科技英语丛书

English for Mechanical CAD

机械CAD专业英语

主编　邵鹏飞

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内 容 简 介

本书是一本结合双语教学实践和体会编写的专业英语教材。书中内容选自经典英文教材和CAD专业网站，编成10个单元，内容涵盖机械CAD的基本教学内容。第1～3单元介绍CAD技术、图形编程和平面绘图；第4～6单元讲述实体、曲面和装配建模系统；第7～10单元讲述逆向工程、数据交换、产品生命周期管理和几何造型平台。各单元配有大量插图、中文导语和单元练习；对难句和重点内容作了翻译和解释说明；以书中内容为例讲述科技英语的句式特点和翻译技巧。附录提供常用CAD专业词汇表和参考资源信息。

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前　言

本书是为机械工程专业的本科生学习机械CAD所编写的一本专业英语教材，可作为双语教学用书。

本书从经典英文教材和专业网站上选取了与机械CAD相关的10个主题内容，分别编成10个单元，其内容体现了机械CAD技术的基本知识和应用。书中各单元内容取自不同风格的教材和作者，让读者可以学习专业英语中的用词造句和写作方法。

每个单元分为4个部分：第1部分为中文导语，详细介绍了本单元的内容和知识点。第2部分为正文，按照主题和内容分成若干篇章。在一些单元里还安排了补充阅读材料，以供学生进一步阅读和学习。每个篇章后附有单词和专业术语注译、名词解释、长句和难句翻译、背景知识介绍等。第3部分为翻译技巧训练，全部以本书中出现的句子为例讲述科技英语的句式特点和翻译技巧。第4部分是单元练习，设置了问答、填空、选择、判断、翻译练习，供学生复习使用。

每个单元都配有大量的图表，除了原著中的插图外，作者还根据文章内容补充和绘制了不少附图，使得学生能更容易理解所述的文字内容。本书提供了两个附录：附录A列出了本学科领域的重要期刊、学术会议、学术和资讯网站以及专业软件网站；附录B列出了本书中出现的生词术语以及CAD专业的常用词汇。

本书的具体内容包括：第1单元介绍工程设计过程和CAD技术；第2单元叙述计算机图形库和图形编程工具；第3单元以AutoCAD为例讲述计算机平面绘图系统；第4单元讲述实体造型系统和参数化特征造型；第5单元讲解自由曲线曲面的概念和生成技术；第6单元介绍装配建模的概念和装配过程；第7单元讲述逆向工程技术和应用；第8单元以IGES、STEP为重点介绍数据交换标准；第9单元讲述产品生命周期管理(PLM)的概念；第10单元介绍几何造型平台Parasolid和ACIS以及NX在机械CAD中的应用。

感谢中国科学技术大学教务处对双语教学示范课程“机械CAD”的支持，感谢中国科学技术大学出版社对本书编写和出版的支持。

由于编者水平有限，书中若有不妥之处，敬请指正。

编　者

2011年3月

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Unit 1 The Engineering Design Process

导 语

工程设计过程是利用现有资源、知识等对系统或产品进行设计，使之达到实用、美观、经济、环保和兼具社会效益的过程。现代企业的设计过程已从传统的线性顺序设计过程转向以并行工程为理念的异地网络化的协同设计过程。

计算机辅助设计(Computer-Aided Design，CAD)技术在如今的工程设计领域已经无所不在，它已成为产品和系统设计的最有力工具。目前的CAD系统多是CAD/CAM/CAE的集成系统，包括很多应用模块，如实体和曲面建模、装配建模、工业设计、运动仿真、有限元分析、数控加工、钣金设计、注塑模具等。其中，CAD几何造型系统构成这些应用模块的数据核心，也是设计过程中最基本的工具。

随着计算机软硬件技术和网络科技的迅猛发展，集成软件的目标定位已从设计、分析和加工过程的集成发展为服务于完整企业活动的以产品全生命周期管理(Product Lifecycle Management，PLM)为目标的应用。

Text 1 Design

Design is the process of conceiving or inventing ideas mentally and communicating those ideas to others in a form that is easily understood. Most often, the tool is graphics.

Design is used for two primary purposes: personal expression, and product or process development. Design for personal expression, usually associated with art, is divided into concrete (realistic) and abstract design and is often a source of beauty and interest (Fig. 1.1). When a design serves some useful purpose, such as the shape of a new automobile wheel, it is classified as a design for product or process development.

An abstract design, such as this sculpture, is meant to evoke a personal, emotional response to the viewer. Though it does not serve the same functional purpose as the office building behind it, the sculpture enhances the office worker's environment.

Fig. 1.1 Abstract design

Aesthetic design is concerned with the look and feel of a product. Industrial designers specialize in the aesthetic qualities of products, as well as other elements related to human-machine functionality (Fig. 1.2).

Fig. 1.2 Aesthetic design

Aesthetic design is an important part of the engineering design process. Industrial designers day a major role in the engineering design process for consumer products, such as automobiles, appliances, and consumer electronics.

Functional design is concerned with the function of a product or process. Airflow over an automobile is an example of a functional design element. Most engineers are concerned with functional elements (Fig. 1.3).

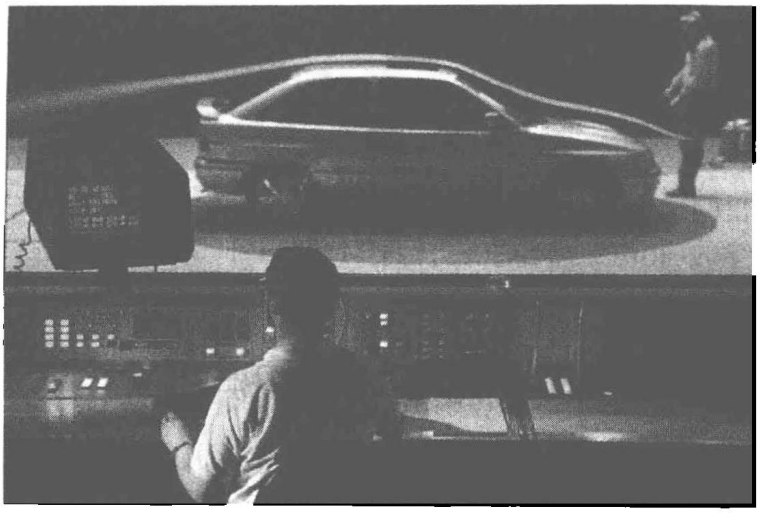

Fig. 1.3 Functional design

The wind tunnel testing of a new automobile determines how the car would function when moving through the air. This is an example of functional design.

Many products will have both aesthetic and functional design elements, requiring the engineers and designers to work as a team to produce a product or system that is both functionally and aesthetically pleasing (Fig. 1.4).

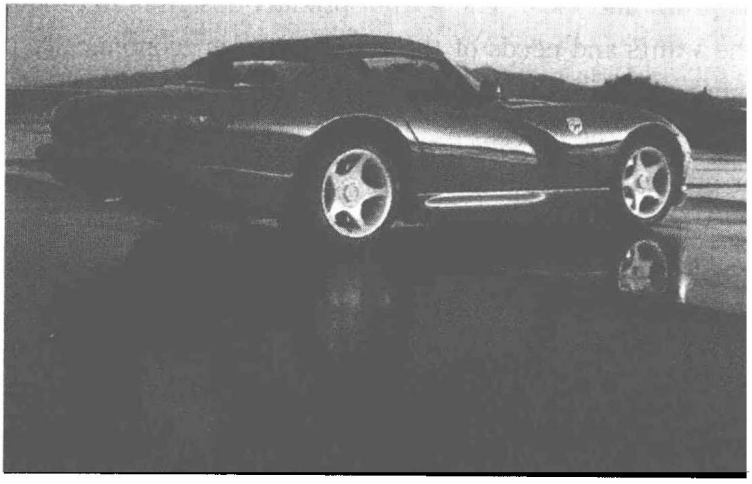

Fig. 1.4 Aesthetic and functional design

Aesthetic and functional design combine to give this sports car a look of speed and elegance. The car is the result of a product design intended to meet the needs of a specific market.

Vocabulary

conceive 想出(主意、计划等),构想
aesthetic 美学的,审美的,美感的
functionality 功能性,性能
evoke 唤起,激起
wind tunnel 风洞

Text 2 The Engineering Design Process

Engineering design is a problem-solving process that uses knowledge, resources, and existing products to create new goods and processes. Engineering design has both aesthetic and functional elements and can be broken into two broad categories: product design and system design. The design process, as implemented by industry, varies among companies; some use a linear or step-by-step approach, while others use a more integrated team approach.

Product design is the process used to create new products, such as a new automobile model, a new appliance, or a new type of wheelchair. Product design is a complex activity that includes market, production, sales, service, function, and profit analyses. The goal of product design is to produce a product that meets the wants and needs of the consumers, is economically produced, is safe for the consumers and the environment, and is profitable to the company.

System design is the process used to create a new system or process. A system engineer or an industrial engineer is an engineer that specializes in designing system. A system is an orderly arrangement of parts that are combined to serve one general function. Examples of the system designs include the arrangement of the assembly process in a factory; the heating, ventilation, and air-conditioning system in a structure; and the electrical system in an automobile. The objective is to produce a system that serves a specific function economically, is safe for the consumers and the environment, and is profitable to the company.

Engineering design is one of the processes normally associated with the entire business or enterprise, from receipt of the order or product idea, to maintenance of the product and all stages in Fig. 1.5. The design process requires in-

put from such areas as customers' needs, materials, capital, energy, time requirements, and human knowledge and skills.

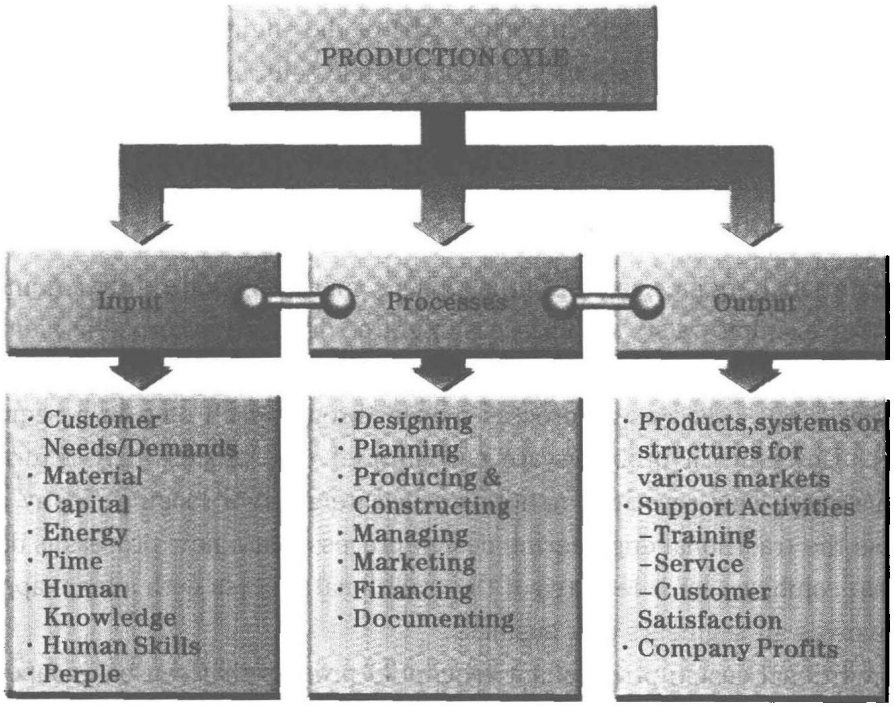

Fig. 1.5 Manufacturing business process

Two important societal concerns that an engineer must take legal and environmental issues into account. When designing, it is important for the engineer understand that legal issues may affect the designed product. Safety laws related to automobiles are an example of how government legislation can affect a design. Government regulations related to the environment may also have a bearing on the final outcome of the design. For example, the emission requirements on an automobile engine have a great effect on the final design.

A manufacturing business or enterprise includes all the inputs, processes, and outputs necessary to produce a product or construct a structure. Designing is one of the major processes in such a business.

An engineering design involves both a process and a product. A process is a series of continuous actions ending in a particular result. A product is anything

produced as a result of some processes. As the design of a product or a process is developed, the design team applies engineering principles, follows budgetary constraints, and takes legal and social issues into account.

Graphics is an extremely important part of the engineering design process, which uses graphics as a tool to visualize possible solutions and to document the design for communications purposes. Graphics or geometric modeling using CAD is used to visualize, analyze, document, and produce a product or a process.

Traditional Engineering Design

Traditional engineering design is a linear approach divided into a number of steps. For example, a six-step process might be divided into problem identification, preliminary ideas, refinement, analysis, documentation, and implementation (Fig. 1. 6). The design process moves through each step in a sequential manner. However, if problems are encountered, the process may return to a previous step. This repetitive action is called iteration or looping. Many industries use the traditional engineering design process, but a new process is developing that combines some features of the traditional process with a team approach that involves all segments of a business.

Traditional design process is a sequential process that can be grouped into six major activities, beginning with identification of the problem and ending with documentation of the design.

Concurrent Engineering Design

The production process executes the final results of the design process to produce a product or a system. In the past, the creative design process was separated from the production process. With the advent of computer modeling, this separation is no longer necessary, and the modern engineering design approach brings both processes together.

Concurrent engineering is a nonlinear team approach to design that brings together the input, processes, and output elements necessary to produce a product. The people and processes are brought together at the very beginning, which is not normally done in the linear approach. The team consists of design and production engineers, technicians, marketing and finance personnel, planners, and managers, who work together to solve a problem and produce a

product. Many companies are finding that concurrent engineering practices result in a better, higher quality product, more satisfied customers, fewer manufacturing problems, and a shorter cycle time from design initiation to final production.

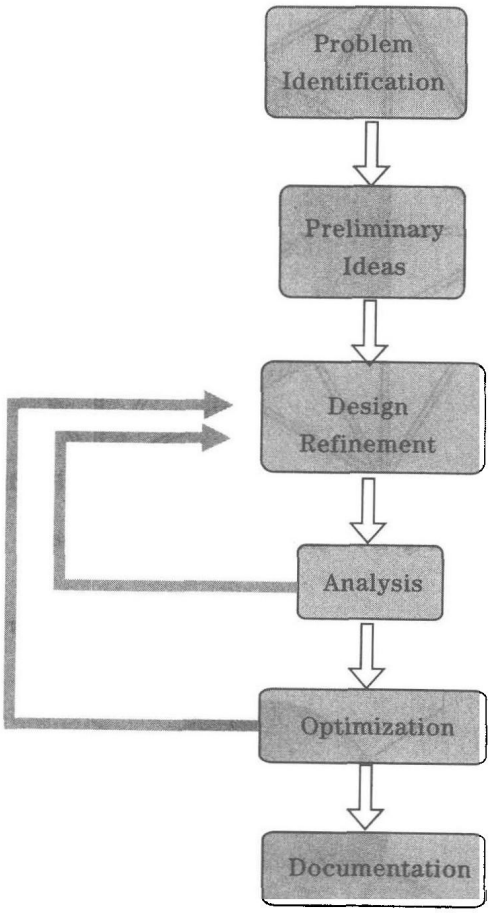

Fig. 1.6 Linear engineering design process

Fig. 1. 7 and Fig. 1. 8 represent the concurrent approach to engineering design, based on 3D modeling. The three intersecting circles represent the concurrent nature of this design approach. The center area in Fig. 1. 8 represents the 3D computer model and reflects the central importance of 3D modeling and graphics knowledge in engineering design and production. With the use of a

modeling approach, everyone in the team can have access to the current design through a computer terminal. This data sharing is critically important to the success of the design process.

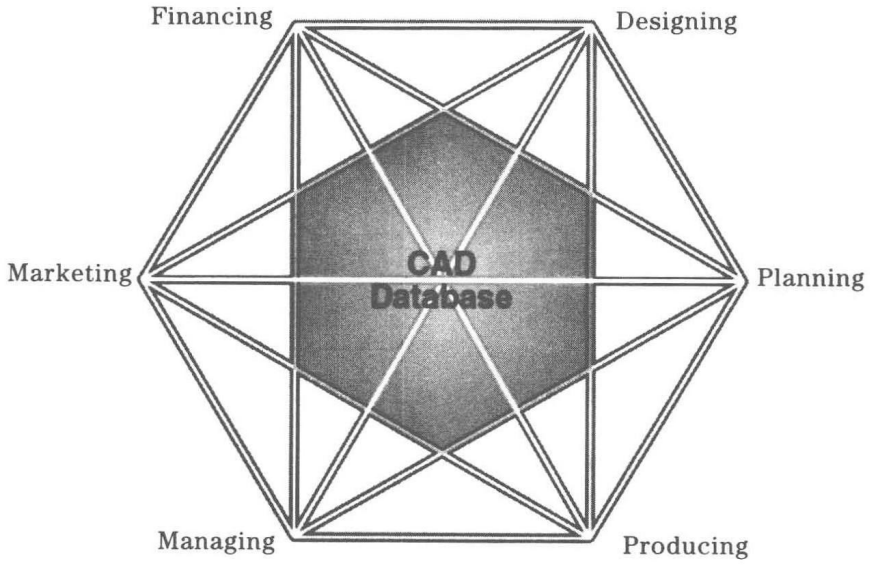

Fig. 1.7 Sharing the CAD database

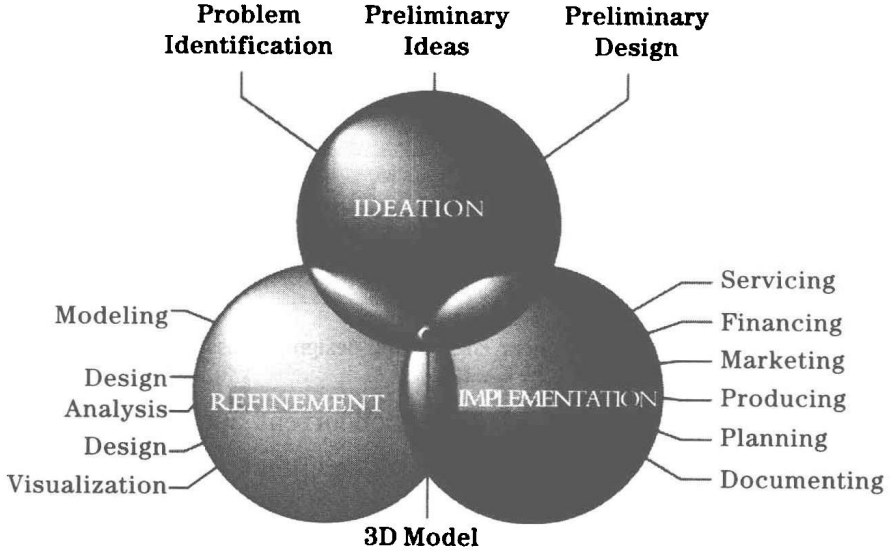

Fig. 1.8 Concurrent engineering design

The concurrent engineering model shows how every area in an enterprise is related, and the CAD database is the common thread of information between areas.

The engineering design process consists of three overlapping areas: ideation, refinement, and implementation, which all share the same 3D CAD database.

Through the sharing of information, often in the form of a database, it is possible for all areas of the enterprise to work simultaneously on their particular needs as the product is being developed. For example, a preliminary 3D model could be created by the design engineers early in the ideation phase. A mechanical engineer could use the same 3D model to analyze its thermal properties. The information gained from this preliminary analysis could then be given to the design engineers, who could then make any necessary changes early in the ideation phase, minimizing costly changes later in the design process.

Vocabulary

implementation 实施,实现
ventilation 通风
enterprise 企业,企业经营,企业活动
maintenance 保持,维持,维修
legislation 立法
emission 排放
budgetary 预算
sequential 顺序的
iteration 重(反)复,迭代
loop 循环,圆圈,环形
nonlinear 非线性的
overlap 重叠
concurrent 并行的,并发的
simultaneously 同时地

Text 3 Collaborative Design

Collaborative Engineering

Collaborative Engineering (CE) is the systematic approach to the integrated, concurrent design of products and related processes, including manufacturing, product service, and support. This approach is intended to cause developers to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and users' requirements. The objective of CE is to reduce the development cycle time through a better integration of re-

sources, activities, and processes.

Collaborative Design

Collaborative design is an interactive process of real-time communication among members of a design team who are physically in different locations. During this process, several engineers or a team of designers are simultaneously involved to agree or disagree on design issues and address them during the early phases of product design. Concurrent engineering is considered the grander philosophy that motivates collaborative design as a key ingredient.

Collaborative design fosters the ability to conceptually design a product in a distributed manner by involving supply-chain and other members who have the expertise to accomplish the design task at hand. It has the advantages over traditional design, of increasing productivity, shortening product development lifecycle, and improving competitiveness.

The client program (or client, for short), installed on one computer (known as the client computer) communicates with the server program (or server, for short) installed on the other computer(Fig. 1.9).

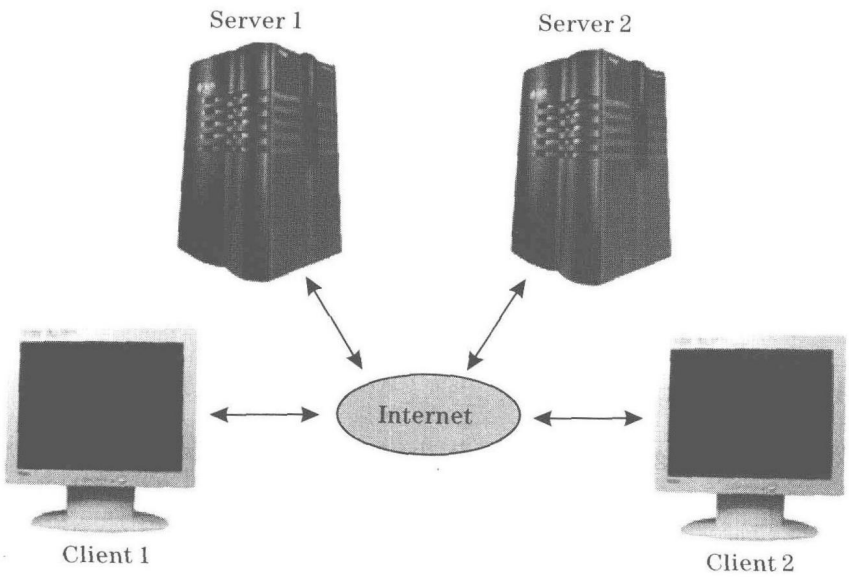

Fig. 1.9 Client/Server model