教育部高等教育面向21世纪课程教材

普通高等学校机械工程类专业双语系列教材

MACHINERY DESIGN

机械设计

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ABSTRACT

Machinery Design is an important technological basic course in mechanical engineering education. This English textbook of Machinery Design is written for Chinese students majoring in mechanical engineering in accordance with the basic teaching requirements for this course set up by National Education Ministry and to enhance bilingual teaching in China's universities of science and technology. It is designed to satisfy the teaching requirements for this course, to develop the English competence of the students, and to help them to meet the challenge of economic globalization and technical and scientific revolution.

There are 19 chapters in this textbook: Introduction, Principles of Machinery Design, Failure Theories and Material strength, Friction, Wear and Lubrication, Design of Threaded Fasteners and Joints, Design of Keys, Splines and Pins, Design of Riveted, Welded and Bonded Joints, Transmission of Belts, Transmission of Chains, Design of Gears, Design of Worm Gearing, Sliding Bearings, Rolling-Contact Bearings, Couplings and Clutches, Shafts, Springs, Housings and Frames of Machines, Reducer, and Projects of Machinery Design. At the end of each chapter some problems and notes are designed for practice and better understanding.

This textbook can be used as textbook for teachers and students of mechanical engineering for the course of Machinery Design, and as reference book for teachers, students and engineers of other relevant engineering areas.

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出版说明

随着经济全球化的发展，中国的经济必然要与世界接轨。由于近年来中国经济的快速增长，各发达国家的装备制造业纷纷向中国转移，中国将会成为世界制造业的中心。大力发展装备制造业是我国经济发展的一个重要方向，机电产品将是出口创汇的主要来源之一。中国的企业和产品必须面向世界市场，参与国际竞争。与此相适应，高等学校培养出来的人才，不管是到国外的企业（包括合资企业）工作，还是在国内的企业就业，用外语进行交流的机会将逐渐增多。因此，能熟练使用外语的学生在人才市场的竞争中将会具有更大的优势。

为了提高我国高等教育的国际竞争能力，教育部于2001年8月印发了《关于加强高等学校本科教学工作提高教学质量的若干意见》的通知（教高[2001]4号），文件强调，“按照‘教育面向现代化、面向世界、面向未来’的要求，为适应经济全球化和科技革命的挑战，本科教育要创造条件使用英语等外语进行公共课和专业课教学。……力争三年内，外语教学课程达到所开课程的5%～10%。暂不具备直接用外语讲授条件的学校、专业，可以对部分课程先实行外语教材，中文授课，分步到位。”该文件还大力提倡编写、引进和使用先进教材。高等学校要结合学科的调整，加快教材的更新换代，鼓励有条件的高等学校编写具有特色的高水平教材。

双语教学（使用母语和英语等外语进行教学）对于提高学生的外语水平非常有利。因此，有计划地逐步推进双语教学，扩大双语教学的课程门数，提高双语教学的质量，是今后一个时期内高等学校必须重视的工作之一。机械工程类专业招生人数最多、就业面最广，而且随着我国装备制造业的发展，今后对能够熟练使用外语（主要是英语）的机械工程类人才的需求会越来越大。因此，在机械工程类专业中实施双语教学，具有更加现实的意义。

教材是教学的基础，对于双语教学来说尤其如此。要搞好机械工程类专业的双语教学工作，必须要有相应的英文教材，而机械工业类专业的原版英文教材与我国的教学大纲及教学体系差异较大，不太适合我国高校阶段的教学状况。此外，我国大学生现阶段的英语水平参差不齐，大多数学生的英语水平还不足以很好地理解英文原版教材的体系和内容，故英文原版教材现在还不可能在我国一般的高等院校大面积地推广。

许多高等学校的机械工业类专业，在开展双语教学的试点工作中，除了采用少量英文原版教材之外，还编写了部分英文讲义，经过试用后有的已经出版。但迄

今为止，各校出版的零星英文教材，还没有形成系列，还远远不能满足日益发展的双语教学的需要。为此，武汉理工大学出版社经过广泛、深入的调研，组织编写了这套面向全国普通高等学校机械工程类专业双语教学的系列教材。

本套教材集中了国内十多所大学从事过双语教学的专家、教授和有过留学经历的中青年骨干教师，承担教材编写和审校的任务；并且组织了以全国高校机械工程类专业教学指导委员会主任杨叔子院士为首的编审委员会，负责整套教材的策划和指导工作。

本套教材以机械工程类专业的学科基础课为主要对象，选择相应的优秀中文教材作为蓝本，同时广泛收集国外优秀的同类英文教材作为参考。各门课程都按照我国通用教学大纲的要求，用英文编写，并附有适当的中文注释和说明，在文字上力求规范、通俗易懂、繁简得当。本套教材分两批编写、出版，并逐步配齐相应的电子课件，以满足双语教学的需要。我们衷心希望广大读者多提宝贵意见，共同将这套教材建设成为机械工程类专业双语教学的精品。

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PREFACE

Machinery Design is an important technological basic course in mechanical engineering education. It aims to develop engineering students' competence of machine design that is the primary concern of machinery manufacturing and the key to manufacturing good products. This course is required to provide engineering students—future engineers—with an elementary knowledge of machine design, to teach them the method, procedures and calculation of machine design, to train them in dealing with practical issues such as simplifying configurations of mechanical elements, establishing models of mathematics and physics, selecting materials, processes and heat-treatments, understanding inspection and maintenance of machinery.

Machinery Design is a compulsory course for all the engineering students. As teachers of this course, we believe that it is of urgent necessity for us to compile an English textbook of Machinery Design in accordance with the basic teaching requirements for this course set up by National Education Ministry in order to enhance bilingual teaching in China's universities of science and technology. Textbooks of Machinery Design popular in American or European universities are, of course, our main source of reference. But they can only serve as reference because the authors of those textbooks have a thinking pattern different from ours and the machinery manufacturing environments of those countries are different from ours, too. We have established three principles for compiling this textbook; (1) to meet the needs of the Chinese engineering students; (2) to take in the essence of the similar textbooks compiled by American and European professors; (3) in plain and concise English. Meanwhile, we have not only introduced in it the advanced ideas and methods of machine design, but also refreshed the teaching contents with the focus shifted on developing the students' competence of mechanical engineering design. Besides, we have emphasized creative design and the cultivation of the students' ability for analysis and synthesis. In a word, our English textbook of Machinery Design is intended to satisfy the teaching requirements for this course, to develop the English competence of engineering students, and to help them to meet the challenge of economic globalization and technical and scientific revolution.

This textbook is a collective work of experienced teachers from different universities. Editor-in-chief Yang Mingzhong from Wuhan University of Technology has established its framework, revised and finalized the whole book. In addition, he has compiled Chapter 4 & Chapter 12. Other compilers with their contributions are listed below alphabetically by surname.

An Qi from East China University of Science and Technology has compiled Chapter 13 & Chapter 15.

Chen Xiaoyong from Southwest University of Science and Technology has compiled Chapter 5 and the smaller part of Chapter 18.

Guo Bolin from Wuhan University of Technology has compiled Chapter 8 & Chapter 9.

Li Qing from Hunan University has compiled Chapter 1, Chapter 17, Chapter 19 and the greater part of Chapter 18.

Li Wei from Hunan University has compiled Chapter 2 & Chapter 3.

Ren Jiajun from Taiyuan University of Technology has compiled Chapter 11.

Shi Sujuan from North China Institute of Water Conservancy and Hydroelectric Power has compiled Chapter10.

Yin Yufeng from Taiyuan Heavy Machinery Institute has compiled Chapter 14 & Chapter 16.

Yue Daxin from Southwest University of Science and Technology has compiled Chapter 6 & Chapter 7.

Prof. Liao Daoxun from Huazhong University of Science and Technology has kindly and patiently examined all the manuscripts and made insightful suggestions.

It is our hope that this textbook will make a small contribution to the bilingual teaching in the universities of science and technology. Since it is our first attempt to compile and write a technical textbook in English, we may, inevitably, make mistakes and inappropriate treatments. We would welcome suggestions and criticism from teachers, students and readers for its improvement.

Yang Mingzhong
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