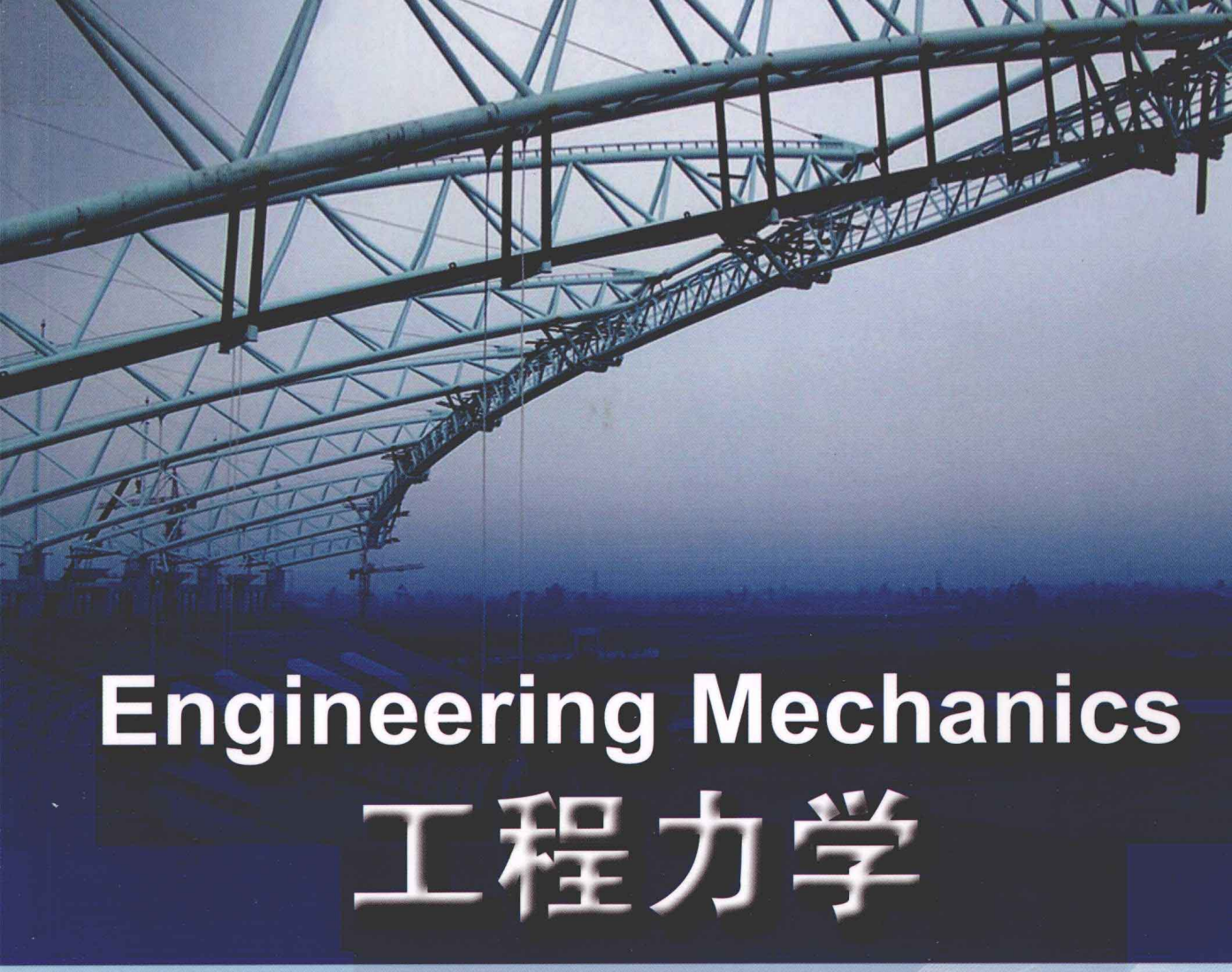

Engineering Mechanics

工程力学

Kaifu WANG
王开福 著

科学出版社

Synopsis

内容简介

This book consists of statics, kinematics, kinetics, and mechanics of materials. The main contents of the book include: statics of a particle and of a rigid body, friction, kinematics of a particle and of a rigid body in plane motion, resultant motion of a particle, kinetics of a particle and of a rigid body in plane motion, mechanical properties of materials, axial tension and compression of bars, torsion of shafts, bending of beams, stress analysis and theories of strength, combined loadings, and stability of columns.

The book can be used as an English, Chinese, or bilingual textbook of engineering mechanics for the student majoring in aeronautical, mechanical, civil, and hydraulic engineering.

本书由静力学、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。

本书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。

图书在版编目(CIP)数据

工程力学=Engineering Mechanics / 王开福著. —北京：科学出版社，2012
ISBN 978-7-03-035230-9

Ⅰ.①工… Ⅱ.①王… Ⅲ. ①工程力学–双语教学–高等学校–教材 – 汉、英 Ⅳ. ①TB12

中国版本图书馆 CIP 数据核字(2012)第 174691 号

责任编辑：尚 雁 罗 吉 / 责任校对：黄 海
责任印制：赵德静 / 封面设计：许 瑞

科 学 出 版 社 出版
北京东黄城根北街 16 号
邮政编码：100717
http://www.sciencep.com

中国科学院印刷厂 印刷
科学出版社发行 各地新华书店经销

*

2012 年 9 月第 一 版 开本：(787 × 1092) 1/16
2012 年 9 月第一次印刷 印张：33 1/2
字数：850 000

定价：76.00 元

(如有印装质量问题，我社负责调换)

Preface

1. Objectives

Engineering mechanics is a required subject for the student majoring in aeronautical, mechanical, civil, and hydraulic engineering and usually taught during the sophomore year. This book is intended to provide the student with the theory and application of engineering mechanics. It mainly includes theoretical mechanics and mechanics of materials; the former consisting of the first 10 chapters is devoted to the equilibrium and motion of bodies subjected to the action of forces, while the latter covering the other 10 chapters contributes to the analysis and design of structural members subjected to tension/compression, torsion, bending, and combined loadings.

2. Features

The book is written by using English and Chinese, respectively; the English part of the book can be used as an English textbook of engineering mechanics, while the Chinese part can be used as a Chinese textbook of engineering mechanics.

The study of engineering mechanics is based on the understanding of concepts and the use of principles. Examples are thus presented in the text in order to illustrate how these concepts and principles can be used in practical situation.

Problem solving is of vital importance in the learning process of engineering mechanics. Hence problems for homework assignments are offered at the end of each chapter.

The International System of Units is utilized in the entire book, and the National Standard of China is used as the design specification.

3. Contents

Engineering mechanics consists of statics, kinematics, kinetics, and mechanics of materials; Statics is the study of bodies at rest or in equilibrium, kinematics deals with the geometry of the motion without regard to the forces acting on bodies, kinetics is with the relation between the motion of bodies and the forces acting on bodies, and mechanics of materials is to study the ability of structures and machines to resist failure.

The book is organized into twenty chapters and five appendixes. Chapter 1 is an introduction to the fundamental concepts and general principles of theoretical mechanics. Chapter 2 discusses the resultant and equilibrium of concurrent forces acting on a particle. In Chapter 3 the reduction and equivalence of a force system acting on a rigid body are discussed,

and in Chapter 4 the equilibrium of a rigid body, as well the internal force of a planar truss, is considered. The concepts of both sliding friction and rolling resistance are introduced in Chapter 5. The velocity and acceleration of a particle are analyzed in Chapter 6. Chapter 7 deals with the velocity and acceleration of a rigid body in translation, rotation, and general plane motion. The resultant motion of a particle is studied in Chapter 8. Chapter 9 and Chapter 10 are on the kinetics of a particle and of a rigid body in plane motion. The fundamental concepts of mechanics of materials are introduced in Chapter 11. Chapter 12 describes the mechanical properties of materials subjected to tension or compression. The stress and deformation are discussed in Chapter 13 for a bar subjected to tension and compression, and in Chapter 14 for a shaft subjected to torsion, respectively. The internal forces, stresses, and deformations of a beam in bending are, respectively, dealt with in Chapter 15, 16, and 17. The plane state of stresses and the failure criteria of materials are presented in Chapter 18. The stress analysis for a member subjected to combined loadings is considered in Chapter 19. In Chapter 20, the buckling of a column subjected to a centric compressive load is analyzed.

The concepts of center of gravity, centroid, and mass moment of inertia are introduced in Appendix I and II, respectively. The geometrical properties of areas and of rolled-steel shapes are, respectively, presented in Appendix III and IV. The deflections and slopes of commonly-used beams are listed in Appendix V.

The book can be used as an English, Chinese, or bilingual textbook of engineering mechanics for the student majoring in aeronautical, mechanical, civil, and hydraulic engineering.

Kaifu WANG

Nanjing, June 2012

前　言

1. 目标

工程力学是航空、机械、土木和水利工程等学科专业学生的必修课，通常在大二学年讲授。本书旨在向学生传授工程力学的理论及其应用，主要包括理论力学和材料力学：前者由前 10 章组成，研究受力作用物体的平衡和运动；后者包含其余 10 章，研究受拉压、扭转、弯曲和组合载荷作用构件的分析和设计。

2. 特点

本书由英语和汉语分别撰写：英语部分可作为工程力学的英文教材，而汉语部分则可作为工程力学的中文教材。

工程力学的学习需要基于概念的理解和原理的应用，因此书中给出了例题以说明怎样把这些概念和原理应用于实际情况。

问题求解在工程力学的学习过程中显得非常重要，因此在每章后面提供了课外习题以供学生练习。

全书采用国际单位制，并采用我国国标作为设计规范。

3. 内容

工程力学由静力学、运动学、动力学和材料力学组成：静力学研究物体的静止与平衡；运动学在不涉及作用力的情况下研究物体的运动；动力学研究物体的运动与作用力之间的关系；材料力学研究结构或机械抵抗失效的能力。

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。

附录 I 和 II 分别介绍重心、形心和转动惯量的概念。附录 III 和 IV 分别介绍截面几何性质和型钢几何性质。附录 V 列出常用梁的挠度与转角。

本书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。

王开福

2012 年 6 月于南京

Contents

目　录

中 文 版

English Edition