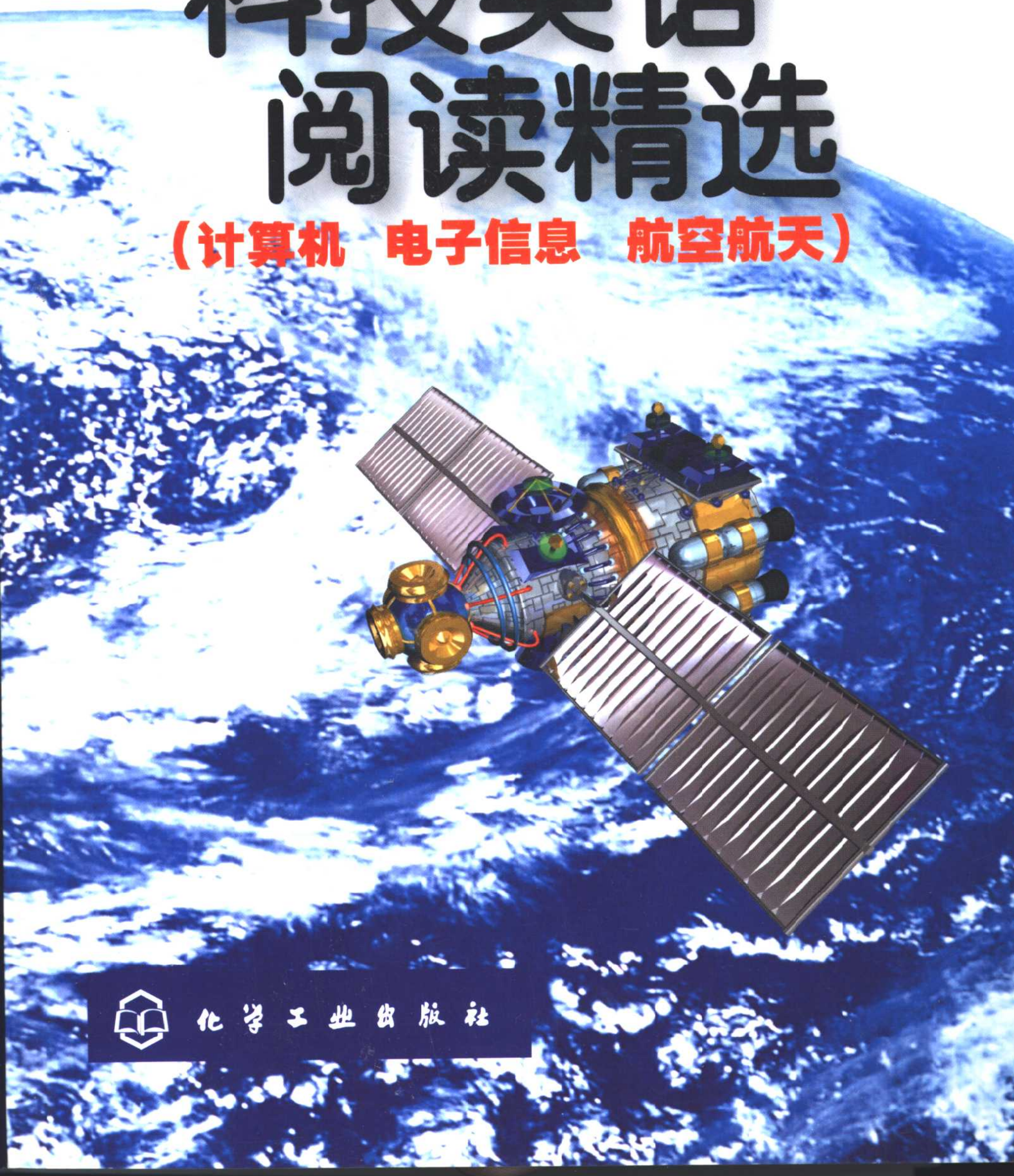
王汝琳 编

科技英语阅读精选

（计算机 电子信息 航空航天）



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前　言

本书是计算机、电子信息及航空航天专业的专业英语阅读材料。专业英语是在结束了基础英语的学习后开设的，目的是使读者巩固已有的英语知识，进一步提高英语水平，培养读者阅读相关专业英语资料的能力。

外语是大学本科教育的重要课程，熟练掌握一门外语是一个科技工作者应具备的一项基本技能，外语能力是衡量新时代一个人素质的一个重要方面。英语是应用最广、最普及的一种语言，而计算机、电子信息及航空航天技术是发展迅速、影响深远的学科，也是目前的热门科学和技术领域。编者希望通过本书，能对提高读者的英语水平和扩大专业知识做出贡献。

专业英语是基础英语的继续，学完基础英语的读者，阅读本书应当没有很大的困难。本书选材的难度定位在科普读物与专业科技文章之间。为了便于读者学习和理解，作者对原文进行了部分改编，对部分词汇给出了中文注解。同时在编写上，阅读材料的难度逐步加深，以便帮助读者逐步提高阅读专业科技英语的能力。

本书编写过程中，研究生刘慧明和雷丽琴同志帮助编辑了专业词汇的注释，在此表示感谢。由于编者水平有限，缺点和错误在所难免，希望广大读者批评指正。

编者

2003. 9. 15

内 容 提 要

本书是计算机、电子信息、航空航天等专业的科技英语阅读参考书。

全书共摘选 34 篇文章，涵盖计算机科学、电子信息技术、航空航天等专业。每篇文章后面给出部分单词和词组的注解。全书选材的难度在科普读物和科技论文之间，每篇文章的难度逐步加深，使读者便于学习和理解。本书力求将英语和专业紧密结合，使读者既能巩固基础英语，又能提高英语的阅读理解和应用能力。

本书可供理工科院校计算机、电子信息、航空航天等专业的师生使用，也可作为相关专业工程技术人员学习英语或其他科技人员了解此类专业的参考书。

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CONTENTS

Unit 1 Computer Science

1 Introduction

Computer science, study of the theory, experimentation, and engineering that form the basis for the design and use of computers——devices that automatically process information. Computer science traces its roots to work done by English mathematician Charles Babbage, who first proposed a programmable mechanical calculator in 1837. Until the advent of electronic digital computers in the 1940s, computer science was not generally distinguished as being separate from mathematics and engineering. Since then it has sprouted numerous branches of research that are unique to the discipline.

2 The Development of Computer Science

Early work in the field of computer science during the late 1940s and early 1950s focused on automating the process of making calculations for use in science and engineering. Scientists and engineers developed theoretical models of computation that enabled them to analyze how efficient different approaches were in performing various calculations. Computer science overlapped considerably during this time with the branch of mathematics known as numerical analysis, which examines the accuracy and precision of calculations.

As the use of computers expanded between the 1950s and the 1970s, the focus of computer science broadened to include simplifying the use of computers through programming languages——artificial languages used to program computers, and operating systems——computer programs that provide a useful interface between a computer and a user. During this time, computer scientists were also experimenting with new applications and computer designs, creating the first computer networks, and exploring relationships between computation and thought.

In the 1970s, computer chip manufacturers began to mass produce microprocessors——the electronic circuitry that serves as the main information processing center in a computer. This new technology revolutionized the computer industry by dramatically reducing the cost of building computers and greatly increasing their processing speed. The microprocessor made possible the advent of the personal computer, which resulted in an explosion in the use of computer applications. Between the early 1970s and 1980s, computer science rapidly expanded in an effort to develop new applications for personal computers and to drive the technological advances in the computing industry. Much of the earlier research that had been done began to reach the public through personal computers, which derived most of their early software from existing concepts and systems.

Computer scientists continue to expand the frontiers of computer and information systems by pioneering the designs of more complex, reliable, and powerful computers; enabling networks of computers to efficiently exchange vast amounts of information; and seeking ways to make computers behave intelligently. As computers become an increasingly integral part of modern society, computer scientists strive to solve new problems and invent better methods of solving current problems.

The goals of computer science range from finding ways to better educate people in the use of existing computers to highly speculative research into technologies and approaches that may not be viable for decades. Underlying all of these specific goals is the desire to better the human condition today and in the future through the improved use of information.

3 Theory and Experiment

Computer science is a combination of theory, engineering, and experimentation. In some cases, a computer scientist develops a theory, then engineers a combination of computer hardware and software based on that theory, and experimentally tests it. An example of such a theory-driven approach is the development of new software engineering tools that are then evaluated in actual use. In other cases, experimentation may result in new theory, such as the discovery that an artificial neural network exhibits behavior similar to neurons in the brain, leading to a new theory in neurophysiology.

It might seem that the predictable nature of computers makes experimentation unnecessary because the outcome of experiments should be known in advance. But when computer systems and their interactions with the natural world become sufficiently complex, unforeseen behaviors can result. Experimentation and the traditional scientific method are thus key parts of computer science.

4 Major Branches of Computer Science

Computer science can be divided into four main fields: software development, computer architecture (hardware), human-computer interfacing (the design of the most efficient ways for humans to use computers), and artificial intelligence (the attempt to make computers behave intelligently). Software development is concerned with creating computer programs that perform efficiently. Computer architecture is concerned with developing optimal hardware for specific computational needs. The areas of artificial intelligence (AI) and human-computer interfacing often involve the development of both software and hardware to solve specific problems.

4.1 Software Development

In developing computer software, computer scientists and engineers study various areas and techniques of software design, such as the best types of programming languages and algorithms (see below) to use in specific programs, how to efficiently store and retrieve information, and the computational limits of certain software-computer combinations. Software designers must consider many factors when developing a program. Often, program performance in one area must be sacrificed for the sake of the general performance of the software. For instance, since computers have only a limited amount of memory, software designers must limit the number of features they include in a program so that it will not require more memory than the system it is designed for can supply.

Software engineering is an area of software development in which computer scientists and engineers study methods and tools that facilitate the efficient development of correct, reliable, and robust computer programs. Research in this branch of computer science considers all the phases of the software life cycle, which begins with a formal problem specification, and progresses to the design of a solution, its implementation as a program, testing of the program, and program maintenance. Software engineers develop software tools and collections of tools called programming environments to improve the development process. For example, tools can help to manage the many components of a large program that is being written by a team of programmers.

Algorithms and data structures are the building blocks of computer programs. An algorithm is a precise step-by-step procedure for solving a problem within a finite time and using a finite amount of memory. Common algorithms include searching a collection of data, sorting data, and numerical operations such as matrix multiplication. Data structures are patterns for organizing information, and often represent relationships between data values. Some common data structures are called lists, arrays, records, stacks, queues, and trees.

Computer scientists continue to develop new algorithms and data structures to solve new problems and improve the efficiency of existing pro-

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grams. One area of theoretical research is called algorithmic complexity. Computer scientists in this field seek to develop techniques for determining the inherent efficiency of algorithms with respect to one another. Another area of theoretical research called computability theory seeks to identify the inherent limits of computation.

Software engineers use programming languages to communicate algorithms to a computer. Natural languages such as English are ambiguous——meaning that their grammatical structure and vocabulary can be interpreted in multiple ways——so they are not suited for programming. Instead, simple and unambiguous artificial languages are used. Computer scientists study ways of making programming languages more expressive, thereby simplifying programming and reducing errors. A program written in a programming language must be translated into machine language (the actual instructions that the computer follows). Computer scientists also develop better translation algorithms that produce more efficient machine language programs.

Databases and information retrieval are related fields of research. A database is an organized collection of information stored in a computer, such as a company's customer account data. Computer scientists attempt to make it easier for users to access databases, prevent access by unauthorized users, and improve access speed. They are also interested in developing techniques to compress the data, so that more can be stored in the same amount of memory. Databases are sometimes distributed over multiple computers that update the data simultaneously, which can lead to inconsistency in the stored information. To address this problem, computer scientists also study ways of preventing inconsistency without reducing access speed.

Information retrieval is concerned with locating data in collections that are not clearly organized, such as a file of newspaper articles. Computer scientists develop algorithms for creating indexes of the data. Once the information is indexed, techniques developed for databases can be used to organize it. Data mining is a closely related field in which a large body of information is analyzed to identify patterns. For example, mining the sales records from a grocery store could identify shopping patterns to help guide the store in stocking its shelves more effectively.

Operating systems are programs that control the overall functioning of a computer. They provide the user interface, place programs into the computer's memory and cause it to execute them, control the computer's input and output devices, manage the computer's resources such as its disk space, protect the computer from unauthorized use, and keep stored data secure. Computer scientists are interested in making operating systems easier to use, more secure, and more efficient by developing new user interface designs, designing new mechanisms that allow data to be shared while preventing access to sensitive data, and developing algorithms that make more effective use of the computer's time and memory.

The study of numerical computation involves the development of algorithms for calculations, often on large sets of data or with high precision. Because many of these computations may take days or months to execute, computer scientists are interested in making the calculations as efficient as possible. They also explore ways to increase the numerical precision of computations, which can have such effects as improving the accuracy of a weather forecast. The goals of improving efficiency and precision often conflict, with greater efficiency being obtained at the cost of precision and vice versa.

Symbolic computation involves programs that manipulate nonnumeric symbols, such as characters, words, drawings, algebraic expressions, encrypted data (data coded to prevent unauthorized access), and the parts of data structures that represent relationships between values. One unifying property of symbolic programs is that they often lack the regular patterns of processing found in many numerical computations. Such irregularities present computer scientists with special challenges in creating theoretical models of a program's efficiency, in translating it into an efficient machine language program, and in specifying and testing its correct behavior.

4.2 Computer Architecture

Computer architecture is the design and analysis of new computer systems. Computer architects study ways of improving computers by increasing their speed, storage capacity, and reliability, and by reducing their cost and power consumption. Computer architects develop both software and hardware models to analyze the performance of existing and proposed computer designs, then use this analysis to guide development of new computers. They are often involved with the engineering of a new computer because the accuracy of their models depends on the design of the computer's circuitry. Many computer architects are interested in developing computers that are specialized for particular applications such as image processing, signal processing, or the control of mechanical systems. The optimization of computer architecture to specific tasks often yields higher performance, lower cost, or both.

4.3 Artificial Intelligence (AI)

Artificial intelligence research seeks to enable computers and machines to mimic human intelligence and sensory processing ability, and models human behavior with computers to improve our understanding of intelligence. The many branches of AI research include machine learning, inference, cognition, knowledge representation, problem solving, case-based reasoning, natural language understanding, speech recognition, computer vision, and artificial neural networks.

A key technique developed in the study of artificial intelligence is to specify a problem as a set of states, some of which are solutions, and then search for solution states. For example, in chess, each move creates a new state. If a computer searched the states resulting from all possible sequences of moves, it could identify those that win the game. However, the number of states associated with many problems (such as the possible number of moves needed to win a chess game) is so vast that exhaustively searching them is impractical. The search process can be improved through the use of heuristics——rules that are specific to a given problem and can therefore help guide the search. For example, a chess heuristic might indicate that when a move results in checkmate, there is no point in examining alternate moves.

4.4 Robotics

Another area of computer science that has found wide practical use is robotics——the design and development of computer controlled mechanical devices. Robots range in complexity from toys to automated factory assembly lines, and relieve humans from tedious, repetitive, or dangerous tasks. Robots are also employed where requirements of speed, precision, consistency, or cleanliness exceed what humans can accomplish. Roboticists——scientists involved in the field of robotics——study the many aspects of controlling robots. These aspects include modeling the robot's physical properties, modeling its environment, planning its actions, directing its mechanisms efficiently, using sensors to provide feedback to the controlling program, and ensuring the safety of its behavior. They also study ways of simplifying the creation of control programs. One area of research seeks to provide robots with more of the dexterity and adaptability of humans, and is closely associated with AI.

4.5 Human-Computer Interfacing

Human-computer interfaces provide the means for people to use computers. An example of a human-computer interface is the keyboard, which lets humans enter commands into a computer and enter text into a specific application. The diversity of research into human-computer interfacing corresponds to the diversity of computer users and applications. However, a unifying theme is the development of better interfaces and experimental evaluation of their effectiveness. Examples include improving computer access for people with disabilities, simplifying program use, developing three-dimensional input and output devices for virtual reality, improving handwriting and speech recognition, and developing heads-up displays for aircraft instruments in which critical information such as speed, altitude, and heading are displayed on a screen in front of the pilot's window. One area of research, called visualization, is concerned with graphically presenting large amounts of data so that people can comprehend its key properties.

5. Connection of Computer Science to Other Disciplines

Because computer science grew out of mathematics and electrical engineering, it retains many close connections to those disciplines. Theoretical computer science draws many of its approaches from mathematics and logic. Research in numerical computation overlaps with mathematics research in numerical analysis. Computer architects work closely with the electrical engineers who design the circuits of a computer.

Beyond these historical connections, there are strong ties between AI research and psychology, neurophysiology, and linguistics. Human-computer interface research also has connections with psychology. Roboticists work with both mechanical engineers and physiologists in designing new robots.

Computer science also has indirect relationships with virtually all disciplines that use computers. Applications developed in other fields often involve collaboration with computer scientists, who contribute their knowledge of algorithms, data structures, software engineering, and existing technology. In return, the computer scientists have the opportunity to observe novel applications of computers, from which they gain a deeper insight into their use. These relationships make computer science a highly interdisciplinary field of study.

Words and Expressions

1. artificial neural network 人工神经网络

2. neurophysiology *n.* 神经生理学
3. algorithms *n*【数】运算法则
4. matrix multiplication 矩阵乘法
5. data mining 数据采集
6. encrypt *v.*【计】加密，将……译成密码
7. artificial intelligence 人工智能
8. virtual reality 【计】虚拟现实

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