21世纪全国高职高专机电系列技能型规划教材

机电专业英语

主　编　戴正阳

- 选自国外专业文献著作，原汁原味地接触专业英语
- 以先进技术和主流产品为主题
- 图文并茂，边学边练，易懂好学

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内 容 简 介

本书系高职高专机电专业英语教材，旨在满足机电一体化及相关专业技能型人才培养的需要，也是行业从业人员学习专业英语的参考书。

依据高度理论知识与较强技能相结合的培养原则，本书突显实际工程应用情况，突出工程实践中“会用、管用”为准，理论以“必需、够用”为度，并力求易懂、好学、用得上。

本书共 7 个项目，每个项目均包含与企业实际紧密结合的专业英语实例。

本书既可作为高职高专、成人高校及相关院校的专业英语教材，也可用作企业培训教材，及有关教师、学生和技术人员的参考用书。

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前　言

本书全面贯彻落实“以服务为宗旨，以就业为导向，以能力为本位”的职业教育办学指导思想，采用最新的项目教学法编写而成。本书综合考虑英语就业岗位多样化等多种因素以及高职专业英语教育的实际情况，结合机电行业工作岗位对专业英语的使用要求，具有良好的通用性，又注意实践性和针对性，按照技能培养的要求，将专业英语融入到机电专业所涉及的绝大多数领域，重复过程而不重复内容，循序渐进地培养学生的专业英语阅读和翻译能力，同时兼顾增强学生的机电专业素养。

本书具有如下特色。

(1) 本书中的文章全部选自英美等以英语为母语的国家的专业文献著作。只做删节，不做改写，力求保持原著的语言风格、精神实质和原著作者对机电专业知识的理解，使学生原汁原味地接触专业英语，从而与原著作者实现思想的撞击。

(2) 本书以能力培养为本位，以训练为手段，不仅在每个项目任务后都配有练习，而且在每篇文章的旁边都配有猜词断义等练习，实现边看边练，切实提高读者阅读和理解机电类专业英语的能力。

(3) 文章中的注释标注在正文一侧，以便读者参考。

(4) 本书图文并茂，可以与实践类课程相结合进行教学，实现理论与实践相结合。

(5) 本书文章主要以现代机电技术中的主流先进技术和产品为载体，体现时代性，也兼顾未来技术发展的趋势。

(6) 本书中的文章短小精悍，便于教学。

本书可作为高职高专院校机电一体化、机械制造及自动化、数控技术应用、模具设计及制造、电气自动化等专业的专业英语教材，也可供从事机电工程领域工作的工程技术人员参考。

本书由戴正阳主编，独立完成。

由于编者水平有限，加之时间仓促，书中难免存在不足与遗漏之处，敬请读者批评指正。

编　者

2011 年

Contents

Project I Automobile

1.1 The Lead-in of the Project

Automobile is a self-propelled vehicle used for travel on land. The term is commonly applied to a four-wheeled vehicle designed to carry two to six passengers and a limited amount of cargo, as contrasted with a truck, as shown in Fig.1.1, which is designed primarily for the transportation of goods and is constructed with larger and heavier parts, or a bus (or omnibus or coach), which is a large public conveyance designed to carry a large number of passengers and sometimes additionally small amounts of cargo.

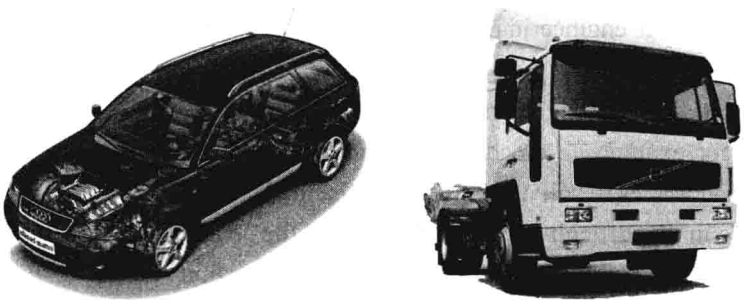


Fig. 1.1 Automobile and Truck

The evolution of modern mechatronics can be illustrated with the example of the automobile. All other functions were entirely mechanical or electrical, such as the starter motor and the battery charging systems. For instance, before the introduction of sensors and microcontrollers, a mechanical distributor was used to select the specific spark plug to fire when the fuel-air mixture was compressed. But the mechanically controlled combustion process was not optimal in terms of fuel efficiency. The electronic ignition system was one of the first mechatronic systems to be introduced in the automobile in the late 1970s. The electronic ignition system consists of a crankshaft position sensor, camshaft position sensor, airflow rate, throttle position, rate of throttle position change sensors, and a dedicated microcontroller determining the timing of the spark plug firings, depicted in Fig.1.2.

猜词断义 & 词义注释

automobile:

propel
v. 推进，推动
travel:

wheel *n.* 轮子
vehicle *n.* 车辆
cargo *n.* 货物
conveyance:

近形记忆

contrast
construct

illustrate
v. 说明，阐明
battery *n.* 电池
charge:

sensor *n.* 传感器
distributor
n. 分配器
specific
a. 具体的
spark plug
火花塞
combustion
n. 燃烧，烧毁
optimal
a. 最佳的，最优的
in terms of:

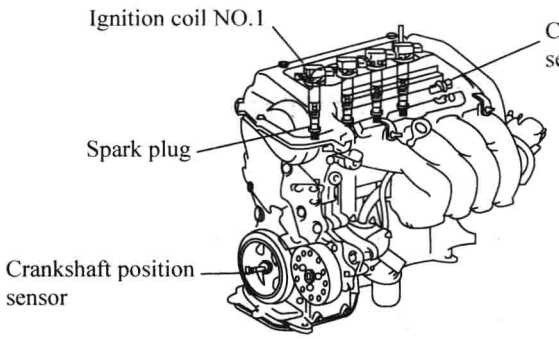


Fig. 1.2 Electronic Ignition System

ignition *n.* 点火
crankshaft *n.* 曲轴
camshaft *n.* 凸轮轴
airflow *n.* 气流
throttle *n.* 控油气阀门
dedicated *a.* 献身的，专注的

1.2 The Contents of the Project

Mechatronics solves technological problems using interdisciplin-ary knowledge consisting of mechanical engineering, electronics, and computer technology.

To solve these problems, traditional engineers used knowledge provided only in one of these areas (for example, a mechanical engineer uses some mechanical engineering methodologies to solve the problem at hand).

Later, due to the increase in the difficulty of the problems and the advent of more advanced products, researchers and engineers were required to find novel solutions for them in their research and development. This motivated them to search for different knowledge areas and technologies to develop a new product (for example, mechanical engineers tried to introduce electronics to solve mechanical problems).

The development of the microprocessor also contributed to encouraging the motivation. Consequently, they could consider the solution to the problems with wider views and more efficient tools; this resulted in obtaining new products based on the integration of interdisciplinary technologies.[1]

猜词断义 & 词义注释

interdisciplinary *a.* 多学科的
advent *n.* 出现，到来
novel:
motivate:
contribute *v.* 贡献，归功于
consequently *adv.* 因此，所以
obtain *v.* 获得

1.3 What is Mechatronics (Task 1)

1.3.1 Introduction to the Mechatronics (Text 1)

Mechatronics, the term coined in Japan in the 1970s, has evolved over the past 25 years and has led to a special breed of intelligent products. What is mechatronics?

(1) Mechatronics is a methodology used for the optimal design of electromechanical products. The word, mechatronics, is composed of

猜词断义 & 词义注释

coin:

"mecha" from mechanism and the "tronics" from electronics. In other words, technologies and developed products will be incorporating electronics more and more into mechanisms, intimately and organically, and making it impossible to tell where one ends and the other begins.[2] A mechatronic system is not just a marriage of electrical and mechanical systems and is more than just a control system; it is a complete integration of all of them, depicted in Fig.1.3.

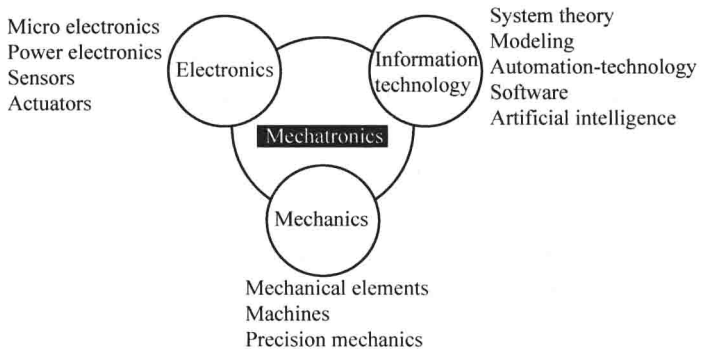


Fig. 1.3 Main Components Of A Mechatronic System

(2) Mechatronics is the application of complex decision making to the operation of physical systems.

Today, mechatronic systems are commonly found in homes, offices, schools, shops, and of course, in industrial applications.

Common mechatronic systems include:

- Domestic appliances, such as fridges and freezers, microwave ovens, washing machines, vacuum cleaners, dishwashers, cookers, timers, mixers, blenders, stereos, televisions, telephones, lawn mowers, digital cameras, videos and CD players, camcorders, and many other similar modern devices;
- Domestic systems, such as air conditioning units, security systems, automatic gate control systems;
- Office equipment, such as laser printers, hard drive, liquid crystal displays, tape drives, scanners, photocopiers, fax machines, as well as other computer peripherals;
- Retail equipment, such as automatic labeling systems, bar-coding machines, and tills found in supermarkets;
- Banking systems, such as cash registers, and automatic teller machines;
- Manufacturing equipment, such as numerically controlled (NC) tools, pick-and-place robots, welding robots, automated guided vehicles (AGVs), and other industrial robots;

evolve
v. 演变，进化
breed
n. 种类，品种
intelligent
a. 聪明的，职能的
compose
v. 组成，构成
incorporate
v. 包含，加入
intimate
a. 亲密的，密切的
organic
a. 有机的
marriage:

integrate
v. 结合成为整体
Integration:

artificial
a. 人造的，人工的
complex
a. 复杂的
application
n. 申请，应用
decision:

domestic
a. 本国的，家用的
appliance:

retail:

- Aviation systems, such as cockpit controls and instrumentation, flight control actuators, landing gear systems, and other aircraft subsystems.

1.3.2 Introduction to the Basic Mechanisms (Text 2)

Complex machines are made up of moving parts such as inclined planes, levers, gears, cams, cranks, spring, belts, and wheels. Machines deliver a certain type of movement to a desired location from an input force applied somewhere. Some machines simply convert one type of motion to another type, such as rotary to linear. While there are a seemingly endless variety of machines, they are all based upon simple mechanisms. Mechanism, a composition of links (or a system of parts working together in a machine), can accomplish determined motion. The difference therefore between mechanism and machine is whether it transforms or transmits energy outward. The common mechanisms discussed here include inclined planes, levers, wheel and axles.

Inclined Plane——Wedge

Under the condition of the same work, an inclined plane, depicted in Fig.1.4, decreases the force required to raise an object a given height by increasing the distance over which a force must be applied. You can imagine lifting something twice your weight to a 4 feet high shelf, or rolling the same mass up a gently sloping surface. The latter would be much easier.

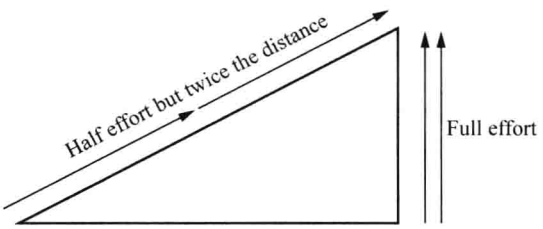


Fig. 1.4 Inclined Plane

Inclined planes are commonly put to use in cutting devices (e.g. an axe) and often two inclined planes are put back-to-back to form a wedge, as shown in Fig.1.5, forward movement is converted into a parting movement acting perpendicularly to the face of the blade. A zipper is simply a combination of two lower wedges for closing and an upper wedge for opening.

(a) (b)

Fig. 1.5 The Inclined Plane at Work

猜词断义 & 词义注释

desired:

incline *v.* 倾斜
plane *n.* 平面
lever *n.* 杠杆
gear *n.* 齿轮
cam *n.* 凸轮
crank *n.* 曲轴
spring *n.* 弹簧
rotary *a.* 旋转的，转动的
linear *a.* 沿直线的，线性的
mechanism *n.* 机构
composition *n.* 组合，构成
accomplish *v.* 完成，实现
determined:

wedge *n.* 楔
height *n.* 高度
shelf *n.* 架子，棚子
roll *v.* 滚动，卷起
mass:

sloping *a.* 倾斜的，有坡度的
perpendicular *a.* 垂直的

Lever

The simplest machine, and perhaps the one with which you are most familiar, is the lever. A seesaw is a familiar example of a lever in which one weight balances the other. As shown in Fig.1.6 to Fig.1.8, there are three different classes of levers defined by the relative position of the fulcrum, effort, and load.

(1) Examples of first class levers are a balance, a crow bar, and scissors, etc.

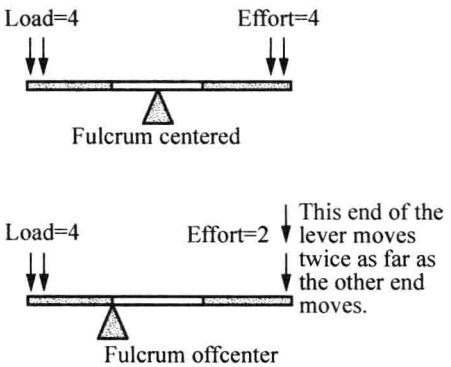


Fig. 1.6 Lever(1)

(2) In the second class lever the load is placed between the fulcrum and the effort. Examples of second class levers are a wheelbarrow, a bottle opener, and a nutcracker, etc.

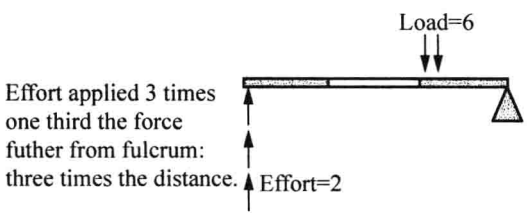


Fig. 1.7 Lever(2)

(3) The third class levers place the effort between the fulcrum and the load. Examples of third class levers are a hammer, a fishing rod, and tweezers, etc.

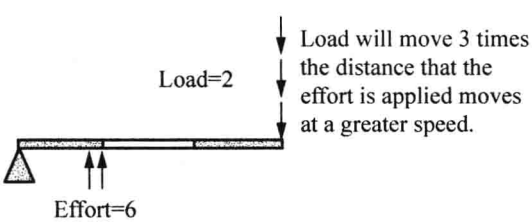


Fig. 1.8 Lever(3)

blade
n. 刃，刀刃
zipper *n.* 拉链
combination
n. 组合，结合

seesaw:

balance
n. 平衡，称
class:

relative:

fulcrum
n. 支撑点
effort *n.* 作用力
load *n.* 载荷
crow bar *n.* 撬杠
scissor *n.* 剪刀

wheelbarrow
n. 独轮手推车

hammer *n.* 锤子
fishing rod
n. 鱼竿
tweezers *n.* 镊子

Most machines that employ levers use a combination of several levers or often of different classes.

Wheel and Axle

Both the inclined plane and levers could lower the force required for a task at the price of having to apply that force over a longer distance. With wheels and axles the same is true: a force and movement of the axle is converted to a greater movement, but less force, at the circumference of the wheel. As a matter of fact, the wheel and axle can be thought of as simply a circular lever, depicted in Fig.1.9. Many common items rely on the wheel and axle such as the screwdriver, the steering wheel, the wrench, and faucet, etc..

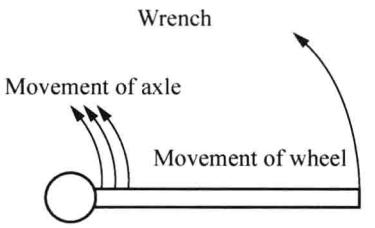


Fig. 1.9 The Wheel and Axle Is Like A Circular Lever

employ:

convert
v. 转换，转变
circumference
n. 圆周
screwdriver
n. 螺丝刀
steering wheel
n. 方向盘
wrench *n.* 扳手
faucet *n.* 水龙头

1.3.3 Introduction to the Basic Electronics (Text 3)

Current and Voltage

Most mechatronic systems contain electrical components and circuits, hence a knowledge of the concepts of electric charge (Q), electric field (E), and magnetic field (B), as well as, potential (V) is important. We will not be concerned with a detailed description of these quantities but will use approximation methods when dealing with them. Electronics can be considered as a more practical approach to these subjects.

The fundamental quantity in electronics is electric charge, which, at a basic level, is due to the charge properties of the fundamental particles of matter. For all intents and purposes it is the electrons (or lack of electrons) that matter. The role of the proton charge is negligible.

The aggregate motion of charge, the current (I), is given as $I(t)=\frac{\mathrm{d}Q}{\mathrm{d}t}$, where $\mathrm{d}Q$ is the amount of positive charge crossing a specified surface in a time $\mathrm{d}t$. It is accepted that the charges in motion are actually negative electrons.[3] Thus the electrons move in the opposite direction to the current flow. The SI unit for current is the ampere (A). For most electronic circuits the ampere is a rather large unit so the milliampere (mA), or even the microampere (μA), unit is more common.

猜词断义 & 词义注释

charge:

field:

magnetic
a. 有磁性的，磁的
approximation
n. 接近，近似值
approach
n. 接近，方法
fundamental
a. 基本的，基础的
particle *n.* 粒子
quantity
n. 数目，大小
proton *n.* 质子
negligible
a. 可忽略的
current *n.* 电流

Current flowing in a conductor is due to a potential difference between its ends. Electrons move from a point of less positive potential to more positive potential and the current flows in the opposite direction.

It is often more convenient to consider the electrostatic potential (V) rather than the electric field (E) as the motivating influence for the flow of electric charge. The generalized vector properties of E are usually not important. The change in potential $\mathrm{d}V$ across a distance $\mathrm{d}x$ in an electric field is $\mathrm{d}V = -E \times \mathrm{d}x$.

A positive charge will move from a higher to a lower potential. The potential is also referred to as the potential difference, or incorrectly as just voltage: $V = V_{21} = V_2 - V_1 = \int_{V_1}^{V_2} \mathrm{d}V$.

The SI unit of potential difference is the volt (V). Direct current (DC) circuit analysis deals with constant currents and voltages, while alternating current (AC) circuit analysis deals with time-varying voltage and current signals whose time average values are zero.

External Energy Sources

Charge can flow in a material under the influence of an external electric field. Eventually the internal field due to the repositioned charge cancels the external electric field resulting in zero current flow. To maintain a potential drop (and flow of charge) requires an electromagnetic force (EMF), that is, an external energy source (battery, power supply, signal generator, etc.).

There are basically two types of EMFs that are of interest.

- The ideal voltage source, which is able to maintain a constant voltage regardless of the current that must be put out ($I \to \infty$ is possible).
- the ideal current source, which is able to maintain a constant current regardless of the voltage that is needed ($V \to \infty$ is possible).

Because a battery cannot produce an infinite amount of current, a suitable model for the behavior of a battery is an internal resistance in series with an ideal voltage source (zero resistance). Real-life EMFs can always be approximated with ideal EMFs and appropriate combinations of other circuit elements.

So long as the battery continues to produce voltage and the continuity of the electrical path isn't broken, electrons will continue to flow in the circuit. Following the metaphor of water moving through a pipe, this continuous, uniform flow of electrons through the circuit is called a current. So long as the voltage sources keep "pushing" in the same direction, the current will continue to move in the same direction in the circuit. This single-direction flow of electrons is called a Direct Current, or DC.

aggregate
n. 总计，总和
opposite
a. 对面的，相反的
flow *n. v.* 流动
SI: 国际单位制
System International
circuit *n.* 电路
conductor
n. 导体
potential difference:

---

vector
n. 矢量，向量
property
n. 属性，特性

对比记忆

positive
a. 积极的，正的
negative:

猜词断义 & 词义注释

eventually
adv. 最后，最终
constant:

---

regardless of
adv. 不管，不顾
infinite
a. 无限的
resistance
n. 阻抗，电阻值
in series with
prep. 与……串联
approximate
v. 接近，近似
appropriate
a. 恰当的，适当的
metaphor
n. 比喻，暗喻
uniform
a. 完全一样的，不变的

Ground

A voltage must always be measured relative to some reference point. We should always refer to a voltage (or potential difference) being "across" something, and simply referring to voltage at a point assumes that the voltage point is stated with respect to ground.[4] Similarly current flows through something, by convention, from a higher potential to a lower (do not refer to the current "in" something). Under a strict definition, ground is the body of the Earth (it is sometimes referred to as earth). It is an infinite electrical sink. It can accept or supply any reasonable amount of charge without changing its electrical characteristics.

猜词断义 & 词义注释

measure *v.* 测量
assume *v.* 假设，猜想
with respect to 关于
by convention 通常
definition *n.* 定义
infinite *a.* 无限的，无穷的
sink:

1.3.4 Exercises to the Task

I. Brief answer to the question according to the text.

1. Compared with trucks and buses, what does characterize the automobile?

2. Please illustrate some types of vehicles.

3. How does an engine work?

4. When and where did mechatronics originate?

5. What are the purposes of mechatronics?

6. How do these basic mechanisms lighten people's intensity of labor?

7. What's the difference between the electrical charge and current?

8. What is the Direct Current?

9. Is the earth a conductor, why?

II. Translate the following sentences into Chinese.

[1] Consequently, they could consider the solution to the problems with wider views and more efficient tools; this resulted in obtaining new products based on the integration of interdisciplinary technologies.

[2] In other words, technologies and developed products will be incorporating electronics more and more into mechanisms, intimately and organically, and making it impossible to tell where one ends and the other begins.

[3] It is accepted that the charges in motion are actually negative electrons.

[4] We should always refer to a voltage (or potential difference) being "across" something, and simply referring to voltage at a point assumes that the voltage point is stated with respect to ground.

1.3.5 Knowledge Widening: Reading Material

Millimeter wave radar technology has recently found applications in automobiles. The millimeter wave radar detects the location of objects (other vehicles) in the scenery and the distance to the obstacle and the velocity in real-time. A detailed description of a working system is given by Suzuki. Fig. 1.10 shows an illustration of the vehicle-sensing capability with millimeter-waver radar. This technology provides the capability to control the distance between the vehicle and an obstacle (or another vehicle) by integrating the sensor with the cruise control and ABS systems. The driver is able to set the speed and the desired distance between the cars ahead of him. The ABS system and the cruise control system are coupled together to safely achieve this remarkable capability. One logical extension of the obstacle avoidance capability is

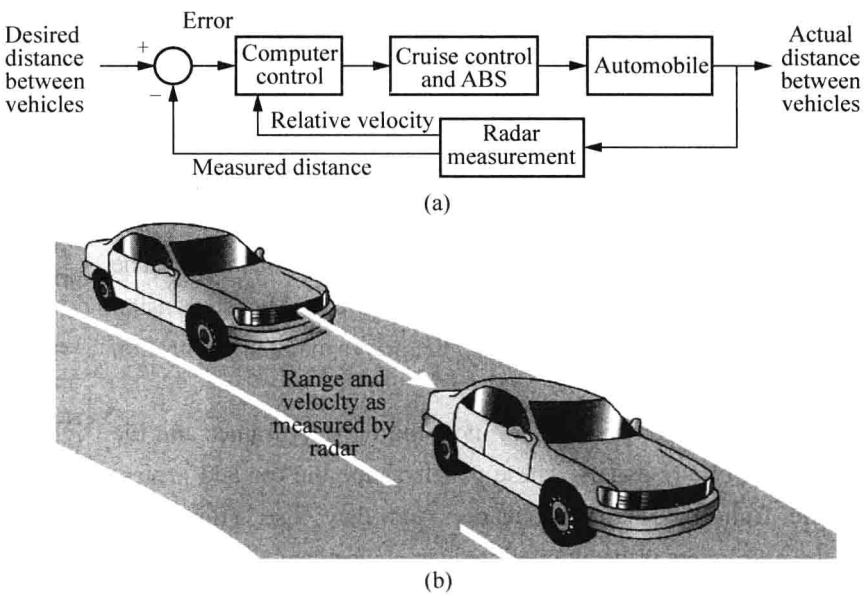


Fig. 1.10 Using Radar to Measure Distances

slow speed semi-autonomous driving where the vehicle maintains a constant distance from the vehicle ahead in traffic jam conditions. Fully autonomous vehicles are well within the scope of mechatronics development within the next 20 years. Supporting investigations are underway in many research centers on development of semi-autonomous cars with reactive path planning using GPS based, continuous traffic model updates and stop-and-go automation. A proposed sensing and control system for such a vehicle, involves differential global positioning systems (DGPS), real-time image processing, and dynamic path planning.

1.4 Engineering Mechanics of the Automobiles (Task 2)

Nearly all of today's cars are made up of engine, chassis, body and electrical equipments, depicted in Fig.1.11.

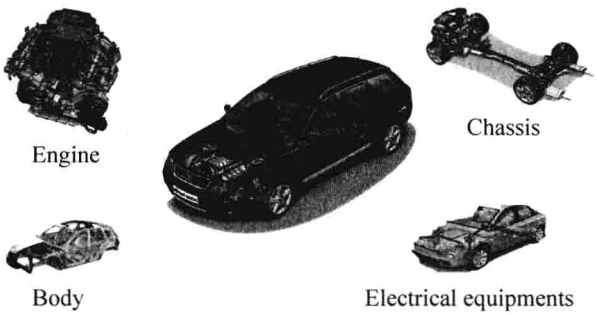


Fig. 1.11 Structure of Automobile

The engine provides the power to drive the wheels of the vehicle. The engine must be built strong enough to hold the pressure and temperatures caused by combustion.

The chassis consists of the drivetrain and running gear. The running gear includes the steering system, braking system and suspension system. The drivetrain transfers power from the engine to the driving wheels of the vehicle. The steering system is used to control the direction of the car. The braking system is used to slow down and stop the car. The suspension system is used to absorb road shocks and help the driver maintain control on bumpy roads.

The parts of these major systems are mounted on steel frames and the frame is covered with body panels. These panels shape the car and protect the parts inside from the damage outside. And they also offer some protection to the passengers if the automobile is in an accident.

Electrical equipment contains battery, generator, meter, light, wire, radio and air conditioner. Automobile have many circuits that carry electrical current from the battery to individual components. So the electrical

猜词断义 & 词义注释

chassis:

pressure *n.* 压力
combustion *n.* 燃烧
drivetrain *n.* 传动系统
gear:

steer *v.* 驾驶，掌舵
brake *v.* 刹车
suspension *n.* 悬挂
absorb *v.* 吸收
shock *n.* 振动
bumpy *a.* 崎岖的

equipment can work.

As a mechatronic product, there is always a risk that the working stress to which an automobile is subjected will exceed the strength of its material.[1] The purpose of a material mechanics is to analyze and minimize this risk.

近形记忆

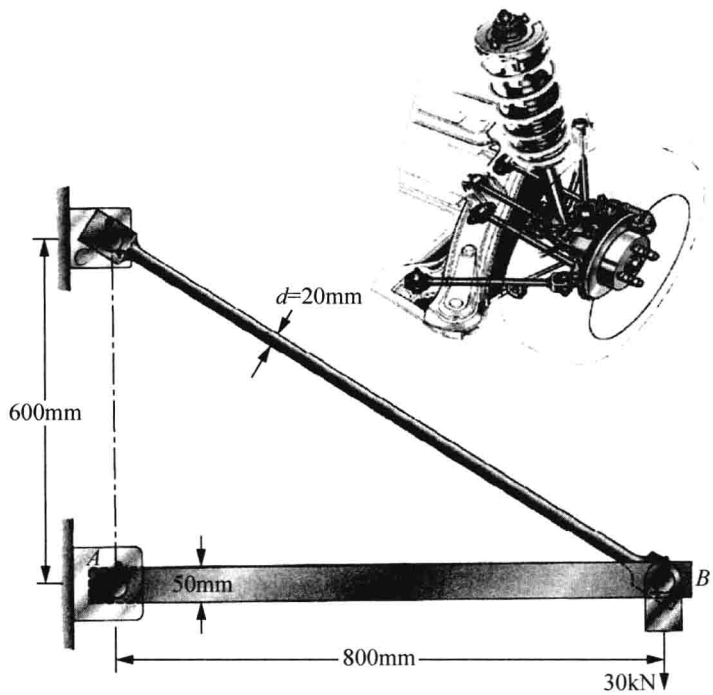
bump
dump
lump
hump
pump
stress *n.* 应力
subject:

exceed *v.* 超过

1.4.1 Axial Tension and Compression (Text 4)

Review of Statics

猜词断义 & 词义注释



statics
n. 静力学
axial
a. 轴向的

- The structure is designed to support a 30kN load.
- Perform a static analysis to determine the internal force in each structural member and the reaction forces at the supports.
- The structure consists of a boom and rod joined by pins (zero moment connections) at the junctions and supports.

a boom and rod
n. 杆件

Structure Free-Body Diagram

Structure is detached from supports and the loads and reaction forces are indicated.

pin *n.* 销子
junction
n. 连接点