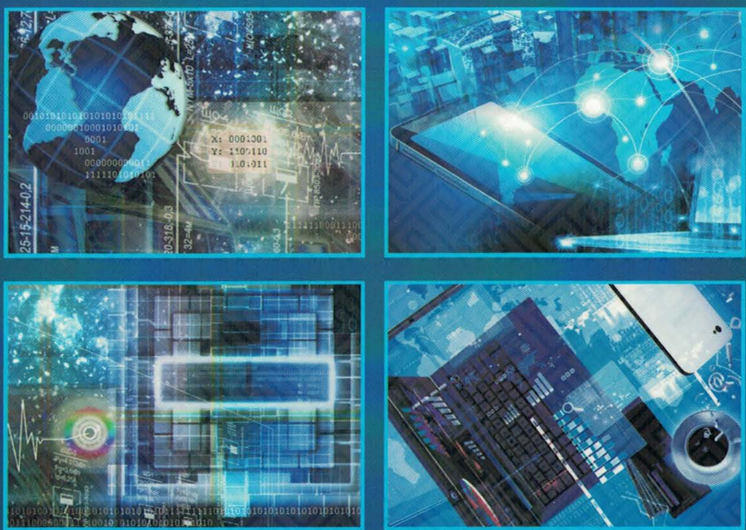
高等院校通信与信息专业规划教材

通信工程专业英语

ENGLISH FOR TELECOMMUNICATION ENGINEERING



刘金龙　张之光　龚育尔　钱平　代小艳　编著

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English for Telecommunication Engineering

刘金龙　张之光　龚育尔　钱　平　代小艳　编著

机 械 工 业 出 版 社

本书共12个单元，前6个单元介绍了通信发展的简史，并从“系统”的角度介绍了一些经典的和最新的通信系统，包括蜂窝移动通信系统、计算机网络通信系统、光纤通信系统、物联网、车联网、量子通信系统等；后6个单元介绍了通信工程领域的一些核心技术，涵盖交换技术、信息安全技术、复用和多址技术、调制解调技术、无线接入技术（WiFi、NFC）、数字信号处理技术等。每个单元又分为Text A和Text B两部分，A篇为该单元阅读和翻译教学的重点，B篇为A篇的补充和扩展，两者形式独立、内容相关。本书构思独特、选材新颖、内容丰富、语言规范、难易适中。每篇课文后面附有专业词汇、难点注释以及相应的练习，并且书后给出了每篇课文的参考译文，有助于学生的学习和理解。本书配有相应的课件，便于教学。

本书可作为高等院校通信工程及相关专业本科生“专业英语”课程的教材，也可供相关专业工程技术人员学习和参考。

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前　言

本书主要作为高等院校通信工程及相关专业本科生的“专业英语”课程教材使用，开课时间一般为第三或第四学年；也可供相关领域工程技术人员学习和参考。本书由通信专业博士和英语专业教师合作撰写，实现了专业和语言的有机结合，具有如下特点：

1. 构思独特

本书首先介绍了通信发展的简史以及代表人物——赫兹，然后从“系统”的角度对通信领域中一些经典的和最新的通信系统进行宏观介绍，最后对这些系统中采用的关键技术进行详细阐述。本书架构合理，内容全面，做到了“系统”和技术的有机结合。

2. 选材新颖

本书从大量的外文资料中遴选出了一些难度适中、语言严谨、能够展现当下最新的通信系统和核心技术的篇章作为素材，譬如物联网、车联网、量子通信、WiFi 和 NFC 等。选材能够有效地拓展学生的视野，使其了解通信行业的最新发展动向。

3. 题材丰富

本书选编的24篇课文，题材涉及行业报告、人物传记、维基百科、新闻报道和技术文档等，能够让学生了解不同题材下的专业英语的风格和写作规范，有助于学生对专业英语在不同题材下呈现特点的把握。

此外，课文的编排也充分考虑到学生在先修大学英语时的学习模式，每篇课文后面附有专业词汇、难点注释以及相应的练习，书后给出了每篇课文的参考译文，有助于学生的学习和理解。本书配有相应的课件，便于教学。同时建议，课程的教授以每单元中的 Text A 为主，Text B 作为选学内容，也可以在教师的指导下留给学生自学。

本书的策划、选材、翻译、校对与审核由刘金龙、张之光、龚育尔完成；Text A 的课后词汇、注解、习题由代小艳编写；Text B 的课后词汇、注解、习题与本书的课件由钱平、龚育尔编写。本书在编写过程中得到了南京航空航天大学电子信息工程学院雷磊副教授和南京邮电大学通信与信息工程学院刘旭副教授的悉心指导，在此对他们深表感谢。

限于编者水平，加之时间仓促，书中难免有疏漏和不妥之处，恳请读者使用后提出宝贵意见，以便今后能进一步改进和充实本书内容。

编　者

目　录

Unit 1

Text A

History of Telecommunication

The history of telecommunication began with the use of smoke signals and drums in Africa, the Americas and parts of Asia. In the 1790s, the first fixed semaphore systems emerged in Europe; however it was not until the 1830s that electrical telecommunication systems started to appear. This article details the history of telecommunication and the individuals who helped make telecommunication systems what they are today. The history of telecommunication is an important part of the larger history of communication.

1. Ancient systems and optical telegraphy

Early telecommunications included smoke signals and drums. Talking drums[1] were used by natives in Africa, New Guinea and South America, and smoke signals in North America and China. Contrary to what one might think, these systems were often used to do more than merely announce the presence of a military camp.

During the Middle Ages, chains of beacons were commonly used on hilltops as a means of relaying a signal. Beacon chains suffered the drawback that they could only pass a single bit of information, so the meaning of the message such as "the enemy has been sighted" had to be agreed upon in advance. One notable instance of their use was during the Spanish Armada, when a beacon chain relayed a signal from Plymouth to London that signaled the arrival of the Spanish warships.[2]

French engineer Claude Chappe began working on visual telegraphy in 1790, using pairs of "clocks" whose hands pointed at different symbols. These did not prove quite viable at long distances, and Chappe revised his model to use two sets of jointed wooden beams. Operators moved the beams using cranks and wires. He built his first telegraph line between Lille and Paris, followed by a line from Strasbourg to Paris (see Figure 1-1).

However, semaphore as a communication system suffered from the need for skilled operators and expensive towers often at intervals of only ten to thirty kilometers. As a result, the last commercial line was abandoned in 1880.

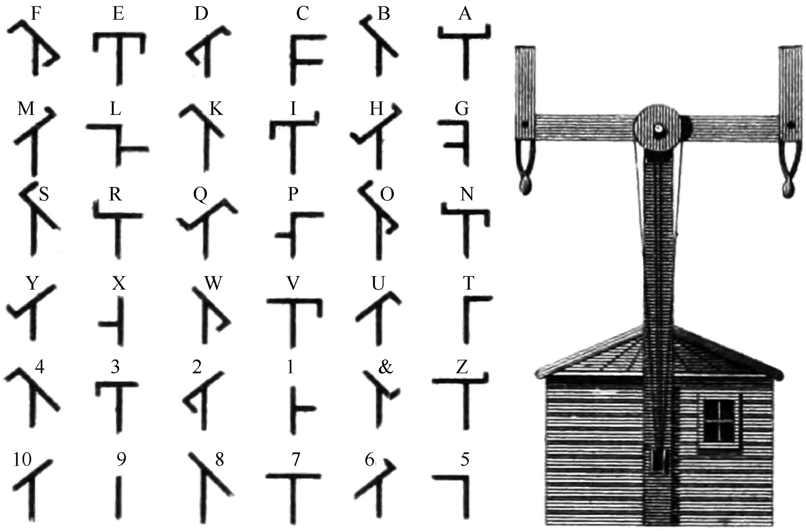

Figure 1-1

2. Electrical telegraph

Experiments on communication with electricity, initially unsuccessful, started in about 1726. Scientists including Laplace, Ampère, and Gauss were involved. The first working telegraph was built by Francis Ronalds in 1816 and used static electricity.

Charles Wheatstone and William Fothergill Cooke patented a five-needle, six-wire system, which entered commercial use in 1838. It used the deflection of needles to represent messages and started operating over twenty-one kilometers of the Great Western Railway on April 9, 1839. Both Wheatstone and Cooke viewed their device as "an improvement to the [existing] electromagnetic telegraph" not as a new device.

On the other side of the Atlantic Ocean, Samuel Morse developed a version of the electrical telegraph which he demonstrated on September 2, 1837. Alfred Vail saw this demonstration and joined Morse to develop the register—a telegraph terminal that integrated a logging device for recording messages to paper tape. This was demonstrated successfully over three miles (five kilometers) on January 6, 1838 and eventually over 40 miles (64 kilometers) between Washington, D. C. and Baltimore on May 24, 1844. The patented invention proved lucrative and by 1851 telegraph lines in the United States spanned over 20, 000 miles (32, 000 kilometers). Morse's most important technical contribution to this telegraph was the simple and highly efficient Morse Code, co-developed with Vail, which was an important advance over Wheatstone's more complicated and expensive system, and required just two wires. [3] The communications efficiency of the Morse Code preceded that of the Huffman code in digital communications by over 100 years, but Morse and Vail developed the code purely empirically, with shorter codes for more frequent letters.

3. Telephone

The electric telephone was invented in the 1870s; it was based on earlier work with harmonic (multi-signal) telegraphs. The first commercial telephone services were set up in 1878 and 1879 on both sides of the Atlantic in the cities of New Haven and London. Alexander Graham Bell held the master patent for the telephone that was needed for such services in both countries. All other patents for electric telephone devices and features flowed from this master patent. Credit for the invention of the electric telephone has been frequently disputed, and new controversies over the issue have arisen from time-to-time. As with other great inventions such as radio, television, the light bulb, and the digital computer, there were several inventors who did pioneering experimental work on voice transmission over a wire, who then improved on each other's ideas. [4] However, the key innovators were Alexander Graham Bell and Gardiner Greene Hubbard, who created the first telephone company, the Bell Telephone Company in the United States, which later evolved into American Telephone & Telegraph (AT&T), at times the world's largest phone company.

The first commercial telephone services were set up in 1878 and 1879 on both sides of the Atlantic in the cities of New Haven, Connecticut, and London, England. The technology grew quickly from this point, with inter-city lines being built and telephone exchanges in every major city of the United States by the mid-1880s. The First transcontinental telephone call occurred on January 25, 1915. Despite this, transatlantic voice communication remained impossible for customers until January 7, 1927 when a connection was established using radio.

4. Radio and television

Over several years starting in 1894 the Italian inventor Guglielmo Marconi built the first complete, commercially successful wireless telegraphy system based on airborne electromagnetic waves (radio transmission). In December 1901, Marconi established wireless communication between St. John's, Newfoundland and Poldhu, Cornwall (England), earning him a Nobel Prize in Physics (which he shared with Karl Braun). In 1900 Reginald Fessenden was able to wirelessly transmit a human voice.

For most of the twentieth century televisions used the cathode ray tube invented by Karl Braun. The first version of such a television to show promise was produced by Philo Farnsworth, who demonstrated crude silhouette images to his family in Idaho on September 7, 1927. Farnsworth's device would compete with the concurrent work of Kalman Tihanyi and Vladimir Zworykin. Though the execution of the device was not yet what everyone hoped it could be, it earned Farnsworth a small production company. In 1934, he gave the first public demonstration of the television at Philadelphia's Franklin Institute and opened his own broadcasting station.

After mid-century the spread of coaxial cable and microwave radio relay allowed television networks to spread across even large countries.

Television is not solely a technology limited to its basic and practical application. It functions both as an appliance, and also as a means for social story telling and message dissemination. It is a cultural tool that provides a communal experience of receiving information and experiencing fantasy. It acts as a "window to the world" by bridging audiences from all over through programming of stories, triumphs, and tragedies that are outside of personal experiences.

5. Satellite

The first U. S. satellite to relay communications was Project SCORE in 1958, which used a tape recorder to store and forward voice messages. It was used to send a Christmas greeting to the world from U. S. President Dwight D. Eisenhower.

Telstar was the first active, direct relay commercial communications satellite. Belonging to AT&T as part of a multi-national agreement among AT&T, Bell Telephone Laboratories, NASA, the British General Post Office, and the French National PTT (Post Office) to develop satellite communications, it was launched by NASA from Cape Canaveral on July 10, 1962, the first privately sponsored space launch. Relay 1 was launched on December 13, 1962, and became the first satellite to broadcast across the Pacific on November 22, 1963.

The first and historically most important application for communication satellites was in intercontinental long distance telephony. The fixed Public Switched Telephone Network relays telephone calls from land line telephones to an earth station, where they are then transmitted a receiving satellite dish via a geostationary satellite in Earth orbit. Improvements in submarine communications cables, through the use of fiber-optics, caused some decline in the use of satellites for fixed telephony in the late 20th century, but they still exclusively service remote islands such as Ascension Island, Saint Helena, Diego Garcia, and Easter Island, where no submarine cables are in service.

6. Computer networks and the Internet

On September 11, 1940, George Stibitz was able to transmit problems using Teletype 1 to his Complex Number Calculator in New York City and receive the computed results back at Dartmouth College in New Hampshire. This configuration of a centralized computer or mainframe with remote dumb terminals remained popular throughout the 1950s. However, it was not until the 1960s that researchers started to investigate packet switching—a technology that would allow chunks of data to be sent to different computers without first passing through a centralized mainframe. A four-node network emerged on December 5, 1969 among the University of California, Los Angeles, the Stanford Research Institute, the University of Utah and the University of California, Santa Barbara. This network would become ARPANET, which by 1981 would consist of 213 nodes. In June 1973, the first non-U. S. node was added to the network belonging to Norway's NORSAR project. This was shortly followed by a node in London.

ARPANET's development centered on the Request for Comment (RFC)[5] process and on

April 7, 1969, RFC 1 was published. This process is important because ARPANET would eventually merge with other networks to form the Internet and many of the protocols the Internet relies upon today were specified through this process. In September 1981, *RFC 791* introduced the Internet Protocol v4 (IPv4) and *RFC 793* introduced the Transmission Control Protocol (TCP)—thus creating the TCP/IP protocol that much of the Internet relies upon today. A more relaxed transport protocol that, unlike TCP, did not guarantee the orderly delivery of packets called the User Datagram Protocol (UDP) was submitted on 28 August 1980 as *RFC 768*. An e-mail protocol, SMTP, was introduced in August 1982 by *RFC 821* and http://1.0 a protocol that would make the hyperlinked Internet possible was introduced in May 1996 by *RFC 1945*.

Internet access became widespread late in the 20th century, using the old telephone and television networks.

New Words

semaphore	[ˈseməfɔː(r)]	*n.* 臂板信号系统，(铁道) 臂板信号装置
optical	[ˈɒptɪkl]	*adj.* 视觉的，视力的；光学的
telegraphy	[tɪˈlegrəfi]	*n.* 电信技术，超感
beacon	[ˈbiːk(ə)n]	*n.* 灯塔，信号浮标，烽火
relay	[ˈriːleɪ]	*n.* 传递；继电器 *v.* 转播；分程传递
crank	[kræŋk]	*n.* [机] 曲柄 *v.* 转动曲柄移动；使弯曲
patent	[ˈpætnt]	*n.* 专利 *v.* 获得……专利，给予……专利权
lucrative	[ˈluːkrətɪv]	*adj.* 获利多的，赚钱的，合算的
span	[spæn]	*v.* 跨越时间或空间
empirically	[ɪmˈpɪrɪkli]	*adv.* 以经验为主地
harmonic	[hɑːˈmɒnɪk]	*adj.* 和声的，谐和的 *n.* [物] 谐波，和声
transmission	[trænsˈmɪʃn]	*n.* 播送，传送；传动装置
transcontinental	[ˌtrænzkɒntɪˈnentl]	*adj.* 横贯大陆的，大陆那边的
electromagnetic	[ɪˌlektrəʊmægˈnetɪk]	*adj.* [物] 电磁的
cathode	[ˈkæθəʊd]	*n.* [电] 阴极，负极
silhouette	[ˌsɪluˈet]	*n.* 轮廓，剪影；(事物的) 形状
coaxial	[kəʊˈæksɪəl]	*adj.* 同轴的，共轴的
communal	[kəˈmjuːnl]	*adj.* 群体的，公民的，公共的
telephony	[təˈlefəni]	*n.* 电话学，电话，电话制造
geostationary	[ˌdʒiːəʊˈsteɪʃnri]	*adj.* 与地球的相对位置不变的
configuration	[kənˌfɪgəˈreɪʃn]	*n.* 布局，构造；配置
protocol	[ˈprəʊtəkɒl]	*n.* (数据传递的) 协议

ARPANET: Advanced Research Project Agency (美国高级研究计划署)

TCP: Transmission Control Protocol (传输控制协议)

UDP: User Datagram Protocol (用户数据报协议)

Notes

[1] Talking drum（信息鼓）：西非的一种形状像沙漏的鼓，可以通过声音的调节来模仿人类语言的语调和韵律，从而传递不同的信息。

[2] One notable instance of their use was during the Spanish Armada, when a beacon chain relayed a signal from Plymouth to London that signaled the arrival of the Spanish warships.

Spanish Armada：无敌舰队是约有 150 艘以上的大战舰，3000 余门大炮、数以万计士兵的强大海上舰队，最盛时舰队有千余艘舰船。这支舰队横行于地中海和大西洋，骄傲地自称为“无敌舰队”。

本句的意思是：关于使用信号灯的一个很典型的例子是在西班牙无敌舰队时期，当一连串的信号灯从普利茅斯传递到伦敦时则示意了西班牙战舰的到来。

[3] Morse's most important technical contribution to this telegraph was the simple and highly efficient Morse Code, co-developed with Vail, which was an important advance over Wheatstone's more complicated and expensive system, and required just two wires.

Morse code 莫尔斯码是一种时通时断的信号代码，通过不同的排列顺序来表达不同的英文字母、数字和标点符号。它发明于 1837 年，发明者有争议，是美国人塞缪尔·莫尔斯或者艾尔菲德·维尔。莫尔斯码是一种早期的数字化通信形式，但是它不同于现代只使用 0 和 1 两种状态的二进制代码，它的代码包括五种：点、划、点和划之间的停顿、每个字符间短的停顿（在点和划之间）、每个词之间中等的停顿以及句子之间长的停顿。

本句的意思是：莫尔斯对于电报最重要的贡献是他与韦尔一同发明的简单并且高效的莫尔斯码，仅需要两根电线即可实现，这是在惠斯通复杂且昂贵的系统之上一次巨大的进步。

[4] As with other great inventions such as radio, television, the light bulb, and the digital computer, there were several inventors who did pioneering experimental work on voice transmission over a wire, who then improved on each other's ideas.

as with 意为“正如，与……一样，就……来说”；句中两个 who 引导两个定语从句修饰先行词 inventors。

本句的意思是：正如其他伟大的发明，如收音机、电视、电灯、计算机，都有一些发明家进行电线传输声音的先驱试验，然后在彼此的想法上不断改进。

[5] RFC（Request for Comments）：是一系列以编号排定的文件。文件收集了有关互联网的相关信息，以及 UNIX 和互联网社区的软件文件。目前 RFC 文件是由 Internet Society（ISOC）赞助发行的。基本的互联网通信协议在 RFC 文件内都有详细说明。

Questions for Discussion

1. What's the main idea of this text?
2. What do you learn about the first commercial telephone?
3. How did Samuel Morse contribute to the development of telegraph?

Text B

Biography of Heinrich Hertz[1]

In a series of brilliant experiments Heinrich Hertz[1] discovered radio waves and established that James Clerk Maxwell's theory of electromagnetism is correct. Hertz also discovered the photoelectric effect[2], providing one of the first clues to the existence of the quantum world. The unit of frequency, the hertz, is named in his honor.

1. School

Aged six, Heinrich began at the Dr. Wichard Lange School in Hamburg. This was a private school for boys run by the famous educator Friedrich Wichard Lange. The school operated without religious influence; it used child-centered teaching methods, taking account of students' individual differences. It was also strict; the students were expected to work hard and compete with one another to be top of the class. Heinrich enjoyed his time at school, and indeed was top of his class. Unusually, Dr. Lange's school did not teach Greek and Latin—the classics—needed for university entry. The very young Heinrich had told his parents he wanted to become an engineer. When they looked for a school for him, they decided that Dr. Lange's alternative focus, which included the sciences, was the best option.

Heinrich's mother was especially passionate about his education. Realizing he had a natural talent for making things and for drawing, she arranged draftsmanship lessons for him on Sundays at a technical college. He started these aged 11.

2. Homeschool and Building Scientific Apparatus

Aged 15, Heinrich left Dr. Lange's school to be educated at home. He had decided that perhaps he would like to go to university after all. Now he received tutoring in Greek and Latin to prepare him for the exams.

He excelled at languages, a gift he seems to have inherited from his father.

Professor Redslob, a language specialist who gave Heinrich some tuition in Arabic, advised his father that Heinrich should become a student of oriental languages. Never before had he met anyone with greater natural talent.

Heinrich also began studying the sciences and mathematics at home, again with the help of a private tutor. He had a colossal appetite for hard work. His mother said, "When he sat with his books nothing could disturb him or draw him away from them".

Although he had left his normal school, he continued attending the technical college on Sunday mornings. In the evenings he worked with his hands. He learned to operate a lathe. He built models, and then began constructing increasingly sophisticated scientific apparatus, such as a spectroscope. He used this apparatus to do his own physics and chemistry experiments.

3. Becoming a Scientist

(1) Physics in Munich

In spring 1876, aged 19, he moved again, to Dresden, to study engineering. After only a few months he was drafted into the army for a year's compulsory service. After completing his army service, the 20-year-old Hertz moved to Munich to begin an engineering course in October 1877. A month later, after much internal anguish, he dropped out of the course. He had decided that above all else he wanted to become a physicist. Then he enrolled at the University of Munich, choosing courses in advanced mathematics and mechanics, experimental physics, and experimental chemistry. After a successful year at Munich he moved to the University of Berlin because it had better physics laboratories than Munich.

(2) Berlin, Helmholtz, and Recognition

In Berlin, aged 21, Hertz began working in the laboratories of the great physicist Hermann von Helmholtz.

Helmholtz must have recognized a rare talent in Hertz, immediately asking him to work on a problem whose solution he was particularly interested in. The problem was the subject of a fierce debate between Helmholtz and another physicist by the name of Wilhelm Weber.

The University of Berlin's Philosophy Department, with Helmholtz's encouragement, had offered a prize to anyone who could solve the problem: Does electricity move with inertia? Alternatively, we could frame the question in the form: Does electric current have mass? Or, as framed by Hertz: Does electric current have kinetic energy?

Hertz started work on the problem and quickly fell into a pleasant routine: Attending a lecture each morning in either analytical dynamics or electricity & magnetism, carrying out experiments in the laboratory until 4pm, then reading, calculating, and thinking in the evening.

He personally designed experiments which he thought would answer Helmholtz's question. He began to really enjoy himself, writing home:

"*I cannot tell you how much more satisfaction it gives me to gain knowledge for myself and for others directly from nature, rather than to be merely learning from others and myself alone.*"

4. The Prize

In August 1879, aged 22, Hertz won the prize—a gold medal. In a series of highly sensitive experiments he had demonstrated that if electric current has any mass at all, it must be incredibly small. We have to bear in mind that when Hertz carried out this work the electron—the carrier of electric current—had not even been discovered. J. J. Thomson's discovery was made in 1897, 18 years after Hertz's work.

Other physicists began to notice just how dazzling Hertz's work had been—the young student had put together experiments at the forefront of physics, personally modifying apparatus as needed. His practical skills, developed at home in the evenings, were proving to be priceless. His prize-winning work was published in the prestigious journal *Annalen der Physik*.