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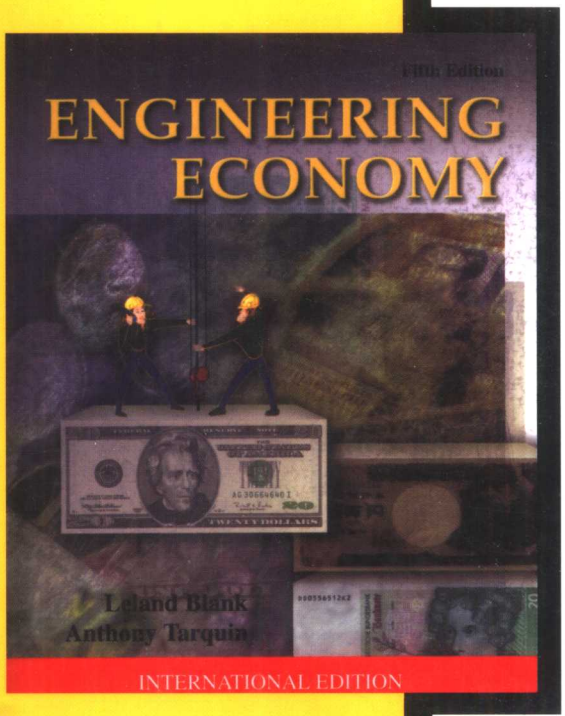
国外大学优秀教材——工业工程系列（影印版）

Leland Blank, Anthony Tarquin

工程经济学

（第5版）



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国外大学优秀教材——工业工程系列（影印版）

Engineering Economy

FIFTH EDITION

工程经济学

（第5版）

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Forward

This textbook series is published at a very opportunity time when the discipline of industrial engineering is experiencing a phenomenal growth in China academia and with its increased interests in the utilization of the concepts, methods and tools of industrial engineering in the workplace. Effective utilization of these industrial engineering approaches in the workplace should result in increased productivity, quality of work, satisfaction and profitability to the cooperation.

The books in this series should be most suitable to junior and senior undergraduate students and first year graduate students, and to those in industry who need to solve problems on the design, operation and management of industrial systems.

Gavriel Salvendy

Department of Industrial Engineering, Tsinghua University

School of Industrial Engineering, Purdue University

April, 2002

前　言

本教材系列的出版正值中国学术界工业工程学科经历巨大发展、实际工作中对工业工程的概念、方法和工具的使用兴趣日渐浓厚之时。在实际工作中有效地应用工业工程的手段将无疑会提高生产率、工作质量、合作的满意度和效果。

该系列中的书籍对工业工程的本科生、研究生和工业界中需要解决工程系统设计、运作和管理诸方面问题的人士最为适用。

加弗瑞尔·沙尔文迪
清华大学工业工程系
普渡大学工业工程学院（美国）
2002年4月

PREFACE

The previous four editions of this text presented the basic principles and applications of economic analysis in a clearly written fashion, supported by a large number and wide range of engineering-oriented examples and end-of-chapter exercises. Our objective has always been to present the material in the clearest, most concise fashion possible without sacrificing coverage or true understanding on the part of the learner. In this fifth edition, the subjects treated and sequencing of material have been enhanced, and there are significant additions to the electronic-based learning options, but the basic structure of the text developed in previous editions has been retained.

EDUCATION LEVEL AND USE OF TEXT

This text is best used in learning and teaching at the university level, and as a reference book for the basic computations of engineering economic analysis. It is well suited for a one-semester or one-quarter undergraduate course in engineering economic analysis, project analysis, or engineering cost analysis. Additionally, because of its behavioral-based structure, it is perfect for individuals who wish to learn the material for the first time completely on their own, and for individuals who simply want to review. Students should be at least at the sophomore level, and preferably of junior standing, so that they can better appreciate the engineering context of the problems. A background in calculus is not necessary to understand the calculations, but a basic familiarization with engineering terminology makes the material more meaningful and therefore easier and more enjoyable to learn. Nevertheless, the building-block approach used in the text's design allows a practitioner unacquainted with economics and engineering principles to use the text to learn, understand, and correctly apply the principles and techniques for effective decision making.

OVERVIEW OF CHANGES IN THE FIFTH EDITION

In addition to the rewording and restructuring that always take place in new editions of textbooks, we have added some new topics and reordered and updated a considerable amount of material to make this edition an even more valuable resource. Comprehensive coverage of spreadsheets, four different kinds of chapter review exercises, and improved in-chapter examples make this revision more student-friendly than any previous edition.

Major topical revisions We have added discussions on many important topics. Among the new additions are

- Public sector economics
- Good-use practices and cautions for each evaluation method (present worth, annual worth, rate of return analysis, and benefit/cost)

- Economic value added
- Varying interest rates

Furthermore, many topics have been significantly rewritten or expanded:

- Factor derivation
- Life-cycle costs
- Replacement analysis
- Multiple-attribute analysis
- Independent projects
- Cost estimation approach and methods
- Transition from before-tax to after-tax analysis via tabulations
- After-tax replacement studies

The latest U.S. depreciation information has been incorporated into a downsized chapter, and material that is of less general interest has been moved into an appendix. The two after-tax chapters of previous editions have been condensed into one that more effectively captures the essence of after-tax economic analysis. We have retained the Monte Carlo simulation chapter that introduces in a clear, easy-to-understand way the use of probability and distributions into engineering economic analysis.

Expanded use of spreadsheets The use of spreadsheets has been significantly expanded to show (1) how easy they are to use in solving virtually any type of engineering economic analysis problem (many problems can be solved using a one-cell spreadsheet function) and (2) how powerful they can be for altering estimates to achieve a better understanding of the sensitivity and economic consequences of the uncertainties inherent in all forecasts. To clarify these discussions, we illustrate our spreadsheet discussions with screen shots from Microsoft Excel™*. Beginning with Chapter 1, students and instructors learn to use the built-in functions, charts, and many of the powerful features that make spreadsheets ideally suited for engineering economic analyses. Additionally, we annotate key spreadsheet functions with cell tags immediately adjacent to the functions in the screen shots. All examples that use a spreadsheet are clearly marked, and a *solution by hand* is included immediately prior to the *solution by computer,* thus allowing both manual and spreadsheet options in the course. Several chapters include a separate section (usually placed last) that illustrates a comprehensive use of spreadsheets highlighting the topics of the chapter. We have also significantly expanded the appendix on spreadsheets. This appendix serves as a quick reference for experienced users, and guides learners new to spreadsheets to becoming effective spreadsheet users (in formatting as well as functions) in a matter of minutes.

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* The screen shots that appear throughout this text were developed by the authors and illustrate screens from Microsoft Excel, a trademark of Microsoft Corporation. All screen shots are reprinted by permission of Microsoft Corporation.

The increasing reliance upon a computer spreadsheet to solve both basic and complex engineering economy problems is emphasized in the text. When a single-cell, built-in Excel function may be used to solve a problem, a checkered flag icon labeled "Q-Solv" (for "quick solution") appears in the margin. The thunderbolt "E-Solve" icon indicates that a more complex, sophisticated spreadsheet is developed, one that contains several functions and possibly an Excel chart or graph. For both Q-solv and E-solve examples, we have included cell tags for representative functions to help explain what takes place on the spreadsheet. The E-solve icon is also used throughout chapters to point out descriptions of how to best use the computer to address the engineering economy topic under discussion.


Q-Solv

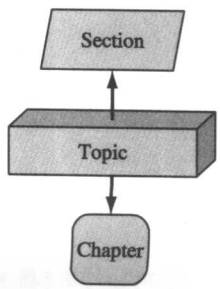

E-Solve

Chapter exercises Users of this book now have more ways to reinforce the concepts they've learned than ever before. The end-of-chapter *Problems, Extended Exercises, Case Studies, and FE (Fundamentals of Engineering) Exam Review Problems* have been significantly expanded or revised in this edition. These in-book resources afford the student the opportunity to learn economic analysis in a variety of ways, ranging from working relatively simple, one-step review problems to answering a series of comprehensive, in-depth questions based on real-world cases.

All the FE review problems, all the extended exercises, and most of the case studies are new to this edition. The FE exam review problems are written in the same multiple-choice format and cover the same topics as the exam, and chapters each have one or two extended exercises and/or case studies. The extended exercises are designed to require spreadsheet analysis with a general emphasis on sensitivity analysis. All the case studies present real-world, in-depth treatments and exercises that cover the wide spectrum of economic analysis in the engineering profession. As in previous editions, each chapter contains many homework problems. More than 90 percent of these chapter problems are new for this edition and are written to be more representative of real-world situations.

Chapter examples Examples within the chapter have been rewritten to present fresh engineering contexts. We sought in this edition to make the examples relevant to all disciplines that use this text, including industrial, civil, environmental, mechanical, petroleum, and electrical engineering, as well as engineering management and engineering technology programs.

Cross-referencing We (and our reviewers) have always strived to make this book the easiest to use and, therefore, the easiest from which to learn, of all the similar texts that serve this market. In this edition, we reinforce the engineering concepts presented throughout the book by making them easily accessible from other sections in the book. Cross-reference icons in the margins refer the reader to additional section numbers, specific examples, or entire chapters that contain either foundational (backward) or more advanced (forward) information that is relevant to that in the paragraph next to the icon.



In making all changes, the overriding consideration has been the preservation of the free-flowing, easy-to-understand format that characterizes previous editions. The result is a text with an up-to-date, well-balanced presentation of economic analysis at the undergraduate level and coverage that is particularly relevant to engineers and other decision makers.

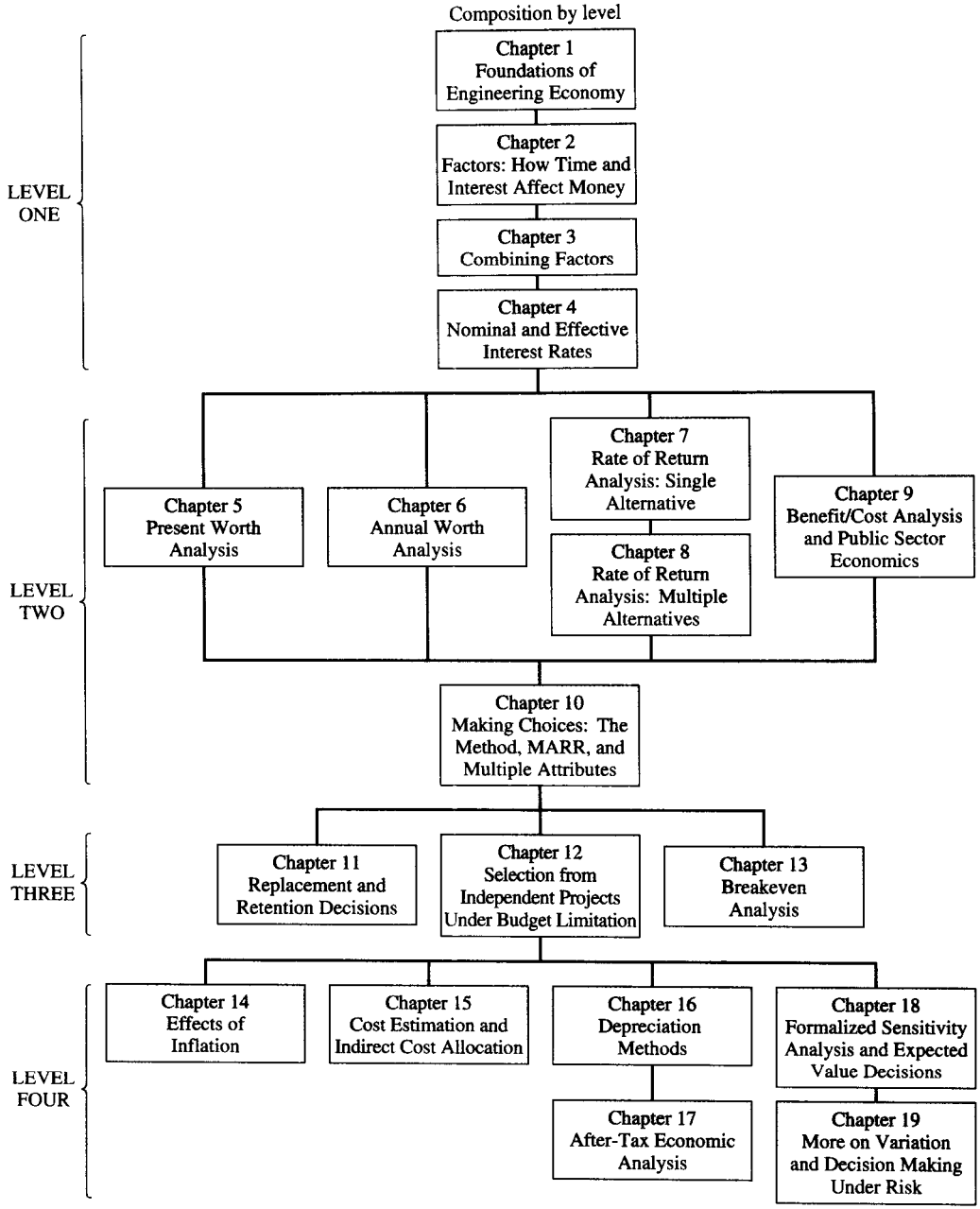
STRUCTURE OF TEXT AND OPTIONS FOR PROGRESSION THROUGH THE CHAPTERS

The text is written in a modular form, providing for topic integration in a variety of ways that serve different course purposes, structures, and time limitations. There are a total of 19 chapters in four levels. As indicated in the flowchart on the next page, some of the chapters have to be covered in sequential order; however, the modular design allows for great flexibility in the selection and sequencing of topics. The chapter progression graphic (follows the flowchart) shows some of the options for introducing chapters earlier than their numerical order. For example, if the course is designed to emphasize after-tax analysis early in the semester or quarter, Chapter 16 and the initial sections of Chapter 17 may be introduced at any point after Chapter 6 without loss of foundation preparation. There are clear primary and alternate entry points for the major categories of inflation, estimation, taxes, and risk. Alternative entries are indicated by a dashed arrow on the graphic.

The material in Level One emphasizes basic computational skills, so these chapters are prerequisites for all the others in the book. The chapters in Level Two are primarily devoted to the most common analytical techniques for comparing alternatives. While it is advisable to cover all of the chapters in this level, only the first two (Chapters 5 and 6) are widely used throughout the remainder of the text. The three chapters of Level Three show how any of the techniques in Level Two can be used to evaluate presently-owned assets or independent alternatives, while the chapters in Level Four emphasize the tax consequences of decision making and some additional concepts in cost estimation, activity-based costing, sensitivity analysis, and risk, as treated using Monte Carlo simulation.

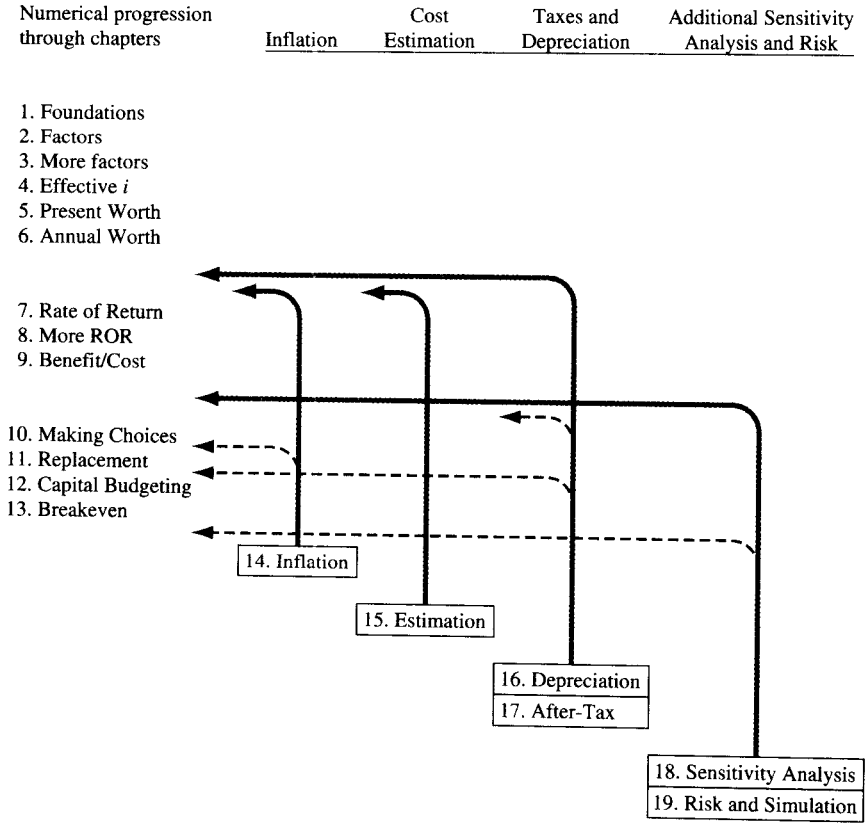
Organization of Chapters and End-of-Chapter Exercises Each chapter contains a purpose and a series of progressive learning objectives, followed by the study material. Section headings correspond to each learning objective; for example, Section 5.1 contains the material pertaining to the first objective of the chapter. Each section contains one or more illustrative examples solved by hand, or by both hand and computer methods. Examples are separated from the textual material and include comments about the solution and pertinent connections to other topics in the book. The crisp end-of-chapter summaries neatly tie together the concepts and major topics covered to reinforce the learner's understanding prior to engaging in the end-of chapter exercises.

The end-of-chapter unsolved problems are grouped and labeled in the same general order as the sections in the chapter. This approach provides an opportunity


Composition by level
LEVEL ONE
Chapter 1 Foundations of Engineering Economy
Chapter 2 Factors: How Time and Interest Affect Money
Chapter 3 Combining Factors
Chapter 4 Nominal and Effective Interest Rates
LEVEL TWO
Chapter 5 Present Worth Analysis
Chapter 6 Annual Worth Analysis
Chapter 7 Rate of Return Analysis: Single Alternative
Chapter 8 Rate of Return Analysis: Multiple Alternatives
Chapter 9 Benefit/Cost Analysis and Public Sector Economics
Chapter 10 Making Choices: The Method, MARR, and Multiple Attributes
LEVEL THREE
Chapter 11 Replacement and Retention Decisions
Chapter 12 Selection from Independent Projects Under Budget Limitation
Chapter 13 Breakeven Analysis
LEVEL FOUR
Chapter 14 Effects of Inflation
Chapter 15 Cost Estimation and Indirect Cost Allocation
Chapter 16 Depreciation Methods
Chapter 17 After-Tax Economic Analysis
Chapter 18 Formalized Sensitivity Analysis and Expected Value Decisions
Chapter 19 More on Variation and Decision Making Under Risk

OPTIONS FOR PROGRESSION THROUGH CHAPTERS

Topics may be introduced at the point indicated or any point thereafter
(Alternative entry points are indicated by ◄- - - -)



to apply material on a section-by-section basis or to schedule problem solving when the chapter is completed.

Appendices A through C contain supplementary information: a basic introduction to the use of spreadsheets (Microsoft Excel) for readers unfamiliar with them; the basics of accounting and business reports; and the final answers to selected problems, arranged by chapter. Interest factor tables are located at the end of the text for easy access. Finally, the inside front covers offer a quick reference to factor notation, formulas, and cash flow diagrams, plus a guide to the format for commonly used spreadsheet functions. A glossary of common terms and symbols used in engineering economy appears inside the back cover.

ONLINE SUPPLEMENTS

The materials available via our McGraw-Hill website, http://highered.mcgraw-hill.com/sites/0072432349/, further expand the ways to learn. The website resources focus on two objectives: reinforcing the concepts presented in the text, and preparing the student for the Fundamentals of Engineering exam. To review the material in the chapters, there are more than 100 true-false and matching questions for student self-tests. There are new in-depth spreadsheet exercises that instructors can assign in class as practice or in laboratory sessions, or as team assignments. Solutions are available for all these exercises. Links to useful websites have been provided to reinforce the use of the Web as a tool for research. The FE exam review component of the site contains downsized sections of this book that cover topics tested on the FE exam. These sections have been digested into a review-type format, with each section containing at least one pertinent multiple-choice example. The site contains additional FE review problems to work in preparation for taking the exam.

The Solutions Manual is available in either print or electronic format. Contact your local McGraw-Hill representative to obtain a copy. Additional learning materials are under development and will be added to the website over time, making this material fresh and current for years to come.

APPRECIATION TO CONTRIBUTORS

Throughout this and previous editions, there are many individuals at universities, in industry, and in private practice who have helped in the development of this text. We thank each of them for their contributions and the privilege to work with them. Some of these individuals are:

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Finally, we welcome any comments or suggestions you may have to help improve the textbook or the book's website. You can reach us at l-blank@tamu.edu or lblank@aus.ac.ae and atarquin@utep.edu. We look forward to hearing from you.

Lee Blank
Tony Tarquin

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