

时代教育 • 国外高校优秀教材精选

PEARSON

**Mechanics of Materials,
Eighth Edition**

材料力学

影印版 • 原书第8版

[美] R.C.Hibbeler 编著



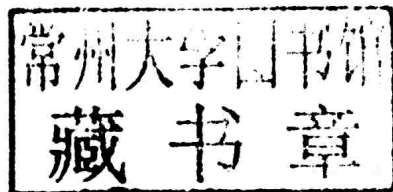
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时代教育·国外高校优秀教材精选

材 料 力 学

影印版·原书第8版

[美] R. C. 希伯勒 (R. C. Hibbeler) 编著



机械工业出版社

本书全面清晰地介绍了材料力学课程的理论和应用,讲解透彻、习题丰富。

本书内容包括应力、应变、材料的力学性能、轴向载荷、扭转、弯曲、横向剪切、组合载荷、应力转换、应变转换、梁和轴的设计、梁和轴的挠度、压杆的屈曲和能量法。

本书可作为普通高等院校材料力学双语教学的教材,也可供相关科研和工程技术人员参考。

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出版说明

随着我国加入 WTO，国际间的竞争越来越激烈，而国际间的竞争实际上也就是人才的竞争、教育的竞争。为了加快培养具有国际竞争力的高水平技术人才，加快我国教育改革的步伐，国家教育部出台了一系列倡导高校开展双语教学、引进原版教材的政策。以此为契机，机械工业出版社推出了一系列国外影印版教材，其内容涉及高等学校公共基础课，以及机、电、信息领域的专业基础课和专业课。

引进国外优秀原版教材，在有条件的学校推动开展英语授课或双语教学，自然也引进了先进的教学思想和教学方法，这对提高我国自编教材的水平，加强学生的英语实际应用能力，使我国的高等教育尽快与国际接轨，必将起到积极的推动作用。

为了做好教材的引进工作，机械工业出版社特别成立了由著名专家组成的国外高校优秀教材审定委员会。这些专家对实施双语教学做了深入细致的调查研究，对引进原版教材提出许多建设性意见，并慎重地对每一本将要引进的原版教材一审再审，精选再精选，确认教材本身的质量水平，以及权威性和先进性，以期所引进的原版教材能适应我国学生的外语水平和学习特点。在引进工作中，审定委员会还结合我国高校教学课程体系的设置和要求，对原版教材的教学思想和方法的先进性、科学性严格把关，同时尽量考虑原版教材的系统性和经济性。

这套教材出版后，我们将根据各高校的双语教学计划，及时地将其推荐给各高校选用。希望高校师生在使用教材后及时反馈意见和建议，使我们更好地为教学改革服务。

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高等教育分社

前 言^①

希伯勒 (R. C. Hibbeler) 编著、S. C. 范改编的《材料力学》(国际单位制, 第 8 版), 全面清晰地介绍了材料力学课程的理论和应用, 讲解透彻、习题丰富, 是当今世界上该领域最畅销的教材之一, 享有盛誉。

本书提供足够数量的习题, 并逐步增加难度, 以便给学生提供所需的实际练习, 培养学生分析问题和解决问题的能力。与第 7 版相比, 本版有 35% 的新编习题、例题, 大约 550 道, 其中包括 134 种新增问题。这些新增习题涉及的领域包括航空航天、石油工程和生物力学等, 展现了工程力学的现代应用, 为学生在新兴工业领域工作打下基础。

例题将帮助学生夯实基础并理解问题背后的概念。习题具有多种可能解法, 通过练习题, 可以培养学生自己解决各种问题的能力。本版提供了新功能: 在例题后设置了基本练习题。这为学生提供了概念的简单应用, 确保他们在着手处理其他问题前, 已经理解本章内容。

概念题是针对实际中遇到的真实问题。目的是培养和检验学生运用所学知识解决问题的能力。学生们将不断接触和掌握工程力学的最新应用。教师也得到了广泛的题目, 可以从中选择、修改和添加内容, 作为自己资料库中的新问题。在每一组概念题中, 都力争按题目序号逐渐增加难度。除了每组第四个题目的答案, 其他的答案都在书的后面给出。在题号前标有“*”的题目, 是不提供答案的。即使材料性能的数据精度不足, 本书的答案仍采用三位有效数字。虽然这可能是一种不适宜的做法, 但全书连续、前后一致, 可以让学生更好地验证自己的解决方案。标有“•”的习题则需要数值分析或运用计算机进行计算。

本书中很多图添加了矢量标注的逼真插图。这些插图形象生动地反映了工程的三维实际情况, 也帮助学生形成形象思维, 掌握问题背后的概念。全书有超过 44 张全新或更新的照片, 用来解释如何将力学原理应用到实际工程中。

很多同行在多年的教学工作中, 对本书提出了许多意见和建议。非常感谢他们的鼓励以及建设性的批评意见, 在此我不再一一罗列。特别感谢:

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^① “前言”与“目录”由顾晓勤教授翻译整理。

VI 材料力学

Roy Xu, 范德比尔特大学

Paul Ziehl, 南卡罗来纳大学

有几个人要特别提及。在校对手稿和准备问题解答方面,老朋友和合作伙伴 Kai Beng Yap 给了我很大的帮助。也特别感谢劳雷尔技术综合出版服务公司的 Kurt Norlin。多年来,出版编辑 Rose Kernan 在出版过程中给与了帮助。我的妻子 Conny 和女儿 Mary Ann 参与了本书的文字输入和校对。

我也要感谢所有使用本书以前版本的学生,以及他们提出的修改意见和建议。

无论什么时候,如果你对本书的内容有任何意见或建议,请提出,我将不胜感激。

RUSSELL CHARLES HIBBELER

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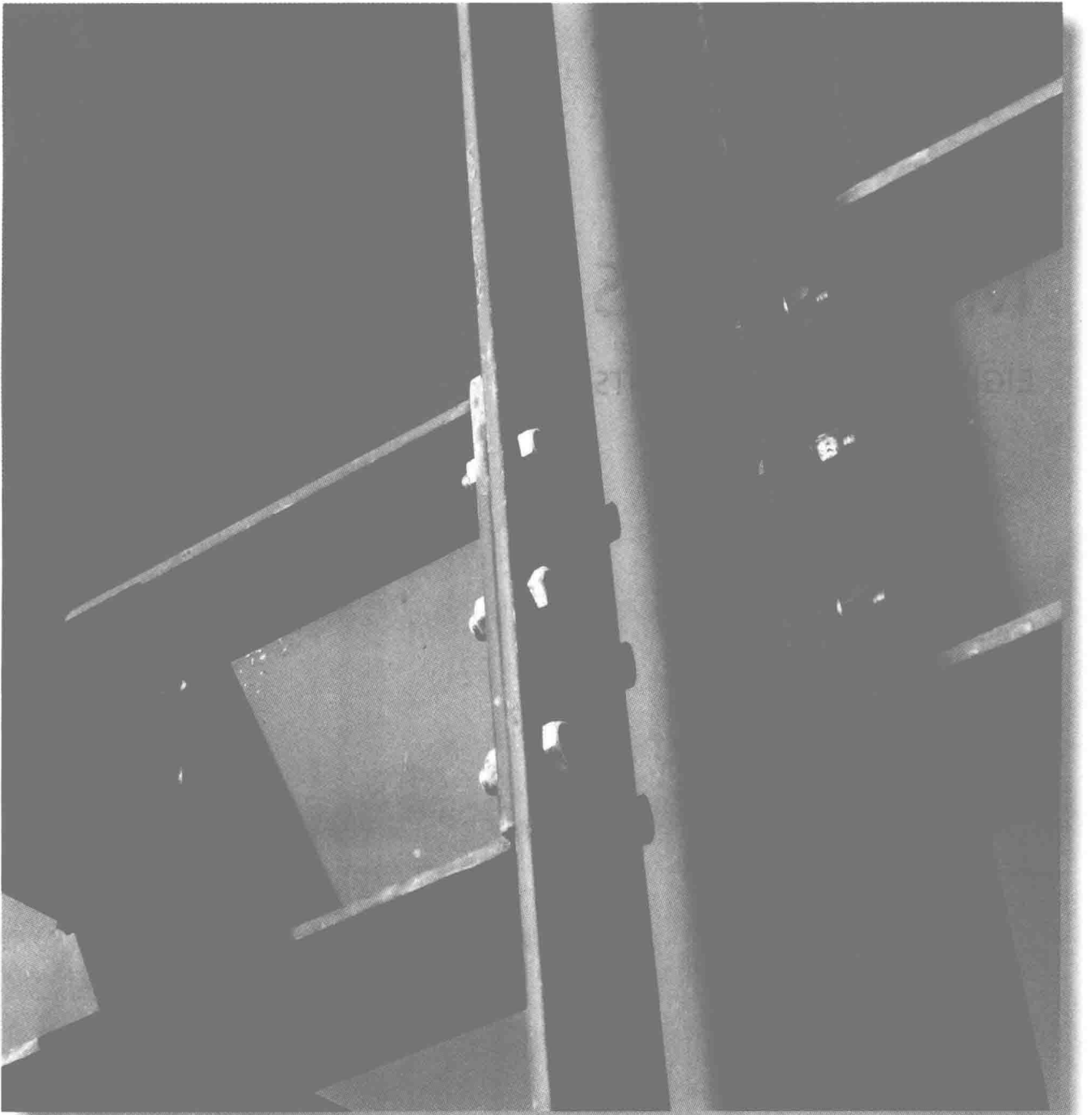
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MECHANICS OF MATERIALS

EIGHTH EDITION IN SI UNITS



The bolts used for the connections of this steel framework are subjected to stress. In this chapter we will discuss how engineers design these connections and their fasteners.

Stress

CHAPTER OBJECTIVES

In this chapter we will review some of the important principles of statics and show how they are used to determine the internal resultant loadings in a body. Afterwards the concepts of normal and shear stress will be introduced, and specific applications of the analysis and design of members subjected to an axial load or direct shear will be discussed.

1.1 Introduction

Mechanics of materials is a branch of mechanics that studies the internal effects of stress and strain in a solid body that is subjected to an external loading. Stress is associated with the strength of the material from which the body is made, while strain is a measure of the deformation of the body. In addition to this, mechanics of materials includes the study of the body's stability when a body such as a column is subjected to compressive loading. A thorough understanding of the fundamentals of this subject is of vital importance because many of the formulas and rules of design cited in engineering codes are based upon the principles of this subject.



Check out the Companion Website for the following video solution(s) that can be found in this chapter.

- Section 2
Internal Forces Review, 2-D
- Section 2
Internal Forces Review, 3-D
- Section 3
Force Resultant Review
- Section 4
Average Normal Stress
- Section 4, 5
Average Normal and Shear Stress
- Section 6
Allowable Stress
- Section 7
Factor of Safety

Historical Development. The origin of mechanics of materials dates back to the beginning of the seventeenth century, when Galileo performed experiments to study the effects of loads on rods and beams made of various materials. However, at the beginning of the eighteenth century, experimental methods for testing materials were vastly improved, and at that time many experimental and theoretical studies in this subject were undertaken primarily in France, by such notables as Saint-Venant, Poisson, Lamé, and Navier.

Over the years, after many of the fundamental problems of mechanics of materials had been solved, it became necessary to use advanced mathematical and computer techniques to solve more complex problems. As a result, this subject expanded into other areas of mechanics, such as the *theory of elasticity* and the *theory of plasticity*. Research in these fields is ongoing, in order to meet the demands for solving more advanced problems in engineering.

1.2 Equilibrium of a Deformable Body

Since statics has an important role in both the development and application of mechanics of materials, it is very important to have a good grasp of its fundamentals. For this reason we will review some of the main principles of statics that will be used throughout the text.

External Loads. A body is subjected to only two types of external loads; namely, surface forces or body forces, Fig. 1-1.

Surface Forces. *Surface forces* are caused by the direct contact of one body with the surface of another. In all cases these forces are distributed over the *area* of contact between the bodies. If this area is small in comparison with the total surface area of the body, then the surface force can be *idealized* as a single **concentrated force**, which is applied to a *point* on the body. For example, the force of the ground on the wheels of a bicycle can be considered as a concentrated force. If the surface loading is applied along a narrow strip of area, the loading can be *idealized* as a **linear distributed load**, $w(s)$. Here the loading is measured as having an intensity of force/length along the line s and is represented graphically by a series of arrows along the line s . **The resultant force F_R of $w(s)$ is equivalent to the area under the distributed loading curve, and this resultant acts through the centroid C or geometric center of this area.** The loading along the length of a beam is a typical example of where this idealization is often applied.

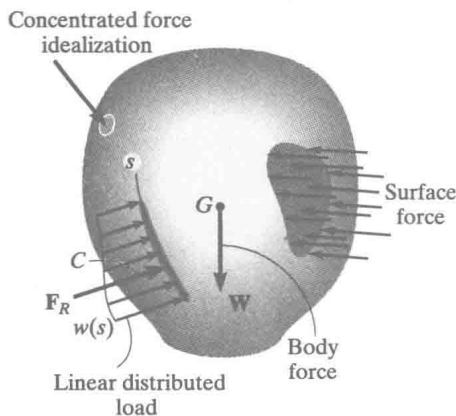


Fig. 1-1