<<工程力学>>

图书基本信息

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内容概要

《工程力学》由静力学、运动学、动力学和材料力学组成。
主要内容包括：质点静力学和刚体静力学、摩擦、质点运动学和刚体平面运动学、质点合成运动、质点动力学和刚体平面动力学、材料机械性能、杆的轴向拉伸与压缩、轴的扭转、梁的弯曲、应力分析与强度理论、组合载荷和压杆稳定。
《工程力学》可作为高等院校航空、机械、土木和水利等学科专业学生的英文、中文或双语工程力学教材。

书籍目录

章节摘录

Chapter 1 Fundamental Concepts of TheoreticalMechanics1.1 What Is Theoretical MechanicsEngineering mechanics is the science that applies the principles of mechanics to the analysis and design of engineering structures and machines. It usually includes theoretical mechanics and mechanics of materials.Theoretical mechanics is the study of equilibrium or motion of bodies subjected to the action of forces, and consists of statics, kinematics and dynamics. Statics is the study of bodies at rest or in equilibrium; kinematics treats the geometry of the motion without regard to the forces acting on bodies; and kinetics deals with the relation between the motion of bodies and the forces acting on bodies.In theoretical mechanics, bodies are assumed to be perfectly rigid. Though actual structures and machines are never absolutely rigid and deform under the action of forces, these deformations are usually small and do not affect the state of equilibrium or motion of the structures and machines under consideration.1.2 Basic Concepts1. LengthLength is used to locate the position of a point in space. The position of a point can be defined by three lengths measured from a certain reference point in three given directions.2. TimeTime is used to represent a nonspatial continuum in which events occur in irreversible succession from the past through the present to the future. To define an event, it is not sufficient to indicate its position in space. The time of the event should be given.3. MassMass is used to characterize the quantity of matter that a body contains. The mass of a body is not dependent on gravity and therefore is different from but proportional to its weight.Two bodies of the same mass, for example, will be attracted by the earth in the same manner; they will also offer the same resistance to a change in velocity.4. ForceForce is used to represent the action of one body on another. A force tends to produce an acceleration of a body in the direction of its application. The effect of a force is completely characterized by its magnitude, direction, and point of application.5. ParticleIf the size and shape of a body do not affect the solution of the specific problem under consideration, then this body can be idealized as a particle, i.e., a particle has a mass, but its size and shape can be neglected. For example, the size and shape of the earth is insignificant compared to the size and shape of its orbit, and therefore the earth can be modeled as a particle when studying the orbital motion of the earth.6. Rigid BodyA rigid body can be considered as a combination of a large number of particles in which all the particles occupy fixed positions with respect to each other within the body both before and after the action of forces, i.e., a rigid body is defined as one which does not deform when it is subjected to the action of forces.7. ScalarsScalars possess only magnitude, e.g., length, time, mass, work, energy. Scalars are added by algebraic methods.8. VectorsVectors possess both magnitude and direction (direction is understood to includes both the inclination angle that the line of action makes with a given reference line and the sense of the vector along the line of action), e.g., force, displacement, impulse, momentum. Vectors are added by the parallelogram law.9. Free VectorsA free vector can be moved anywhere in space provided it remains the same magnitude and direction.10. Sliding or Slip VectorsA sliding or slip vector can be moved to any point along its line of action.11. Fixed or Bound VectorsA fixed or bound vector must remain at the same point of application.1.3 General Principles1. Parallelogram LawThis law states that two forces acting on a particle can be replaced by a single resultant force obtained by drawing the diagonal of the parallelogram which has sides equal to the given forces.For example, two forces 1F and 2F acting on a particle O, Fig. 1.1a, can be replacedby a single force R , Fig. 1.1b, which has the same effect on the particle O and is called the resultant force of the forces 1F and 2F . The resultant force R can be obtained by drawing a parallelogram using 1F and 2F as two adjacent sides of the parallelogram. The diagonal that passes through O represents the resultant force R , i.e., 1 2R=F+F . This method forfinding the resultant force of two forces is known as the parallelogram law.From the parallelogram law, an alternative method for determining the resultant force of two forces by drawing a triangle, Fig. 1.2b, can be obtained. The resultant force R of the forces 1F and 2F can be found by arranging 1F and 2F in tip-to-tail fashion and then connecting the tail of 1F with the tip of 2F , i.e., 1 2R=F+F . This is known as the triangle rule.2. Principle of TransmissibilityThis principle states that the state of equilibrium or motion of a rigid body will remain unchanged if one force acting at a given point of the rigid body is replaced by another force of the same magnitude and same direction, but acting at a different point, provided that the two forces have the same line of action.For example, a force F , Fig. 1.3a, acting on a given point O of a rigid body can be replaced by a force ′ F , Fig. 1.3b, of the same magnitude and same direction, but acting at a different point O ′ on the same line of action. The two forces F and ′ F have the same effect on the rigid body and are said to be equivalent. This principle shows that the effect of a force on a rigid body remains unchanged provided the force acting on the rigid body is moved along its line of action. Thus forces acting on a rigid body are sliding vectors.replaced by a force ′ F , Fig. 1.3b, of the same magnitude and same direction, but acting at a different point O ′ on the same line of action. The two forces F and ′ F have the same effect on the rigid body and are said to be equivalent. This principle shows that the effect of a force on a rigid body remains unchanged provided the force acting on the rigid body is moved along its line of action. Thus forces acting on a rigid body are sliding vectors.where F is the force of gravitation between the two particles, G is the universal constant of gravitation, 1 m and 2m are, respectively, the mass of each of the two particles, and r is the distance between the two particles.When a particle is located on or near the surface of the earth, the force exerted by the earth on the particle is defined as the weight of the particle. Taking 1 m equal to the mass M of the earth, 2 m equal to the mass m of the particle, and r equal to the radius R of the earth, and letting 2Mg GR= (1.3)where g is the acceleration of gravity, then the magnitude of the weight of the particle can be given by W =mg (1.4)The value of g is approximately equal to 9.81 m/s2in SI units, as long as the particle is located on or near the surface of the earth.Chapter 2 Statics of Particle2.1 System of Concurrent ForcesA body under consideration can be idealized as a particle if its size and shape are able to be neglected. All the forces acting on this particle can be assumed to be applied at the same point and will thus form a system of concurrent forces.2.2 Resultant of Coplanar Concurrent ForcesA coplanar system of concurrent forces consists of concurrent forces that lie in one plane.1. Graphical Method for Resultant of ForcesThe resultant force of a coplanar system of concurrent forces acting on a particle can be obtained by using the graphical method. If a particle is acted upon by three or more coplanar concurrent forces, the resultant force can be obtained by the repeated applications of the triangle rule.Considering that a particle O is acted upon by coplanar concurrent forces 1F , 2F , and 3F ,Fig. 2.1a, the resultant force R of these forces can be obtained graphically by arranging all the given forces in tip-to-tail fashion and connecting the tail of the first force with the tip of the last one, Fig. 2.1b. This method is known as the polygon rule.

编辑推荐

《工程力学》编著者王开福。
本书是工程力学双语教材,系统论述了工程力学的基本概念、基础理论、计算方法和工程应用。全书由20章正文和5个附录组成。
全书由20章正文和5个附录组成。
第1章介绍理论力学的基本概念与普遍原理。
第2章讨论作用于质点上的汇交力系的合成与平衡。
第3章讨论作用于刚体上的力系的简化与等效。
第4章考虑刚体的平衡以及平面桁架的内力。
第5章介绍滑动摩擦与滚动摩阻的概念。
第6章分析质点的速度与加速度。
第7章涉及平移、转动和一般平面运动刚体的速度与加速度。
第8章研究质点合成运动。
第9章和第10章分别研究质点动力学和刚体平面动力学。
第11章介绍材料力学的基本概念。
第12章描述材料在拉压时的机械性能。
第13章和第14章分别讨论拉压杆和扭转轴的应力与变形。
第15章、16章和17章分别涉及弯曲梁的内力、应力和变形。
第18章介绍平面应力状态与材料失效准则。
第19章考虑在组合载荷作用下构件的应力分析。
第20章分析压杆的失稳。