it can be said that the output quantity has no effect on the input quantity. The control in this case is identified as an open-loop control system. If some condition such as the ambient temperature surrounding the oven should change, the oven temperature will also change. Thus the open-loop control system cannot correct for changes that disturb the controlled quantity.

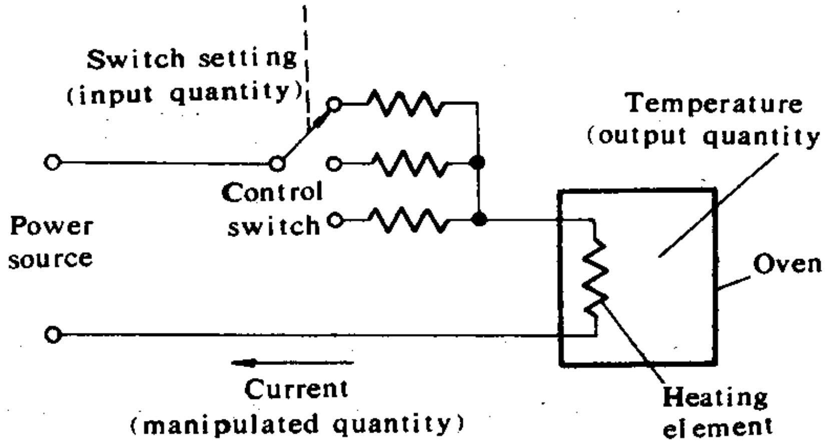

Fig. 1 Oven-temperature control, open-loop

A human being can be added to the system for the purpose of maintaining the oven temperature at a desired value. This is shown in Fig. 2. By observing a thermometer within the oven, the person could alter the position of the control switch to more nearly achieve the required temperature. It is important to note that the addition of the human operator has provided a means by which the output is fed back and compared with the desired value. Actual control of the heating element depends on the error or difference between the desired and actual temperatures. Any necessary change is made in the direction of reducing this error. For example, if the temperature were low, the heater current would be increased to provide more heat.

Systems in which the output has an effect upon the input are called closed-loop control systems or, more commonly, feedback control systems. The feedback nature of the system in Fig. 2 may be seen by tracing the closed-loop. The function of comparing the actual temperature with the desired value is performed in the mind of the operator, and the command is executed by the response of

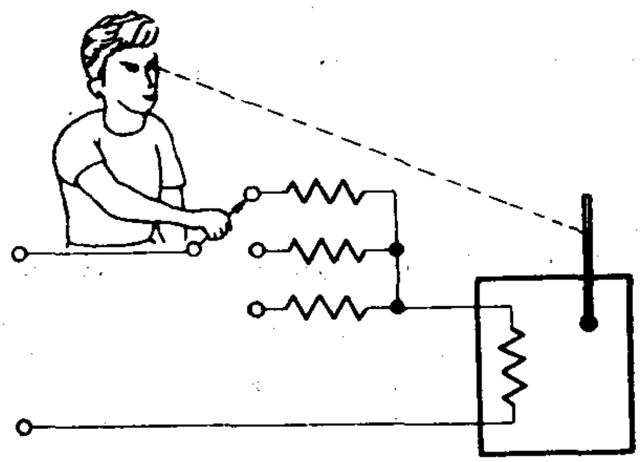

Fig. 2 Oven-temperature control, manual closed-loop

his muscles. Eventhough closed-loop control of the oven is established by the operator, the results may be less than satisfactory. The temperature will cycle above and below the desired value as the operator adjusts the switch even though the excursions would tend to decrease with operator experience. A change in the level of the power source or in the ambient temperature surrounding the oven would adversely affect the system's output. In addition, watching a thermometer and operating a switch would be a dull and time-consuming task. This arrangement could be described as a manual closed-loop control system.

To further improve performance and obtain more precise control, the human may be replaced by a mechanical, electrical, or other form of comparison and control unit. Fig. 3 shows the oven control system with closed-loop control implemented on an automatic basis, that is, without human intervention. The temperature is now measured by a thermocouple, a device that generates an electrical voltage proportional to temperature. This voltage is fed back and compared with a reference voltage that represents the desired temperature. The difference between the two voltages is amplified electronically and controls the current to the heating ele-