

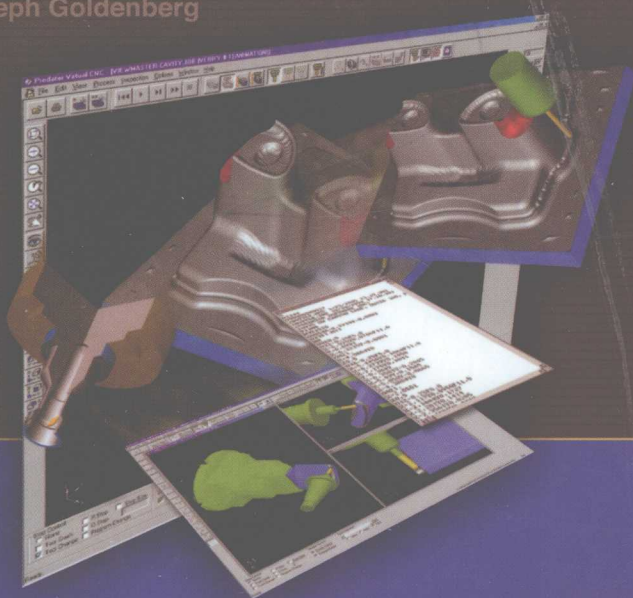
数控加工导论

(英文版·第4版)

Fourth Edition

Introduction to Computer Numerical Control (CNC)

James V. Valentino
Joseph Goldenberg



(美) James V. Valentino 著
Joseph Goldenberg



机械工业出版社
China Machine Press

TG659/Y8D

2008

经 典 原 版

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Original English language title: *Introduction to Computer Numerical Control(CNC), Fourth Edition* (ISBN 978-0-13-243690-8) by James V. Valentino and Joseph Goldenberg, Copyright © 2008, 2003, 2000, 1993 by Pearson Education Inc.

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本书版权登记号:图字:01-2008-3285

图书在版编目(CIP)数据

数控加工导论(英文版·第4版)/(美)瓦伦蒂诺(Valentino, J. V.), (美)戈登堡(Goldenberg, J.)著. —北京:机械工业出版社, 2008.8

(经典原版书库)

书名原文: *Introduction to Computer Numerical Control (CNC), Fourth Edition*

ISBN 978-7-111-24736-4

I. 数… II. ①瓦… ②戈… III. 数控机床-加工-英文 IV. TG659

中国版本图书馆CIP数据核字(2008)第110034号

机械工业出版社(北京市西城区百万庄大街22号 邮政编码 100037)

责任编辑:迟振春

北京牛山世兴印刷厂印刷 · 新华书店北京发行所发行

2008年8月第1版第1次印刷

170mm × 242mm · 37.75印张

标准书号: ISBN 978-7-111-24736-4

ISBN 978-7-89482-766-1 (光盘)

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出版者的话

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，不仅肇划了研究的范畴，还揭橥了学术的源变，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, Wiley, 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, Brian W. Kernighan, Dennis Ritchie, Jim Gray, Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Abraham Silberschatz, William Stallings, Donald E. Knuth, John L. Hennessy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、研究及收藏。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，我们的联系方式如下：

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To my wife Barbara, and to our delightful children, Sarah and Andrew

James V. Valentino

To all my students, past and future, for their inspiration and support

Joseph Goldenberg

PREFACE

One of the greatest challenges facing the United States today is in manufacturing technology. The computer has revolutionized this technology, virtually transforming the processes of product design, analysis, and manufacture. Industries are finding that the new manufacturing technology demands well-trained personnel. Education is now viewed as a continuous and long-term investment.

The fourth edition of *Introduction to Computer Numerical Control (CNC)* has been expanded and improved. Chapter 1 provides updated presentation of input and storage methods. Chapter 2 thoroughly discusses loop systems for controlling tool movement and backlash. Chapter 3 expands discussion of cutting fluids. New material describing important features of the Machine Control Unit for machining centers is given in Chapter 4. The blueprint reading material is divided as follows: Chapter 5—*Review of Basic Blueprint Reading for CNC Programmers*, Chapter 6—*Review of Basic Material Specifications for CNC Programmers*, and Chapter 7—*Review of Basic Geometric Dimensioning and Tolerancing for CNC Programmers*. New KWIK TRIG software for solving right triangles is presented in Chapter 8. Chapter 9 features new material on methods of holding the part during milling operations. Methodizing is also given, complete with setup sheet, tool and operations sheet, and setup procedures for machining centers. Chapter 11 is new and provides step-by-step instructions on how to run the Predator mill simulator. Chapter 17 provides more material on the features on CNC lathes, including a detailed description of the machine control unit. Basic lathe operations, feed directions, and rake angles are thoroughly discussed. Chapter 18 is also new and includes instructions on how to run the Predator lathe simulator. Chapter 19 now includes material on methodizing operations for CNC lathes, setup sheet, tool and operation sheet formats, and setup procedures. Chapter 21 explains how to create a complete part program using *Mastercam X CNC* software.

Appendix B has been updated and new appendices have been added. Appendix E features tables of important GDT symbols and their meanings. An identification system for OD and ID tools is given in the new Appendix F. Appendix G is new and presents instructions on writing and verifying word address programs using Predator's mill simulator. Step-by-step instructions on how to write and verify word address part programs using Predator's lathe simulator are given in Appendix H.

Included with this edition are bound CD-ROM disks containing KWIK TRIG right-triangle solver software and Predator simulation software. The software displays real-time solid model animation of the machining that results from a word address part program. Additionally, it has an inspection mode that enables students to section as well as verify the dimensions of the machined part.

The new release of Predator simulation software works properly to simulate all the sample milling and lathe word address part programs in the text.

- New chapters have been introduced on reading material specifications, running the mill simulator, and running the lathe simulator.
- Each chapter has been updated and expanded with material that is useful to the CNC programmer.

- Each chapter begins with a brief listing of objectives and ends with a chapter summary.
- Illustrations and photographs are used liberally throughout to reinforce material being discussed.
- Students are frequently directed to key terms and concepts.
- Flowcharts are used to teach CNC process planning and program planning.
- The importance of job setup is discussed in the programming examples.
- Fundamental word address (G and M code) programming is stressed.
- Industrial standard practices and terms are emphasized in the programming examples.
- Needless cross-referencing has been eliminated. Each program is listed with all explanations on the same page.
- Pattern recognition is emphasized. The student is taught to recognize a certain group of programming commands as a programming pattern. For example, pattern A commands start up the CNC machine, whereas pattern B commands cause a tool change.
- An excellent assortment of review exercises is provided at the end of each chapter. Setup notes, a CNC tooling and operations sheet, and a clamping sketch is provided with each programming exercise.
- Predator simulation software enables the student to *visualize* and *verify* the *correctness* of *all* written word address part programs in the text.
- The industry standard Fanuc controller is emphasized throughout the text.
- Important mathematical principles are reviewed before programming is presented. A special chapter on right-triangle trigonometry provides the student with the critical mathematical information needed to understand programming.
- KWIK TRIG right-triangle solver is provided as an aid in easily determining the sides or angles of right triangles.
- The student is exposed to the big picture of CNC shop activities. A special chapter explains the most important operations to be carried out in manufacturing a part.
- Appendixes contain information useful to the CNC student including a list of important safety precautions; summaries of G and M codes for milling and turning operations; recommended speeds and feeds for different materials with respect to drilling, milling, and turning operations; important and easy-to-use machining formulas.
- New appendixes feature additional information useful to the CNC student. These include tables of important GDT symbols; identification system for OD and ID tools; step-by-step instructions on writing and verifying mill and lathe part programs via Predator simulation software.
- A comprehensive glossary of key CNC terms is provided at the end of the text.

Introduction to Computer Numerical Control (CNC), Fourth Edition, can be used as an entry-level text for many different types of training applications, including:

- Undergraduate and one-semester or two-semester CNC courses
- The manual component of a CNC programming course
- Industry training course
- Seminar on CNC programming
- Adult education course
- Reference text for self-study

This textbook is designed to be used in many types of educational institutions:

- Four-year engineering schools
- Four-year technology schools

- Community colleges
- Trade schools
- Industrial training centers

This work is the result of several years of experience running CNC courses for both industrial personnel and the students at Queensborough Community College. We found that many existing texts were either too general or too advanced for direct application. As a result, we drafted supplementary notes containing step-by-step information. The notes were enhanced and tested extensively in the classroom. Several colleagues, both in industry as well as in education, were called upon for their input. A thorough market survey also influenced the final content. It should be noted that all the programs presented have been thoroughly tested. The student is advised to take the appropriate safety precautions when running them on a CNC machine.

Online Instructor's Manual

To access supplementary materials online, instructors need to request an instructor access code. Go to www.prenhall.com, click the **Instructor Resource Center** link, and then click **Register Today** for an instructor access code. Within 48 hours after registering you will receive a confirming e-mail including an instructor access code. Once you have received your code, go to the site and log on for full instructions on downloading the materials you wish to use.

ACKNOWLEDGMENTS

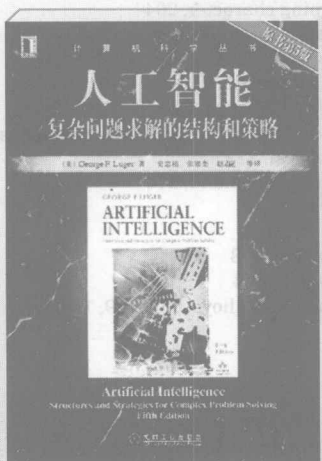
The authors are indebted to many persons and industrial organizations for their assistance in preparing this manuscript. They are listed as follows:

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- Autodesk Corporation
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- Bridgeport Machines, Inc.
- Chick Machine Tool Company
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- Cleveland Twist Drill Company
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- Waukesha Cutting Tools, Inc.
- Robert Brumm, State University of New York and Alfred State College
- Kurt Carlson, Cleveland Industrial Training Center
- Mr. Bernard Hunter, CLT, Queensborough Community College
- Dan Krier, Moraine Park Technical College
- Zhongming Liang, Purdue University at Fort Wayne
- Mr. Martin Powell, Senior CLT, Queensborough Community College

The authors would also like to thank the reviewers of this edition for their helpful comments and suggestions: Michael Denz, Erie Community College; William James Kelly, Santa Rosa Junior College; Kent Kohkonen, Brigham Young University; Robert R. Latham, II, Onondaga Community College; Mark E. Meyer, College of DuPage; and Michael J. Schritchfield, Thomas Nelson Community College.

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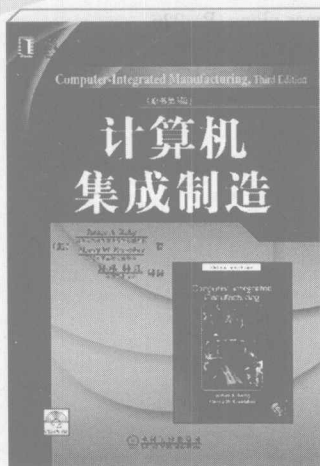
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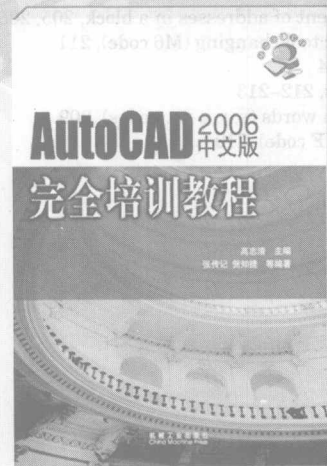
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