Includes bound-in CADTrain CD-ROM

Pro/ENGINEER® 2000i

Louis Gary Lamit

Pro/ENGINEER® 2000i

Louis Gary Lamit
De Anza College

with technical assistance provided by
James Gee
De Anza College

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Dedication

For my new wife **Thuy Dao Lamit**
and the happiness she has brought

Om Mani Padme Hum

About the Author

Louis Gary Lamit is the former head of the drafting department and CAD facility manager, and is currently an instructor, at De Anza College in Cupertino, California, where he teaches computer-aided drafting and design using Pro/ENGINEER.

Mr. Lamit has worked as a drafter, designer, numerical control (NC) programmer, technical illustrator, and engineer in the automotive, aircraft, and piping industries. Most of his work experience is in the area of mechanical and piping design. Mr. Lamit started as a drafter in Detroit (as a job shopper) in the automobile industry, doing tooling, dies, jigs and fixture layout, and detailing at Koltanbar Engineering, Tool Engineering, Time Engineering, and Premier Engineering for Chrysler, Ford, AMC, and Fisher Body. Mr. Lamit has worked at Remington Arms and Pratt & Whitney Aircraft as a designer, and at Boeing Aircraft and Kollmorgan Optics as an NC programmer and aircraft engineer.

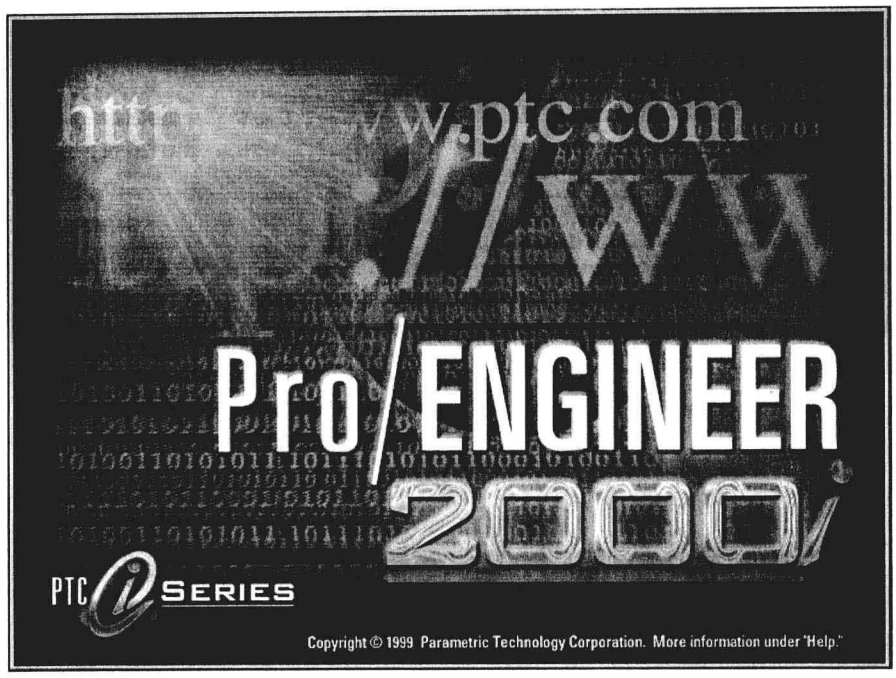
Mr. Lamit has also owned and operated his own consulting firm, and has been involved with advertising and patent illustrating.

Since leaving industry, Mr. Lamit has taught at all levels (Melby Junior High School, Warren, Michigan; Carroll County Vocational Technical School, Carrollton, Georgia; Heald Engineering College, San Francisco, California; Cogswell Polytechnical College, San Francisco and Cupertino, California; Mission College, Santa Clara, California; Santa Rosa Junior College, Santa Rosa, California; Northern Kentucky University, Highland Heights, Kentucky; and De Anza College, Cupertino, California).

Mr. Lamit has written a number of textbooks, including ***Industrial Model Building***, with Engineering Model Associates, Inc. (1981), ***Piping Drafting and Design*** (1981), ***Descriptive Geometry*** (1983), and ***Pipe Fitting and Piping Handbook*** (1984) for Prentice-Hall, ***Drafting for Electronics***, with Sandra Lloyd (3rd edition, 1998), and ***CADD***, with Vernon Paige (1987), were published by Charles Merrill (Macmillan-Prentice-Hall Publishing). ***Technical Drawing and Design*** (1994), ***Principles of Engineering Drawing***, with Kathy Kitto (1994), ***Engineering Graphics and Design***, with Kathy Kitto (1997), and ***Engineering Graphics and Design with Graphical Analysis***, with Kathy Kitto (1997), were published by West Publishing (ITP/Delmar). ***Basic Pro/ENGINEER in 20 Lessons*** (1998) and ***Basic Pro/ENGINEER (with references to PT/Modeler)*** (1999) were published by PWS Publishing (ITP).

Mr. Lamit received a B.S. degree from Western Michigan University in 1970 and did Masters' work at Wayne State University and Michigan State University. He has also done graduate work at the University of California at Berkeley and holds an NC programming certificate from Boeing Aircraft.

Preface



Pro/ENGINEER® is one of the most widely used CAD/CAM software programs in the world today. This book introduces you to the basics of the program and enables you to build on these basic commands to expand your knowledge beyond the scope of the book.

The book does not attempt to cover all of Pro/E's features, but rather to provide an introduction to the software, make you reasonably proficient in its use, and establish a firm basis for exploring and growing with the program as you use it in your career or classroom. For information on new releases of Pro/E, as well as data files and other useful tools pertaining to this book, point your web browser to **www.pws.com/ge/lamit.html**.

The basic premise of this book is that the more parts, assemblies, and drawings you create using Pro/E, the better you learn the software. With this in mind, each lesson introduces a new set of commands (with an incrementally harder set of parts), building on previous lessons. The parts created in the first thirteen lessons are used later in the text to create assemblies (Lessons 14-15), generate drawings (Lessons 16-20), and manufacture parts (Lesson 22). This procedure allows you to work with actual completed parts, assemblies, and drawings in a short lesson format, instead of building large complex projects where basic commands may be overshadowed and lost in a complicated process.

The book is divided into one set of twelve *Sections* and four *Parts*: **Part One--Creating Parts**, **Part Two--Assemblies**, **Part Three--Generating Drawings,** and **Part Four--Advanced Capabilities**. Part Four contains two lessons. Each new edition of the text will add one or more lessons to Part Four. Each **part** has a variety of individual **lessons**.

Every lesson introduces a new set of commands and concepts that are applied to a *part*, an *assembly*, or a *drawing*, depending on where in the book you are working.

Lessons involve creating a new part, an assembly, or a drawing, using a set of Pro/E commands that walk you through the process step by step. Each lesson starts with a list of objectives and ends with a **lesson project**. The lesson project consists of a part, assembly, or drawing that incorporates the lesson's new material and uses and expands on previously introduced material from other lessons. Projects *require* use of planning sheets from Appendix D as tools for establishing the design intent.

The **Appendixes** contain advanced projects, a glossary, reference materials, and planning sheets.

An online demo tutorial from **CADTRAIN**, called **COAch for Pro/ENGINEER®**, has been referenced throughout the book. It is one of the best ways available for teaching and learning CAD/CAM software. **COAch** is used within lessons and as a reference. A sampler CD is included in the back of the text. This CD contains a variety of modules from various products offered in ***CADTRAIN's COAch for Pro/ENGINEER®***. You will need Pro/ENGINEER software installed to run the tutorial and step-by-step functions of the CD. You can view the tutorial and step-by-step instructions without performing the procedures if you have **Netscape® 3.0** or later.

After working and teaching in drafting, design, and engineering graphics-oriented areas since 1966, I feel that Pro/E is one of the most comprehensive, intuitive, productive, and stimulating programs I have experienced. This book was written so that students and professionals will have an up-to-date Pro/E software manual. The book serves well as a home study guide for those wishing to expand their knowledge of Pro/E, as a training guide, or as a reference for the Pro/E user.

Pro/E runs on a **Windows® 95, Windows® 98, Windows NT®, Windows® 2000,** or UNIX platform. UNIX and Windows NT are preferred.

Engineering students and professionals with technical training in Pro/E are finding that knowledge of this powerful tool can open up a whole new career path with unlimited possibilities.

If you wish to contact me concerning questions, changes, additions, suggestions, comments, and so on, please send email to one of the following:

llamit@ix.netcom.com (Lamit and Associates)
lglamit@yahoo.com (De Anza College)
http://www2.netcom.com/~llamit/small.html

Acknowledgments

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- **Robert Conroy**, California Polytechnic State University, San Luis Obispo
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- **Dave Pettine** *Parametric Technology Corporation*

CADTRAIN, makers of COAch for Pro/ENGINEER® , for their Pro/ENGINEER tutorial software.

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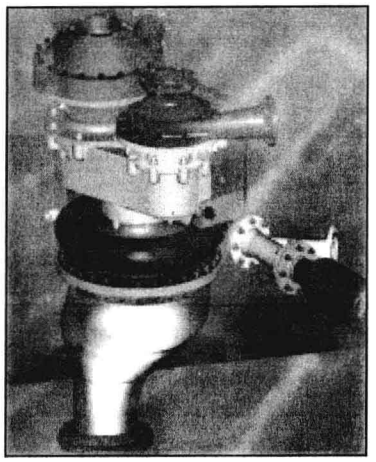
- **Kathy Bennett** CADTRAIN
- **Ron Gates** CADTRAIN
- **Rick Navarre** CADTRAIN

Lastly, I would like to thank my editor Suzanne Jeans for the help, understanding, and assistance she has provided in the last two versions of this text.

Resources

A variety of information, books, online products, and job opportunities (**www.pejn.com**) are available. We have listed some of the more useful and important resources. You can also do a search on the web with PTC, Proe, Pro/E, Pro/ENGINEER, and so on as keywords. Resources include web site addresses for a variety of companies, a list of books on Pro/ENGINEER, links to **InPart Design**, an internet-based company that supplies 3D models of standard parts over the web, and **CADTRAIN**, the creator of **COAch for Pro/ENGINEER**.



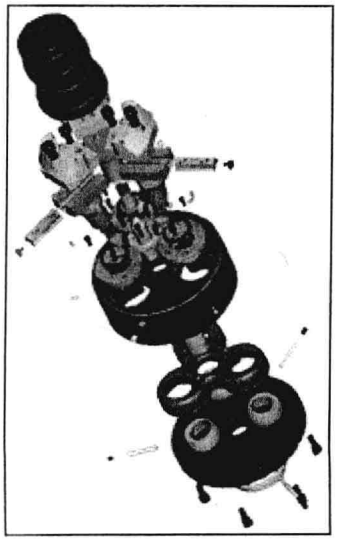
Parametric Technology Corporation

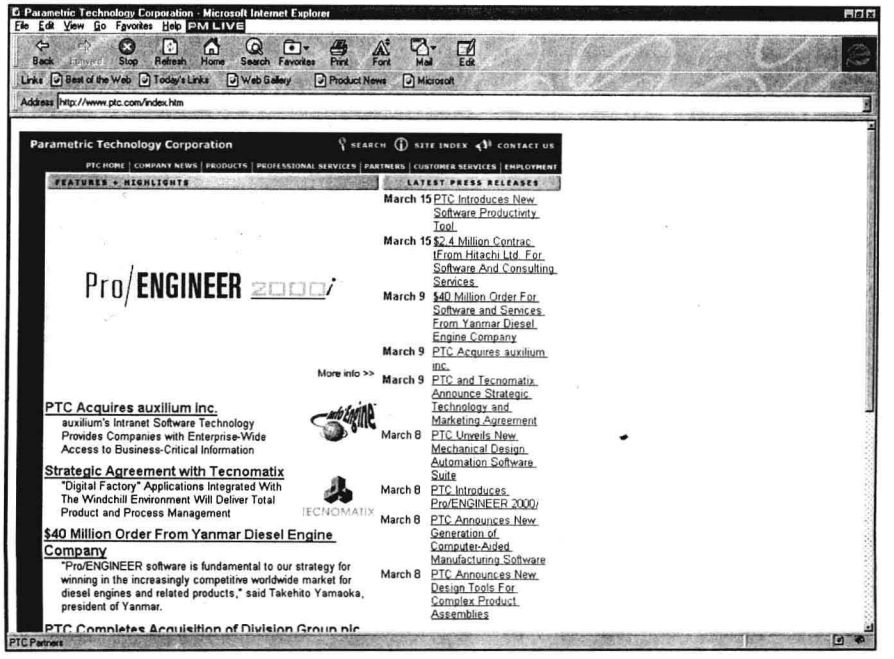
Pro/ENGINEER 2000i delivers the most comprehensive and tightly integrated applications available today to leverage the product model throughout the enterprise. With **Pro/ENGINEER 2000i**, PTC provides new and powerful functionality, including enhanced information management tools; improved capabilities for migration of legacy data; and dynamic tools to allow interaction with Pro/ENGINEER through a Netscape® browser.

This production-proven, fully mature release offers enhanced capabilities for leveraging both legacy data and Pro/ENGINEER product model information throughout the product development process.

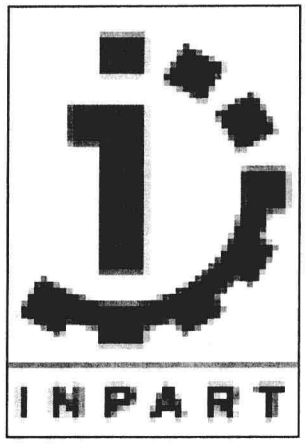
See
www.ptc.com
www.ptc.com/register.htm
www.ptc.com/cs/index.htm

Access the PTC web site at **www.ptc.com**. Register for an account on the system at **www.ptc.com/register.htm**. An email address and a valid software serial number are required for you to register. After registering, you will have your own login and password to enter the customer service site for technical support at **www.ptc.com/cs/index.htm**. Explore the different sections, including the Knowledge Base.





InPart DESIGN



See **www.inpart.com**

InPart is an Internet-based technical publisher serving the mechanical engineering market. With its manufacturing partners, InPart develops, markets, and supports three-dimensional (3D) computer-aided design (CAD) libraries of mechanical and electrical components. InPart offers these libraries containing 3D geometry, accompanying technical specifications, and component selection software to mechanical engineers via the Internet.

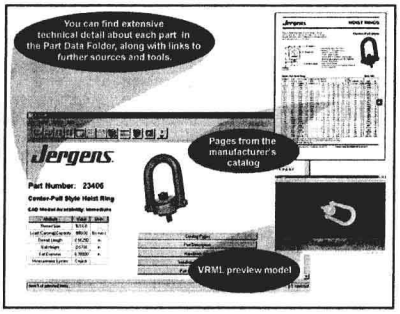
The company was founded in 1996 and launched its first product in February 1998. That product, DesignSuite, allows designers to intuitively search for and specify standard mechanical components from multiple manufacturers, including Aeroquip, Boston Gear, Parker Hannifin, The Torrington Company, Thomson Industries, and many more. A broad range of product categories are represented in the library, such as gears, actuators, automation equipment, hoses, clamps, tooling fixtures, motors, controls, connectors, pumps, fittings, and bearings.

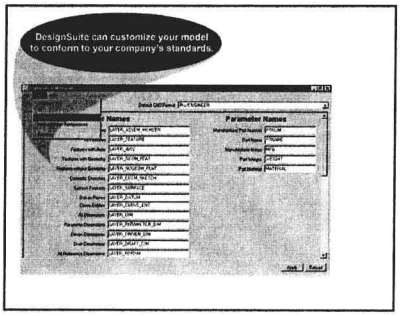
InPart's CAD modeling factory publishes technical data and models for approximately 20,000 new components per month, using tools that allow for real-time model configuration, creation, and customization. Models are delivered via popular CAD file formats, including Pro/ENGINEER, STEP, IGES, and 2D DXF.

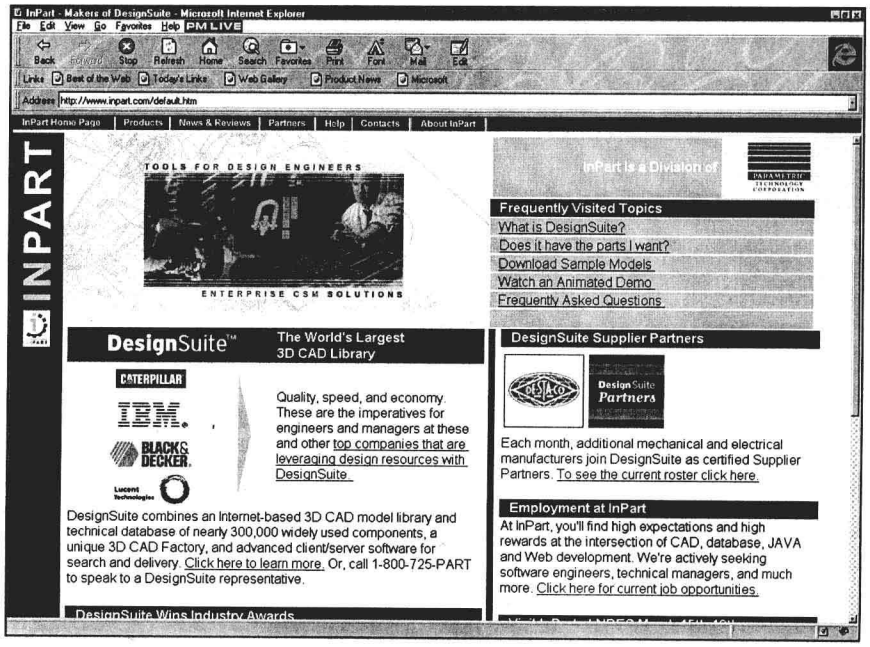
In the spring and summer of 1998, InPart launched DesignSuite on Solaris, HP-UX, DEC Alpha NT, and SGI platforms.

On 2 October 1998, InPart was acquired by Parametric Technology in a stock exchange.

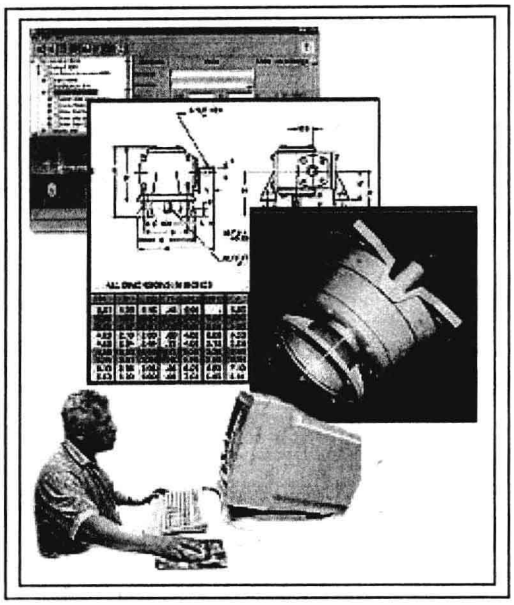
DesignSuite's powerful search engine can locate and retrieve the right standard part for your Pro/E design. Efficient search algorithms give DesignSuite an unprecedented high-performance query capability--results are returned to you within seconds.

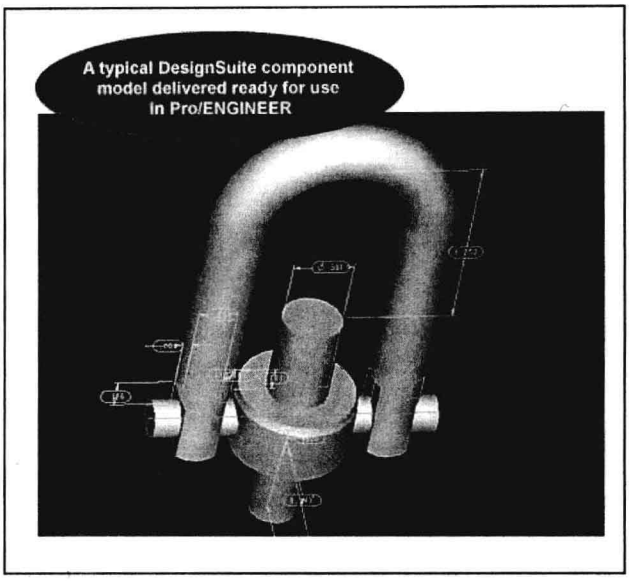




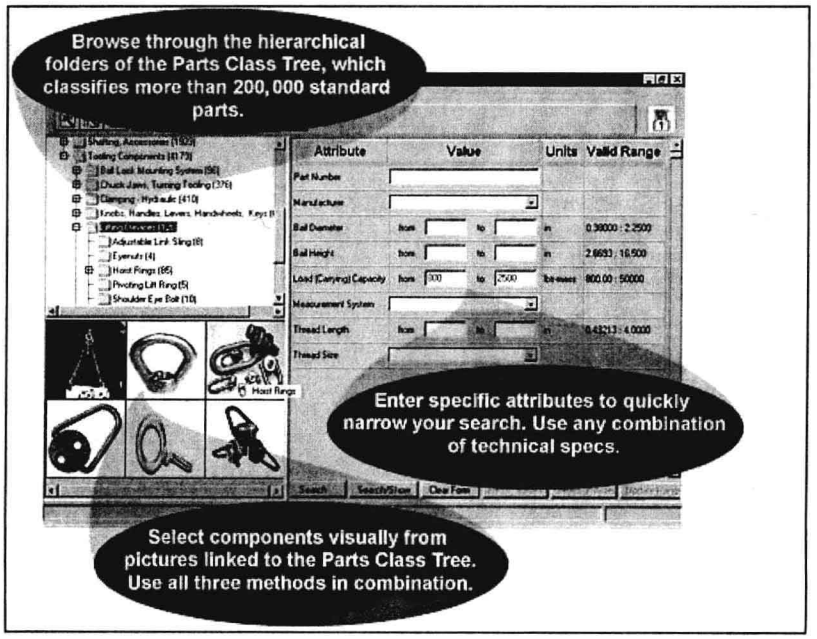


You can:
Search by part hierarchy, part graphics, and/or parametric data.
Search an extensively categorized database of vendor parts.
Search across top manufacturers in each part category.
Search a complete list of parts manufacturers.
Search through only the manufacturers you select.
Search by pertinent technical specifications.
Search by a specific part number.
Search by any combination of the above.
Search for the part you need.

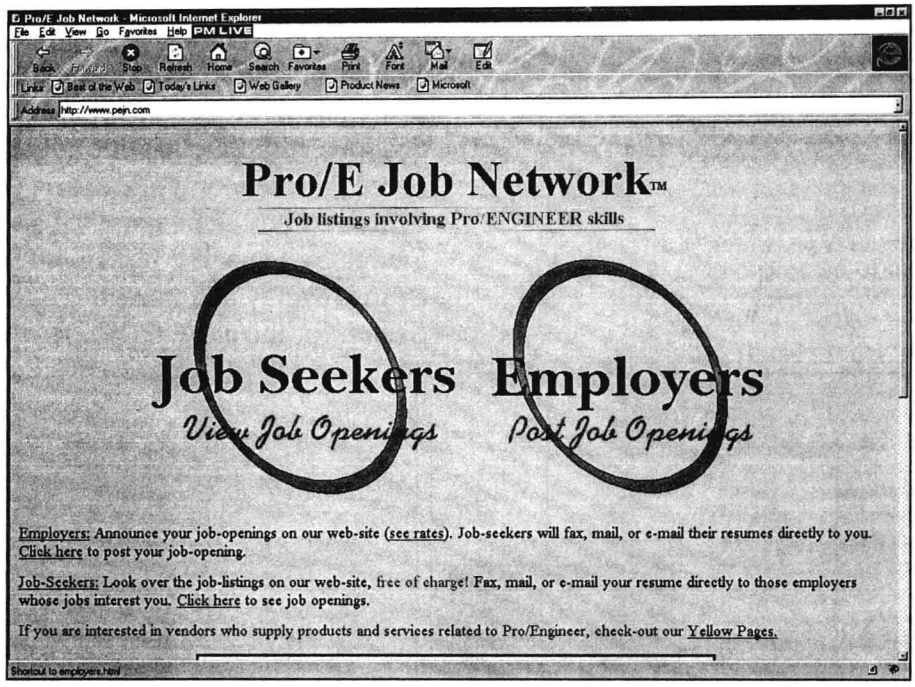




Parts are located by navigating the Part Class Tree and entering specifications in the Query Form. As the leaves in the Part Class Tree are selected, pertinent technical specifications or attributes are presented in the Query Form on the right panel. A toolbar is provided for quick access to commonly used commands.

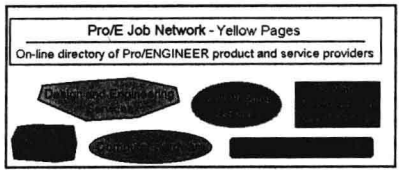


See **www.pejn.com**



Pro/ENGINEER Job Network

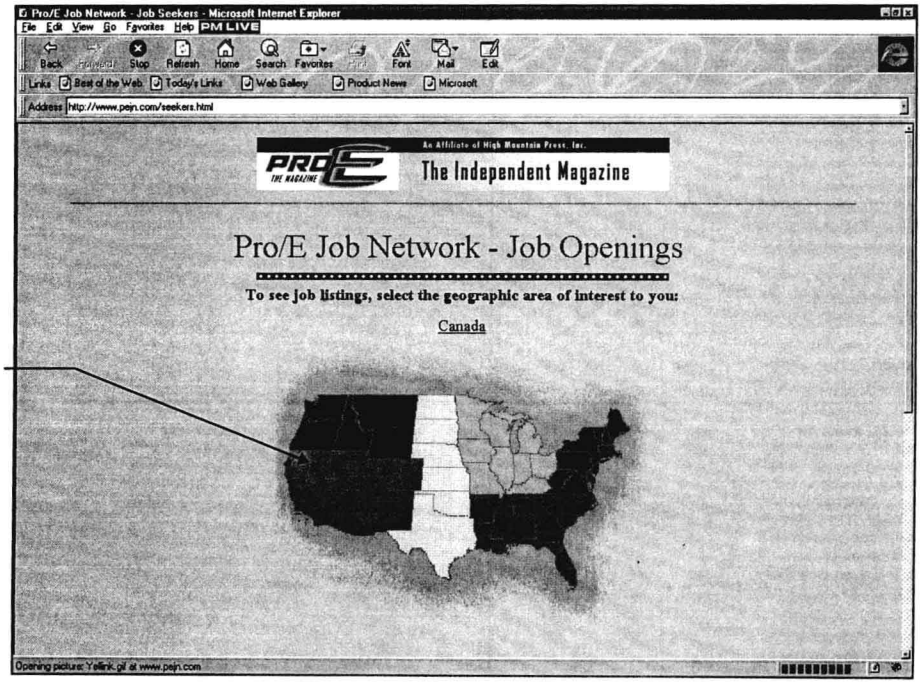
A variety of services are available over the Internet:



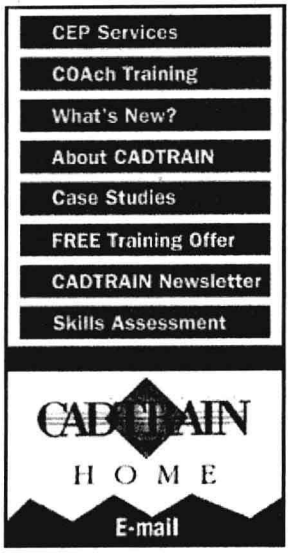
Employers: Announce your job openings on our web site. Job seekers will fax, mail, or email their resumes directly to you. If you request it, your company name, address, and phone number will not be listed.

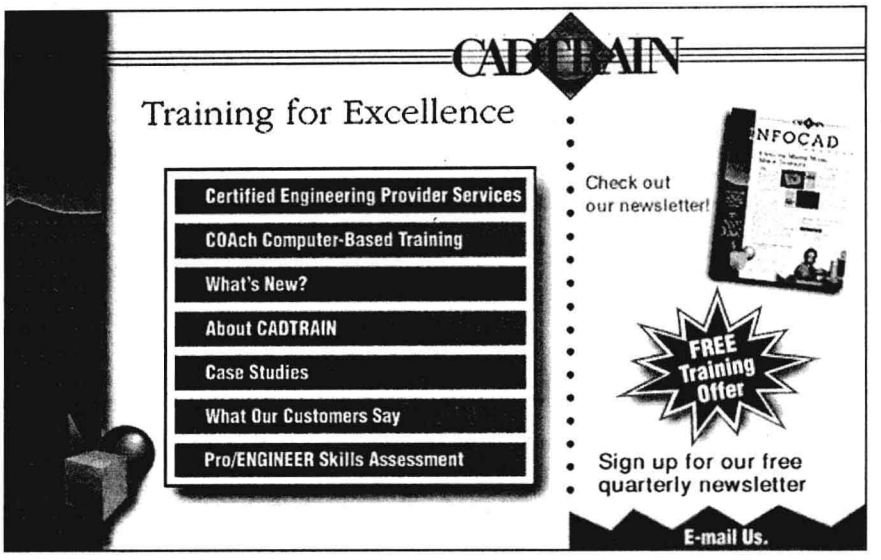
Job Seekers: Look over the job listings on our web site, free of charge. Fax, mail, or email your resume directly to those employers whose jobs interest you.

To see a list of jobs, pick on a section of the country where you are interested in working



See **www.cadtrain.com**



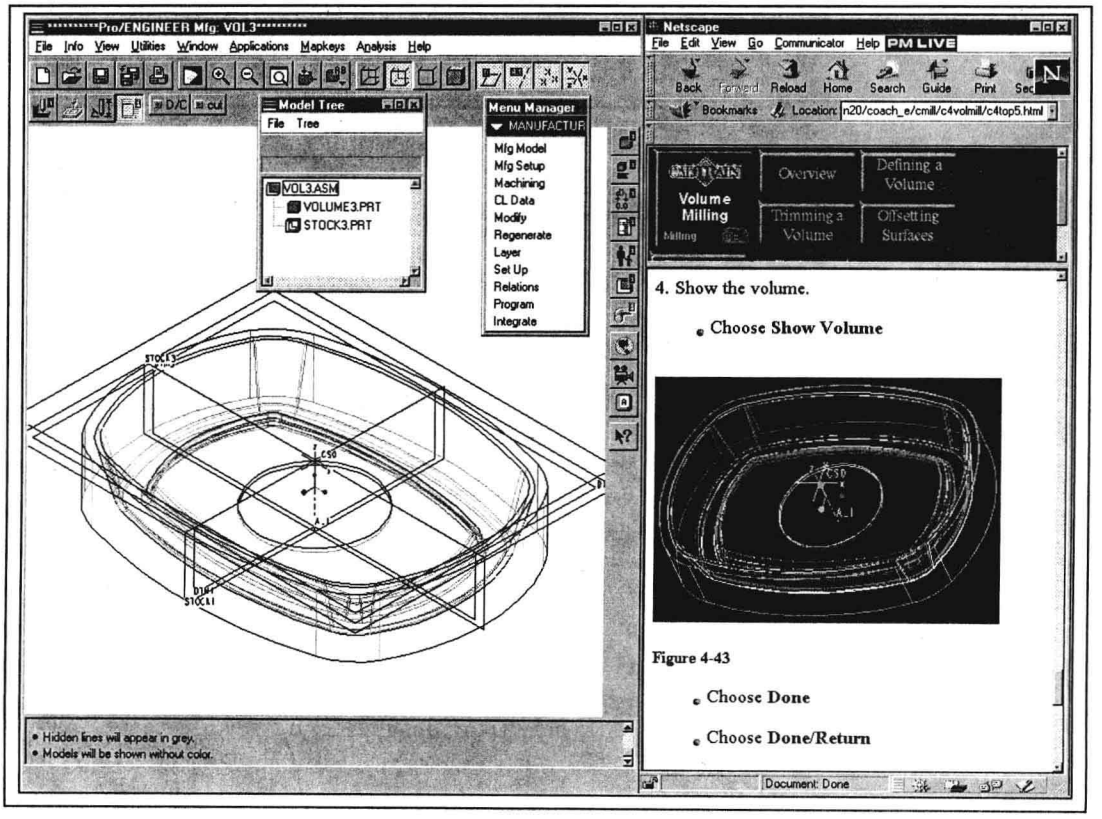


CADTRAIN's COAch for Pro/ENGINEER

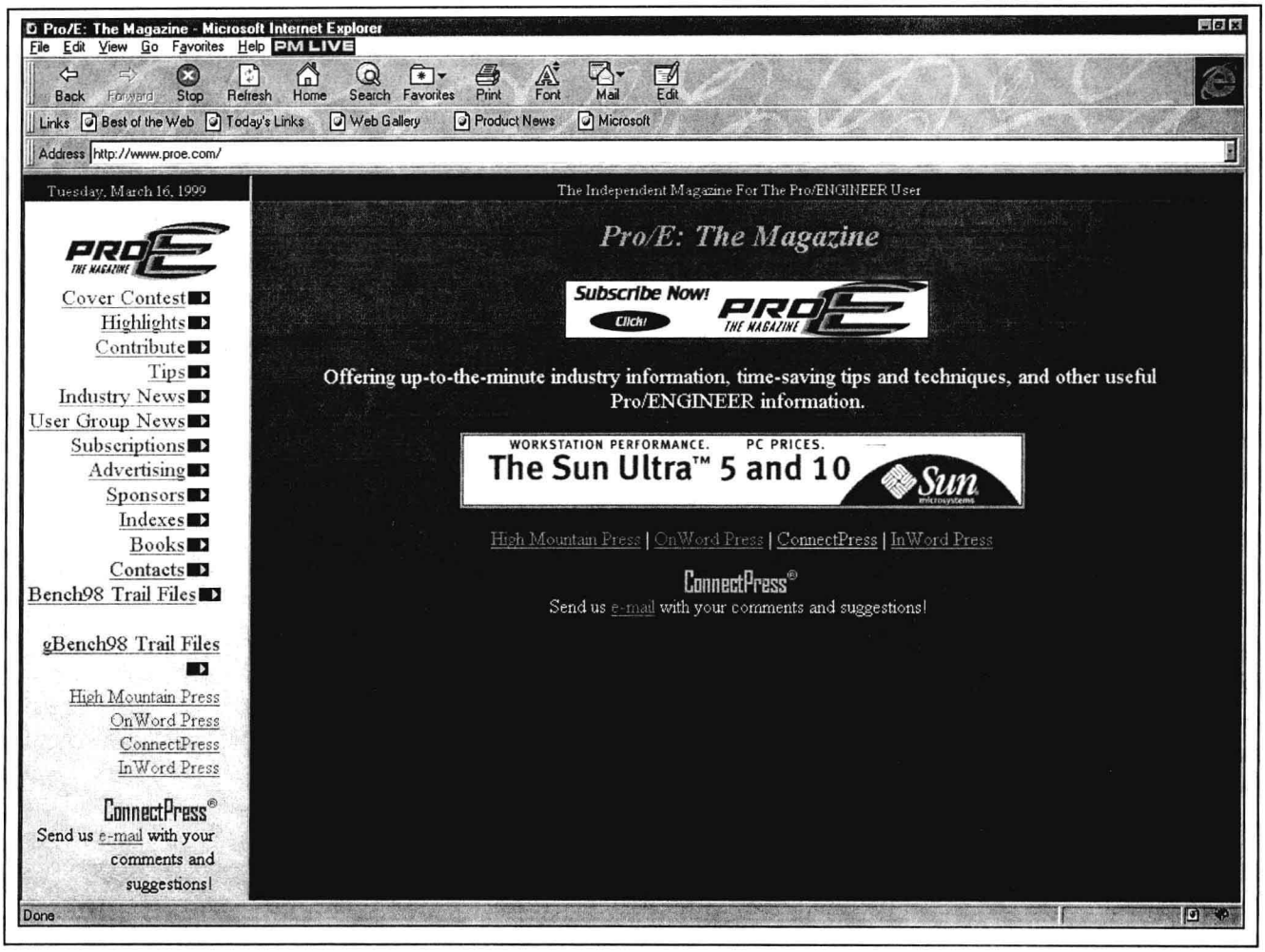
COAch is a computer-based training (CBT) product designed to provide a comprehensive and affordable training program for Pro/ENGINEER users in their actual CAD environment. This self-paced onscreen training tool enables engineers, designers, drafters, and NC programmers to customize their training experience by following the learning sequence best suited to their individual needs. Working in an interactive environment, students are introduced to key concepts, are guided through demonstration exercises, answer test questions, and complete comprehensive modeling projects.

NOTE

The CD provided at the back of this text contains a sampler of CADTRAIN's COAch for Pro/ENGINEER and includes a variety of modules.



See www.proe.com



PROE: THE MAGAZINE

An independent magazine for the Pro/ENGINEER market by ConnectPress, Ltd. Published nine times a year, Pro/E: THE MAGAZINE includes up-to-the-minute industry information, features designed to make Pro/ENGINEER users more productive, and tips for upgrading to the latest releases.

Books on Pro/ENGINEER

Automating Design in Pro/ENGINEER with Pro/Program: The Professional User's Guide to Programming with Pro/Program
Mark Henault (Editor) et al. / Paperback / Published 1996

Inside Pro/ENGINEER: The Professional User's Guide to Designing with Pro/ENGINEER Book and Disk
James Utz, W. Robert Cox / Paperback / Published 1995

Inside Pro/Surface
Norman Ladouceur / Paperback / Published 1997

Pro/ENGINEER Exercise Book
Bill Paul / Paperback / Published 1995

Pro/ENGINEER Tips and Techniques
Tim McLellan, Fred Karam / Paperback / Published 1996

Thinking Pro/ENGINEER: Mastering Design Methodology
David Bigelow / Paperback / Published 1995

Inside Pro/ENGINEER: The Professional User's Guide to Pro/ENGINEER
Dennis Steffen / Paperback / Published 1997

Pro/ENGINEER Quick Reference
Robert Monat / Published 1995

Design Modeling Using Pro/ENGINEER
James E. Bolluyt / Paperback

Introduction to Pro/ENGINEER
Jeffrey S. Freeman, Andrew E. Whelan / Paperback / Published 1997

The Pro/ENGINEER Exercise Book: Optional Instructor's Guide
Onword Press Development Team / Paperback / Published 1993

Pro/ENGINEER in Practice
David Bigelow / Paperback / Published 1998

Pro/ENGINEER Tutorials (Release 18)
Roger Toogood / Paperback / Published 1997

Solid Modeling with Pro/ENGINEER
Clarence W. Mayott, Geraldine B. Milano / Hardcover / Published 1993

What's New in Pro/ENGINEER Release 20?
Roger Toogood / Paperback / Published 1998

An Introduction to Pro/SHEETMETAL
G. Marie Pace Planchard / Paperback / Published 1999

Pro/ENGINEER Advanced Tutorial (Release 21)
Roger Tooood / Paperback / Published 1999

Pro/ENGINEER Release 20/21: Strategies for a Successful Implementation
Lisa Schmitt / Paperback / Published 1999

Pro/Engineer Solutions Advanced Techniques
Bob Townsend, Greg Schmidt / Hardcover / Published 1999

Pro/Engineer Solutions and Plastic Design
Norm Ladouceur, John McKeen / Hardcover / Published 1999

Pro/ENGINEER Tutorial (Release 21)
Roger Toogood / Paperback / Published 1999

Inside Pro/Engineer/Book and Disk
James Utz, W. Robert Cox

The Pro/Engineer Exercise Book: Build Pro/Engineer Skills for Real-World Problem-Solving/Book and Disk
Onword Press

The Pro/Engineer Quick Reference: Everything You Want to Know About Pro/Engineer, Fast!
Onword Press

Pro/E Mentor

www.solididea.com

Pro/E Mentor, a Companion Multimedia 3 CD Disk Set is available to accompany Louis Gary Lamit's *Pro/Engineer 2000i*

Pro/E Mentor enables the beginner student to gain knowledge in basic Pro/ENGINEER in a home environment without a license for Pro/Engineer. The 3 CD set brings not only the Pro/ENGINEER environment to your home, but also the teacher at an affordable price. This tutorial accelerates developing mastery of Pro/ENGINEER at your own place and at your own pace.

Pro/E Mentor was developed based on our teaching experiences. Students enrolled in our first, 11-week Pro/ENGINEER course at College of DuPage typically spend 5 to 10 hours outside of class working on their assignments and sometimes become frustrated when attempting to complete exercises. When students are stymied by a problem there is no one around to help them. As a result, we developed **Pro/E Mentor** as a companion multimedia 3 disk set to Louis Gary Lamit's textbook as an interactive support tutorial for our students to demonstrate the various Pro/ENGINEER skills introduced in the textbook assignments in Lessons 1 through 12.

Students may either view the tutorials independently of Pro/ENGINEER on their computer at home or run the tutorial concurrently while working with Pro/ENGINEER. By pausing the demonstration tutorial and toggling to Pro/ENGINEER, students have the opportunity to concurrently practice the demonstrated skills in a Pro/ENGINEER file while viewing the tutorial demonstrations. Pro/ENGINEER model files are supplied on the CDs containing the same geometry as in the tutorial.

At $27.95 plus $3.00 shipping (and sales tax as applicable), **Pro/E Mentor** is affordable and delivers the opportunity to master the skills consistently through thorough step-by-step lectures complemented by the graphics that virtually resembles Pro/ENGINEER environment. A computer equipped with a CD-ROM drive, a sound card, and speakers or head phone are all that is needed to take advantage of the instructional value of the CDs in support of your use of this textbook.

Don't delay in taking advantage of this instructional support. To order your 3 CD set today, see our link at www.brookscole.com/engineering/cad/lamit.html or visit our web site: http://www.solididea.com.