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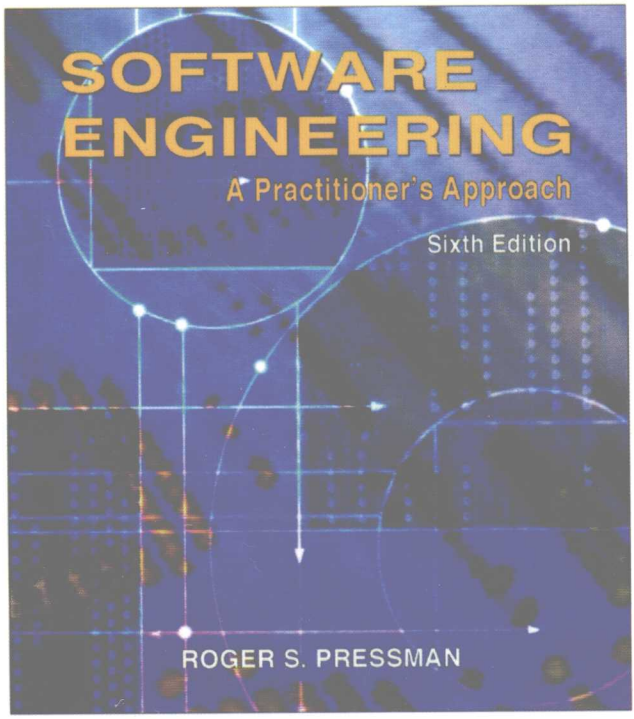

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(美) Roger S. Pressman 著

机械工业出版社
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软件工程

实践者的研究方法

（英文精编版 · 第6版）

Software Engineering

A Practitioner's Approach

(Sixth Edition)

（美）Roger S. Pressman 著

机械工业出版社
China Machine Press

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20多年以来，《软件工程：实践者的研究方法》一书是最受学生和行业专业人员欢迎的软件工程指南。它在全面而系统、概括而清晰地介绍软件工程的有关概念、原则、方法和工具方面获得了广大读者的好评，在国际软件工程界享有无可质疑的权威地位。

本书基于该书第6版进行改编，保留其中的基本内容，压缩或删除了一些高级内容，使之更加适合作为国内高校计算机及相关专业本科生软件工程课程双语教学的教材，也可供软件工程领域的技术人员参考。

Roger S. Pressman: Software Engineering: A Practitioner's Approach, Sixth Edition (ISBN 0-07-123840-9).

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文艺复兴以降，源远流长的科学精神和逐步形成的学术规范，使西方国家在自然科学的各个领域取得了垄断性的优势；也正是这样的传统，使美国在信息技术发展的六十多年间名家辈出、独领风骚。在商业化的进程中，美国的产业界与教育界越来越紧密地结合，计算机学科中的许多泰山北斗同时身处科研和教学的最前线，由此而产生的经典科学著作，不仅擘划了研究的范畴，还揭示了学术的源变，既遵循学术规范，又自有学者个性，其价值并不会因年月的流逝而减退。

近年，在全球信息化大潮的推动下，我国的计算机产业发展迅猛，对专业人才的需求日益迫切。这对计算机教育界和出版界都既是机遇，也是挑战；而专业教材的建设在教育战略上显得举足轻重。在我国信息技术发展时间较短的现状下，美国等发达国家在其计算机科学发展的几十年间积淀和发展的经典教材仍有许多值得借鉴之处。因此，引进一批国外优秀计算机教材将对我国计算机教育事业的发展起到积极的推动作用，也是与世界接轨、建设真正的世界一流大学的必由之路。

机械工业出版社华章分社较早意识到“出版要为教育服务”。自1998年开始，华章分社就将工作重点放在了遴选、移译国外优秀教材上。经过多年的不懈努力，我们与Pearson，McGraw-Hill，Elsevier，MIT，John Wiley & Sons，Cengage等世界著名出版公司建立了良好的合作关系，从他们现有的数百种教材中甄选出Andrew S. Tanenbaum，Bjarne Stroustrup，Brain W. Kernighan，Dennis Ritchie，Jim Gray，Afred V. Aho，John E. Hopcroft，Jeffrey D. Ullman，Abraham Silberschatz，William Stallings，Donald E. Knuth，John L. Hennessy，Larry L. Peterson等大师名家的一批经典作品，以“计算机科学丛书”为总称出版，供读者学习、研究及珍藏。大理石纹理的封面，也正体现了这套丛书的品位和格调。

“计算机科学丛书”的出版工作得到了国内外学者的鼎力襄助，国内的专家不仅提供了中肯的选题指导，还不辞劳苦地担任了翻译和审校的工作；而原书的作者也相当关注其作品在中国的传播，有的还专程为其书的中译本作序。迄今，“计算机科学丛书”已经出版了近两百个品种，这些书籍在读者中树立了良好的口碑，并被许多高校采用为正式教材和参考书籍。其影印版“经典原版书库”作为姊妹篇也被越来越多实施双语教学的学校所采用。

权威的作者、经典的教材、一流的译者、严格的审校、精细的编辑，这些因素使我们的图书有了质量的保证。随着计算机科学与技术专业学科建设的不断完善和教材改革的逐渐深化，教育界对国外计算机教材的需求和应用都将步入一个新的阶段，我们的目标是尽善尽美，而反馈的意见正是我们达到这一终极目标的重要帮助。华章分社欢迎老师和读者对我们的工作提出建议或给予指正，我们的联系方法如下：

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Adapter's Forword

Purpose

The original of this book is an excellent work of Dr. Pressman. The 6th edition emphasizes on the new software engineering process and techniques, and is definitive on basically all the subjects that are listed by the Software Engineering Body of Knowledge (SWEBOK, http://www.swebok.org/). The extensive examples, references and online exercises are also quite helpful to the students. There are numbers of universities and colleges in China that are taking this book as their textbooks and keep tracking through its different versions.

As the idea of bilingual teaching is promoted in the higher education institutes in China, more and more schools are getting interested in this book. However, over nine hundred pages of the original book make it too difficult for a Chinese student with an average English reading ability to comprehend the fundamentals of software engineering in a semester. In order to introduce this book to more Chinese college students, a compression of the original book is made to better fit the book into the syllabus of an undergraduate course with only the core contents, and to reduce the students' reading load.

What's Compressed

First of all, since most of the undergraduate Software Engineering course is mainly a "methods course" plus some fundamentals on management, only the parts 1, 2 and 4 of the original book are kept. Parts 3 (Web Engineering) and 5 (Advanced Topics) are for graduate courses and hence will not appear in the compressed version, neither Section 27.4 (Configuration Management for Web Engineering).

Secondly, according to the feedbacks from the students in the past eight years, we realize that as undergraduate students who have no experience on doing any large-scaled project, it is quite difficult for them to fully understand the point of doing measurements and collecting statistical data. It would be enough to simply introduce some basic concepts on metrics and estimation. Hence the following contents are removed: Sections 15.3-15.7 (Product Metrics for analysis, design, source code, testing and maintenance), Sections 22.4-22.6 (Metrics for Process and Projects - integrating metrics within the process, metrics for small organizations, and establishing a software metrics program), and Sections 23.9-23.10 (Specialized estimation techniques and the make/buy decision).

Other minor compressions are made at the following 5 chapters:

1. In Chapter 1, Section 1.6 (How It All Starts) is removed to reduce the students' reading load.

2. In Chapter 2, Section 2.5 (Process Assessment) and Section 2.6 (Personal and Team Process Models) are considered as the advanced topics and hence are not kept in the

compressed version.

3. The content of Chapter 5 (Software Engineering Practice) will eventually be introduced in the following chapters and is removed to save the students some reading time.

4. In Chapter 7, Sections 7.6-7.8 (Building the analysis model, negotiating and validating requirements) are considered as the advanced topics and are cut from the compressed version.

5. In Chapter 14, Sections (and sub-sections) 14.4.4 (Graph Matrices), 14.6.1 (Graph-Based Testing Methods), 14.6.4 (Orthogonal Array Testing), 14.7.6 (Testing Surface and Deep Structures), 14.10 (Testing for Specials) and 14.11 (Testing Patterns) are considered as the advanced topics and hence will not appear in the compressed version.

Acknowledgments

We feel grateful to Roger Pressman, the author of the original book, and McGraw Hill, the original publisher, for allowing us to compress the original 912-pages book into about five hundred pages. It is their understanding and generosity that make it possible for more Chinese students to enjoy this distinguished book. Since the compression is made by simply removing some chapters or sections, we hope to keep as far as possible the elegancy of Dr. Pressman's writing style.

Thanks to everyone at China Machine Press who have put in great effort to make this kind of cooperation possible.

The compression is made according to my own experience in teaching and practicing in software engineering. It is certainly wild open for discussions and suggestions on further improvements. Your comments are important to us, and would be very much appreciated.

Yue Chen
Zhejiang University
(chenyue@cs.zju.edu.cn)

Preface

When computer software succeeds—when it meets the needs of the people who use it, when it performs flawlessly over a long period of time, when it is easy to modify and even easier to use—it can and does change things for the better. But when software fails—when its users are dissatisfied, when it is error prone, when it is difficult to change and even harder to use—bad things can and do happen. We all want to build software that makes things better, avoiding the bad things that lurk in the shadow of failed efforts. To succeed, we need discipline when software is designed and built. We need an engineering approach.

In the 25 years since the first edition of this book was written, software engineering has evolved from an obscure idea practiced by a relatively small number of zealots to a legitimate engineering discipline. Today, it is recognized as a subject worthy of serious research, conscientious study, and tumultuous debate. Throughout the industry, software engineer has replaced programmer as the job title of preference. Software process models, software engineering methods, and software tools have been adopted successfully across a broad spectrum of industry applications.

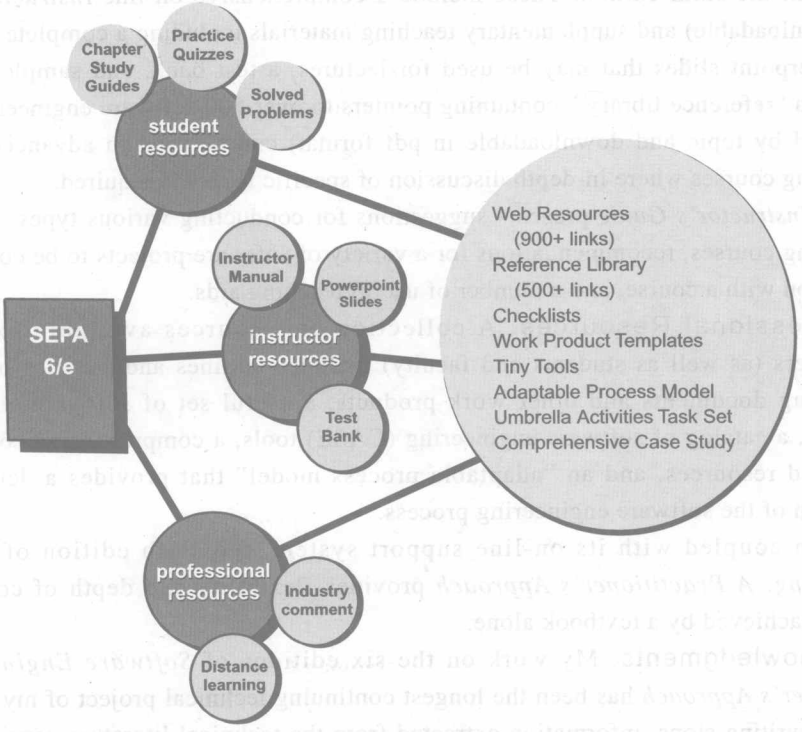
Although managers and practitioners alike recognize the need for a more disciplined approach to software, they continue to debate the manner in which discipline is to be applied. Many individuals and companies still develop software haphazardly, even as they build systems to service today's most advanced technologies. Many professionals and students are unaware of modern methods. And as a result, the quality of the software that we produce suffers, and bad things happen. In addition, debate and controversy about the true nature of the software engineering approach continue. The status of software engineering is a study in contrasts. Attitudes have changed, progress has been made, but much remains to be done before the discipline reaches full maturity.

The sixth edition of *Software Engineering: A Practitioner's Approach* is intended to serve as a guide to a maturing engineering discipline. The sixth edition, like the five editions that preceded it, is intended for both students and practitioners, retaining its appeal as a guide for the industry professional and as a comprehensive introduction for the student at the upper-level undergraduate or first-year graduate level.

The sixth edition is considerably more than a simple update. The book has been revised extensively and restructured to emphasize new and important software engineering processes and practices. In addition, a new "support system," illustrated on the next page, provides a comprehensive set of student, instructor, and professional resources to complement the content of the book. These resources are presented as part of a Web site (www.mhhe.com/pressman) specifically designed for *Software Engineering: A Practitioner's Approach.*

The Sixth Edition. The 32 chapters of the sixth edition have been organized into five parts. This has been done to compartmentalize topics and assist instructors who may not have the time to complete the entire book in one term. Part 1, *The Software Process*,

presents different views of software process, considering all important process models and addressing the debate between prescriptive and agile process philosophies. Part 2, *Software Engineering Practice*, presents analysis, design, and testing methods with an emphasis on object-oriented techniques and UML modeling. Because object-oriented methods are now widely used throughout the industry, the content of Part 4 of the fifth edition ("object-oriented software engineering") has now been fully integrated into all discussions of software engineering practice in this edition. Part 3, *Applying Web Engineering*, presents a complete engineering approach for the analysis, design, and testing of Web applications. Part 4, *Managing Software Projects*, presents topics that are relevant to those who plan, manage, and control a software project. Part 5, *Advanced Topics in Software Engineering*, presents dedicated chapters that address formal methods, cleanroom software engineering, component-based software engineering, reengineering, and future trends.



The SEPA 6/e Support System

In addition to many new and significantly revised chapters, the sixth edition introduces over 120 sidebars that (1) allow the reader to follow a (fictional) project team as it plans and engineers a computer-based system; (2) provide complementary discussions of selected topics; (3) outline "task sets" that describe work flow for selected software engineering activities; and (4) suggest automated tools relevant to chapter topics.

The five-part organization of the sixth edition enables an instructor to "cluster" topics

based on available time and student need. An entire one-term course can be built around one or more of the five parts. For example, a "methods course" might emphasize only Parts 1 and 2; a Web development course might emphasize Parts 1 and 3; a "management course" would stress Parts 1 and 4. By organizing the sixth edition in this way, I have attempted to provide an instructor with a number of teaching options. In every case, the content of the sixth edition is complemented by the following elements of the *SEPA, 6/e Support System.*

Student Resources. A wide variety of student resources includes an extensive on-line learning center encompassing study guides, practice quizzes and a variety of Web-based resources including software engineering checklists, an evolving collection of "tiny tools," a complete case study, and work product templates. In addition, over 900 categorized Web references allow a student to explore software engineering in greater detail.

Instructor Resources. A broad array of instructor resources has been developed to supplement the sixth edition. These include a comprehensive on-line *Instructor's Guide* (also downloadable) and supplementary teaching materials including a complete set of over 700 Powerpoint slides that may be used for lectures, a test bank, and sample exams. In addition, a "reference library", containing pointers to over 500 software engineering papers (organized by topic and downloadable in pdf format) can be used in advanced software engineering courses where in-depth discussion of specific topics is required.

The *Instructor's Guide* presents suggestions for conducting various types of software engineering courses, recommendations for a variety of software projects to be conducted in conjunction with a course, and a number of useful teaching aids.

Professional Resources. A collection of resources available to industry practitioners (as well as students and faculty) includes outlines and samples of software engineering documents and other work products, a useful set of software engineering checklists, a catalog of software engineering (CASE) tools, a comprehensive collection of Web-based resources, and an "adaptable process model" that provides a detailed task breakdown of the software engineering process.

When coupled with its on-line support system, the sixth edition of *Software Engineering: A Practitioner's Approach* provides flexibility and depth of content that cannot be achieved by a textbook alone.

Acknowledgments. My work on the six editions of *Software Engineering: A Practitioner's Approach* has been the longest continuing technical project of my life. Even when the writing stops, information extracted from the technical literature continues to be assimilated and organized. For this reason, my thanks to the many authors of books, papers, and articles (in both hardcopy and electronic media) who have provided me with additional insight, ideas, and commentary over the past 25 years.

Special thanks go to Tim Lethbridge of the University of Ottawa who performed an extremely detailed review of the sixth edition, assisted me in the development of UML and OCL examples, and developed the comprehensive case study that accompanies this book. His assistance and comments were invaluable. Special thanks also go to Bruce Maxim of

the University of Michigan-Dearborn, who assisted me in developing the Web site that accompanies this book. Bruce is responsible for much of its pedagogical content. Finally, I wish to thank the reviewers of the sixth edition. Their in-depth comments and thoughtful criticism have been invaluable.

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The content of the sixth edition of *Software Engineering: A Practitioner's Approach* has been shaped by industry professionals, university professors, and students who have used earlier editions of the book and have taken the time to communicate their suggestions, criticisms, and ideas. My thanks to each of you. In addition, my personal thanks go to our many industry clients worldwide, who certainly have taught me as much or more than I could ever teach them.

As the editions of this book have evolved, my sons, Mathew and Michael, have grown from boys to men. Their maturity, character, and success in the real world have been an inspiration to me. Nothing has filled me with more pride. And finally, to Barbara, my love and thanks for encouraging still another edition of "the book."

Roger S. Pressman

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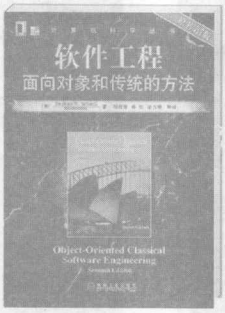

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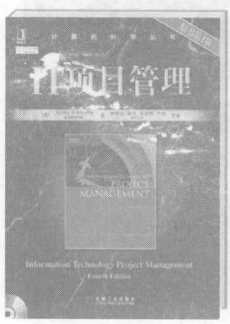

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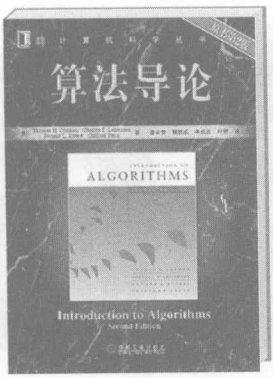

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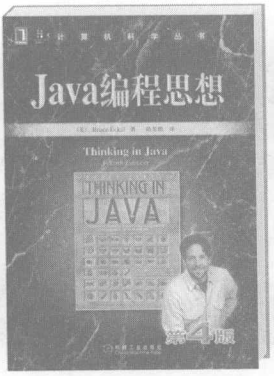

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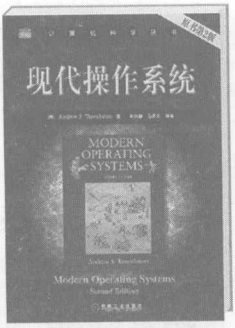

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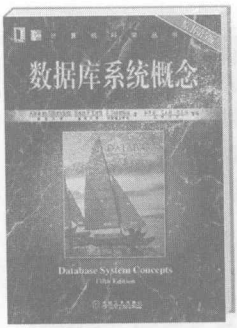

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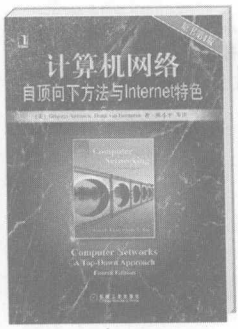

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