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大学计算机教育国外著名教材系列（影印版）

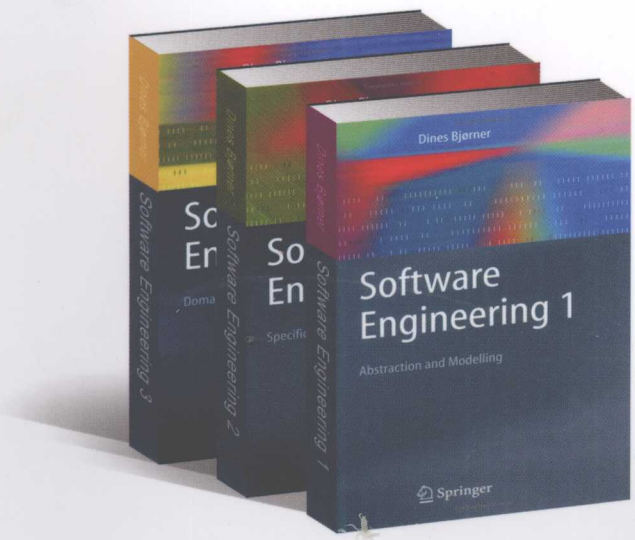
SOFTWARE ENGINEERING 2

SPECIFICATION OF SYSTEMS AND LANGUAGES

软件工程 卷2

系统与语言规约

Dines Bjørner 著



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Software Engineering 2

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出 版 说 明

进入 21 世纪，世界各国的经济、科技以及综合国力的竞争将更加激烈。竞争的中心无疑是对人才的竞争。谁拥有大量高素质的人才，谁就能在竞争中取得优势。高等教育，作为培养高素质人才的事业，必然受到高度重视。目前我国高等教育的教材更新较慢，为了加快教材的更新频率，教育部正在大力促进我国高校采用国外原版教材。

清华大学出版社从 1996 年开始，与国外著名出版公司合作，影印出版了“大学计算机教育丛书（影印版）”等一系列引进图书，受到国内读者的欢迎和支持。跨入 21 世纪，我们本着为我国高等教育教材建设服务的初衷，在已有的基础上，进一步扩大选题内容，改变图书开本尺寸，一如既往地请有关专家挑选适用于我国高校本科及研究生计算机教育的国外经典教材或著名教材，组成本套“大学计算机教育国外著名教材系列（影印版）”，以飨读者。深切期盼读者及时将使用本系列教材的效果和意见反馈给我们。更希望国内专家、教授积极向我们推荐国外计算机教育的优秀教材，以利我们把“大学计算机教育国外著名教材系列（影印版）”做得更好，更适合高校师生的需要。

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中 文 序

信息化社会的发展越来越依赖于软件。如何在期望的时限内、以可承受的开销、开发具有满意质量的软件成为人们特别是软件开发人员所关心的问题。自 1969 年 NATO 会议首次提出“软件工程”一词以来，软件工程已成为了一门学科。IEEE 的 SWEBOK 和 SEEK，以及 ACM/IEEE 的计算教程 2005 相继发布，标志着软件工程的学科内涵及其教育逐步走向规范与成熟。

软件形式化开发方法是软件工程的重要组成，荟萃了软件工程在原理和科学上的许多精华，被认为是开发可靠、安全软件的重要途径。Dines Bjørner 教授所著的《软件工程》（卷 1～3）系统地介绍了软件形式化开发方法，包括数学基础、形式化模型与建模、形式化规约、领域与需求分析以及软件设计等内容。该书对如何运用形式化方法进行软件开发进行了比较全面的阐述。Dines 是软件工程领域的著名专家，是著名的 VDM 方法和 RAISE 方法的创建者之一，因其在形式化软件开发方法及其在工业界的应用的突出贡献和倡导作用而获选 ACM Fellow 和 IEEE Fellow。这本书是他长期研究和实践的总结和提炼，内容丰富，想必会令中国的软件工程人员开卷有益。

很高兴得知《软件工程》（卷 1～3）的英文影印版和中文翻译版即将出版，应老友之邀，提笔作序，以资庆贺。

陈火旺

于梦泽园

Preface

The present volume is the second of three volumes on the engineering principles and techniques of software engineering. We refer to the Preface of Vol. 1, as well as to Chap. 1 of that same volume, for a proper preface and overall introduction to all volumes in this series. We assume that the reader has studied Vol. 1.

Overview

The present volume focuses on principles and techniques for specifying languages and systems. It uses the abstraction and modelling principles, techniques and tools covered in Vol. 1, and it supplements those principles, techniques and tools with additional ones. In particular the present volume emphasises the following four aspects:

- advanced specification facets:
  - ⋆ hierarchies and composition Chap. 2
  - ⋆ denotations and computations Chap. 3
  - ⋆ configurations: contexts and states Chap. 4
  - ⋆ time, space and space/time Chap. 5
  - ⋆ modularisation and Chap. 10
  - ⋆ automata and machines Chap. 11
- linguistics:
  - ⋆ pragmatics Chap. 6
  - ⋆ semantics Chap. 7
  - ⋆ syntax and Chap. 8
  - ⋆ semiotics Chap. 9
- concurrency and temporality:
  - ⋆ Petri nets Chap. 12
  - ⋆ message sequence charts and live sequence charts Chap. 13
  - ⋆ statecharts and Chap. 14

"UML"-ising Formal Techniques

Some notable features should be emphasised here. The concurrency aspect, Chaps. 12–14, also illustrates diagrammatic specifications, as does Sect. 10.3 (UML class diagrams). Together this material illustrates that popular features of the Unified Modeling Language (UML [59, 237, 382, 440]) can simply and elegantly be included, i.e., used, with RSL. Christian Krog Madsen is the main author of Chaps. 12–14.

The RAISE Specification Language: RSL

As in Vol. 1, we use RSL extensively in the present volume. Hence we insert, in Chap. 1, an RSL Primer — and otherwise refer to the RAISE URL: http://www.iist.unu.edu/raise/.

Acknowledgments

The preface of Vol. 1 contained an extensive acknowledgment section.

Combining RSL with Petri nets (Chap. 12), with message or live sequence charts (Chap. 13), and with statecharts (Chap. 14) is due primarily to Christian Krog Madsen [316, 317]. Very many and dear thanks are therefore extended to Christian. Combining RSL with UML-like class diagrams (Sect. 10.3) is due primarily to Steffen Holmslykke [9, 10]. Similar thanks are therefore graciously extended to Steffen. Martin Pěnička is likewise dearly acknowledged for having provided Examples 12.8 (Sect. 12.3.4), 14.7 (Sect. 14.4.1) and 14.8 (Sect. 14.4.2).

Colleagues at the National University of Singapore, Andrei Stefan and Yang ShaoFa, studied and proofread Chaps. 12–15. It was with Yang ShaoFa, as the leading person, that I decided to work out the model of CTP (Communicating Transaction Processes) of Sect. 13.6. Their comments and work are much appreciated.

A main source of academic joy has been the 30 years I have been at the Technical University of Denmark, 1976 till now.

Last, but not least, I acknowledge the tremendous support received from the Springer editor, Ronan Nugent.

Brief Guide to Volume 2

This volume has several chapters. The chapters are grouped into parts. Figure 2 abstracts a precedence relation between chapters. It is one that approximates suggested sequences of studying this volume.

- Chapter 1 is considered a prerequisite for the study of any chapter.
- We group some parts into the dash-circled groups $A - E$.
- Group A consists of Chaps. 2–5 that can be studied in any order.
- Group B consists of Chaps. 6–9 that should be studied in order 6, 7, 8 and 9.
- Group C consists of Chaps. 10–11 that can be studied in any order.
- Group D consists of Chaps. 12–15 that can be studied in almost any order. Chap. 14 does contain an example which requires having studied Chap. 13 first.
- Group E consists of Chaps. 16–19 that should be studied in order 16, 17 and 18. Chap. 19 can be studied in-between, before, or after. Preferably after.
- Groups $A - E$ can be studied in any order. But it might be useful to have studied Chap. 5 before Chap. 15, and Chap. 10 before Chap. 18, and to have studied Group B before Group E.
- It is no harm to study Chap. 20.
- Appendix A contains an overview of our naming convention.

Within most chapters many sections can be skipped. Typically those with larger examples or towards the end of the chapters.

In this way a teacher or a reader can compose a number of suitable courses and studies. Some such are suggested in Fig. 1.

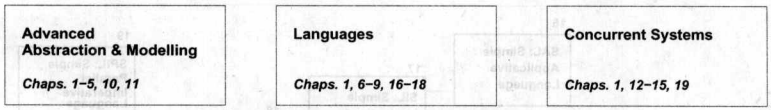
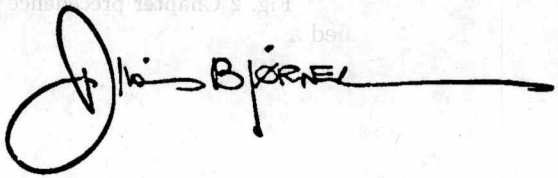


Fig. 1 Alternative courses based solely on Vol. 2



Dines Bjørner
Technical University of Denmark, 2005–2006

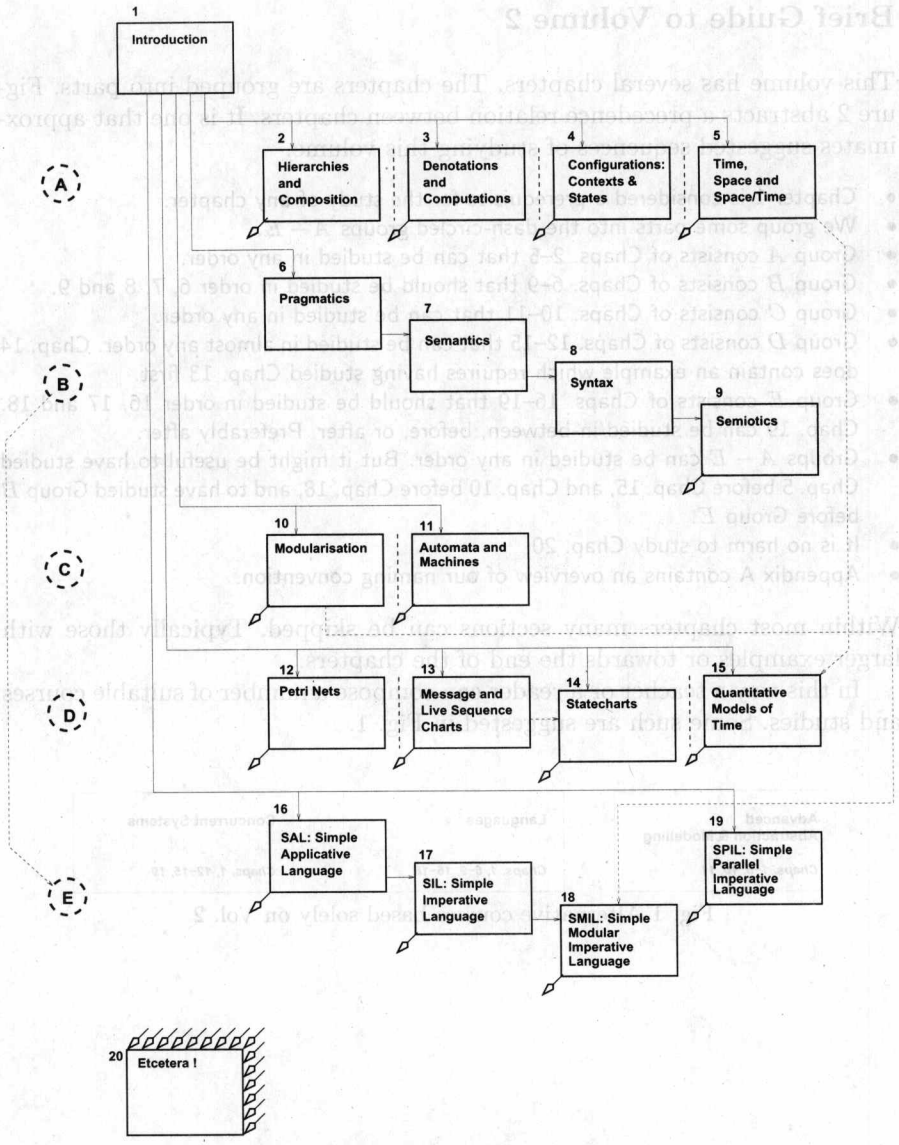


Fig. 2 Chapter precedence graph

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Part II SPECIFICATION FACETS