机电工程专业英语

ENGLISH FOR ELECTROMECHANICAL ENGINEERING

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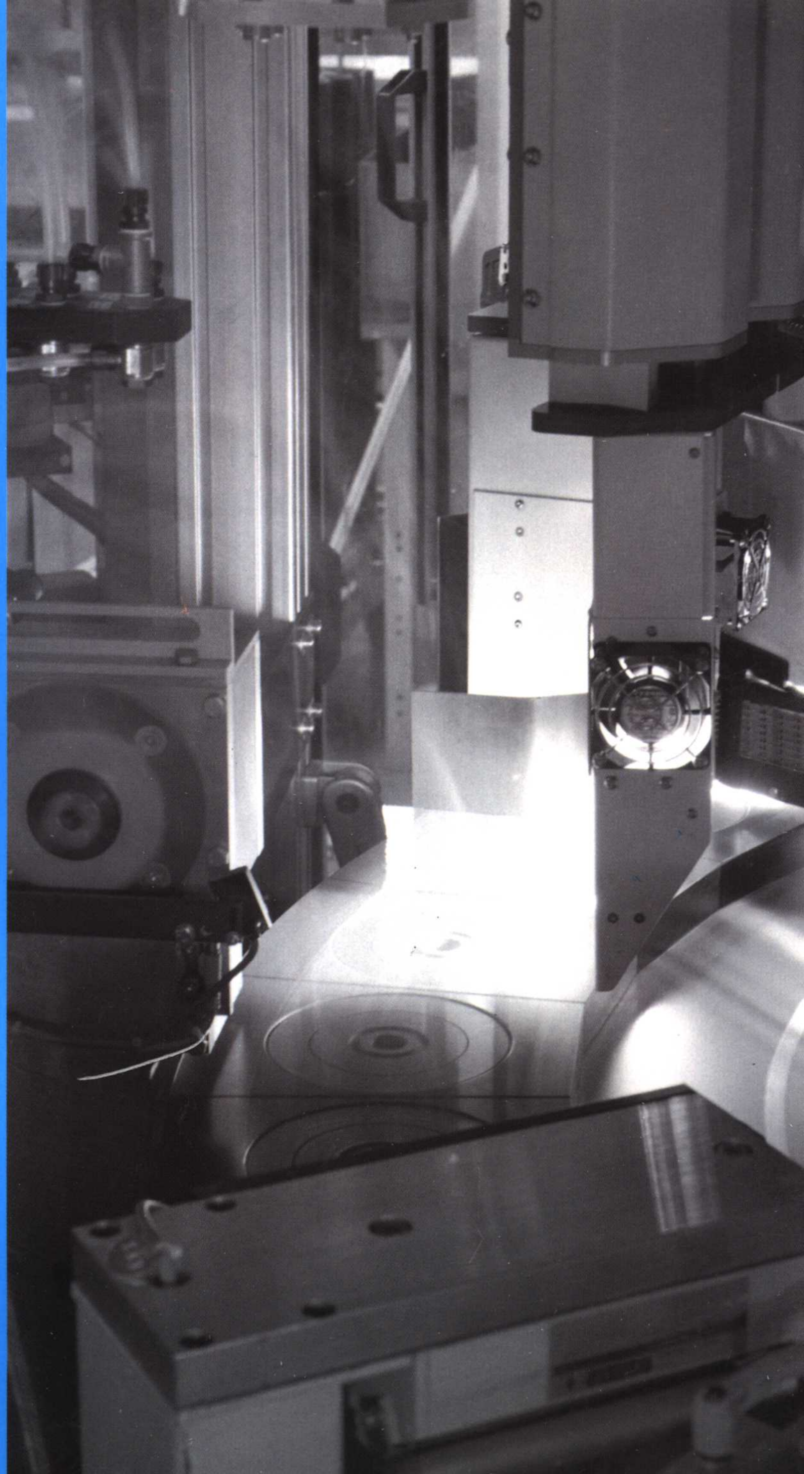

同济大学出版社

大学专业英语系列教程

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内容提要

本书以培养学生的机电专业英语能力为宗旨。全书共分七个部分，包括科普短文、机械零件、机构和机器、设计、机床和加工、制造系统、测试和教育。本书紧密贴合学生所学的专业基础课和专业课内容，为配合提高学生的自学能力，每篇课文配有注释、课后练习、参考译文和习题答案。本书强调专业性和实用性，实现了从书本知识到工作岗位专业英语实际应用的过渡。本书可作为全国高等院校机电工程、机械设计制造及其自动化、机械工程及自动化、工业工程等专业学生的教材，也可作为上述及相关专业工程技术人员的参考书。

图书在版编目(CIP)数据

机电工程专业英语/王永鼎，姜少杰主编. —上海：同济大学出版社，2006. 9

ISBN 7-5608-3361-6

Ⅰ. 机... Ⅱ. ①王... ②姜... Ⅲ. 机电工程—英语—高等学校—教材 Ⅳ. H31

中国版本图书馆 CIP 数据核字(2006)第 087423 号

机电工程专业英语

王永鼎 姜少杰 主编

责任编辑 朱振华 责任校对 谢惠云 装帧设计 潘向蓁

出版发行	同济大学出版社
	(上海四平路 1239 号 邮编 200092 电话 021-65985622)
经 销	全国各地新华书店
印 刷	同济大学印刷厂
开 本	787mm×960mm 1/16
印 张	27
字 数	540 千
印 数	1—4100
版 次	2006 年 9 月第 1 版 2006 年 9 月第 1 次印刷
书 号	ISBN 7-5608-3361-6/H・403
定 价	38.00 元

本书若有印装质量问题，请向本社发行部调换

前　言

随着21世纪信息技术的发展，机电行业的国际学术交流和技术合作越来越频繁。英语作为国际交流的工具，其作用不可忽视。然而因专业英语的特性，仅仅通过一般英语语言知识的学习无法解决生产实际问题。专业英语的应用能力已成为高等院校学生和科技工作者应有的基本素质。

本书的宗旨是提高机电工程、机械设计制造及其自动化、机械工程及自动化、工业工程等专业学生的专业英语实际应用能力，适应从大学英语教学基础阶段（一至二年级）到应用提高阶段（三至四年级）的过渡，为踏入工作岗位做好准备。

全书包括七个部分。第一部分为科普短文，第二部分为机械零件、机构和机器，第三部分为设计，第四部分为机床和加工，第五部分为制造系统，第六部分为测试，第七部分为教育。所有文章均选自相关具有权威性和代表性的专业书籍，注重实用性。每篇课文配有参考译文，具有一定的参考价值。

教材由浅入深，增加了具有趣味性的机械专业科普短文，以提高学生的学习兴趣。在编排上，每课都有两篇难度系数不同但内容密切相关的文章，每篇文章都附有生词表及疑难句注释，方便读者阅读和理解，也便于学生自学。各校教师可以根据自己学校学生的具体情况选择其中的一篇进行教学，另一篇作为阅读材料。每篇课文都配有相关练习题，以巩固文章的知识要点，进一步熟悉专业词汇。

本书由王永鼎（Part Ⅰ，Part Ⅶ）、姜少杰（Part Ⅱ，Part Ⅲ，Part Ⅳ，Part Ⅵ及译文）主编，参加编写的还有李俊（Part Ⅴ及译文）、周华（Appendix）。由于作者水平有限，对书中的不足之处，恳请广大读者指正。

编　者

2006年8月

CONTENTS

Part Ⅰ Short Articles about Science and Technology

Part Ⅱ Components, Mechanisms and Machinery

Part Ⅳ Machining and Machine Tools

Part Ⅴ Manufacturing System

Appendix Ⅰ Product Specification

Appendix Ⅱ Abstract

Part I

Short Articles about Science and Technology

Unit 1

What is a PLC?

The PLC, or Programmable Logic Controller, is a computer with a single mission. Most commonly used in industrial applications, it usually lacks a monitor, keyboard, and a mouse, as it is normally programmed to operate a machine or system using but one program. Factory assembly line machinery is activated and monitored by a single PLC, where in the past hundreds of timers and relays would have been required to do the task. The machine or system user rarely, if ever, interacts directly with the PLC's program. When it is necessary to either edit or create the PLC program, a personal computer is usually (but not always) connected to it.

In the 1960s, the American automotive industry was searching for a way to do business better. The processes of sequencing, control and interlock logic needed for automobile manufacturing was a time consuming and arduous task, which required manual updating of relays, timers and dedicated closed-loop controllers. When a new year's model was coming off the drawing board, skilled electricians were called on to reset the production line. GM Hydramatic specifically requested proposals for a replacement for the old system that would speed up the process and keep costs down.

Bedford Associates, out of Bedford, Massachusetts, came up with the winning proposal, designated the 084. The 084 became the first PLC, and a new industry was born.

Programmable logic controllers, sometimes referred to simply as programmable controllers, are microprocessor based units that, in essence, monitor external sensory activity from additional devices. They take in the data, which reports on a wide variety of activity, such as machine performance, energy output, and process impediment. They also control attached motor starters, pilot lights, valves and many other devices. Both functions respond to a custom, user-created program.

Programmable logic controllers contain a variable number of Input/Output (I/O) ports, and are typically Reduced Instruction Set Computer (RISC) based. They are designed for real-time use, and often must withstand harsh environments on the shop floor. The programmable logic controller circuitry monitors the status of multiple sensor inputs, which control output actuators, which may be things like motor starters, solenoids, lights and displays, or valves.

Most PLCs are programmed in a special language called Ladder Logic. Ladder Logic is essentially a Boolean logic-solving program with a graphical user interface designed to look like an elementary wiring diagram, familiar to all industrial electricians. A modern programmable logic controller is usually programmed in any one of several languages, ranging from ladder logic to Basic or C. Typically, the program is written in a development environment on a personal computer (PC), and then is downloaded onto the programmable logic controller directly through a cable connection. The program is stored in the programmable logic controller in non-volatile memory.

Words and Expressions

timer ['taimə] *n*. 计时器,定时器

relay ['ri:lei] *n*. 继电器

interlock [ˌintə'lɔk] *v*. 互锁

arduous ['ɑ:djuəs] *adj*. 费劲的,辛勤的

closed-loop [kləuzdlu:p] *adj*. 闭环的

GM 美国通用汽车公司

hydramatic [ˌhaidrə'mætik] 油压[液压]自动式的

designate ['dezigneit] *vt*. 指定、指出,任命

sensory ['sensəri] *adj*. 感觉的,感官的

impediment [im'pedimənt] *n*. 阻碍,障碍

port [pɔ:t] *n*. 端口

Unit 2

CNC Machining

CNC stands for Computer Numerical Control. CNC machining is a versatile system that allows you to control the motion of tools and parts through computer programs that use numeric data. CNC machining can be used with nearly any traditional machine.

CNC machining starts with a piece of metal, sometimes called a "billet".

(***Billet***: *pretentious word for "lump of metal", used by machinests and marketeers to confuse outsiders.*)

That piece of metal might have been cast, forged, or rolled (squeezed between rollers, sort of a limited forging, only capable of making flat things with straight grain like a board).

It is put into a fairly standard machine tool, that has had position sensing and motors on the control knobs installed. This is basically just a robot machinist. You use a rotating cutting tool to cut away all the metal that isn't your crank. 3D metal etch-a-sketch, with the computer interpolating so the circles come out looking pretty smooth.

The down-side of CNC machining

There are a couple of issues. First, it wastes a lot of metal. The stuff removed is just metal shavings, and can only be sold for scrap. By comparison, forging uses almost all of the metal, except for a little bit of "flash" that seeps into the crack between the tool and the die. The process can be time consuming — you can remove a couple of cubic inches of metal per minute, (limited mostly by your ability to keep the friction of cutting from overheating, and possibly melting things. This is especially important for the cutting tool, which may be severely weakened if you get it too hot, never mind near to melting). A part that is "sprawling" like your right crank, can take 10 minutes or more to make, compared to the small number of seconds that it takes a press to cycle. (A large press can make several parts per squish, providing even higher productivity.)

They are complicated machines, full of servomechanisms, and measuring technology that can measure to 0.005 mm (0.000 1") while covered in oil. A CNC machine has a minimum of 6 motors (including some to change tools, and one or more to pump oil and coolant various places). This translates to running costs that may be well over $1/minute. (The computer is not a significant part of the cost any more.)

Oh yeah, strength. Well, if you cut away metal, it doesn't have the tightly packed surface finish of a forging. Worse, there may be inside corners that have a sharp junction. These are "stress risers", places that cracks can start (in any metal, but aluminium is particularly sensitive to it. Titanium is even worse.)

Advantages of CNC machining

You can't use an acute inside angle on a forging, you would never be able to get the part out of the mold. So all inside corners must be wider than 90 degrees, and have radiused edges (if you had a die mold) that tried to form a sharp corner, it would cut rather than push the metal into place.

CNC machining doesn't impose such restrictions, though to get nicely radiused corners, you might have to change tools, to make the last pass. (you use a flat tool to get rid of the bulk of the metal over the flat areas, and use a round nosed tool to form the inside radius where needed.) So eliminating stress risers means more expensive machining time.

Words and Expressions

versatile ['və:sətail] *adj*. 通用的，万能的

numeric [nju:'merik] *adj*. 数字的

billet ['bilit] *n.* 短条(锭),棒料

lump [lʌmp] *n.* 块(尤指小块)

straight grain 直行纹理,直纹(理)

etch [etʃ] *v.* 蚀刻

interpolate [in'tə:pəuleit] *v.* 篡改,添写进去

scrap [skræp] *n.* 小片,废料

seep [si:p] *v.* 渗出,渗漏

servomechanism ['sə:vəu'mekənizəm] *n.* 自动驾驶装置,伺服机构(系统),自动控制装置,跟踪器

coolant ['ku:lənt] *n.* 冷冻剂,冷却液,散热剂