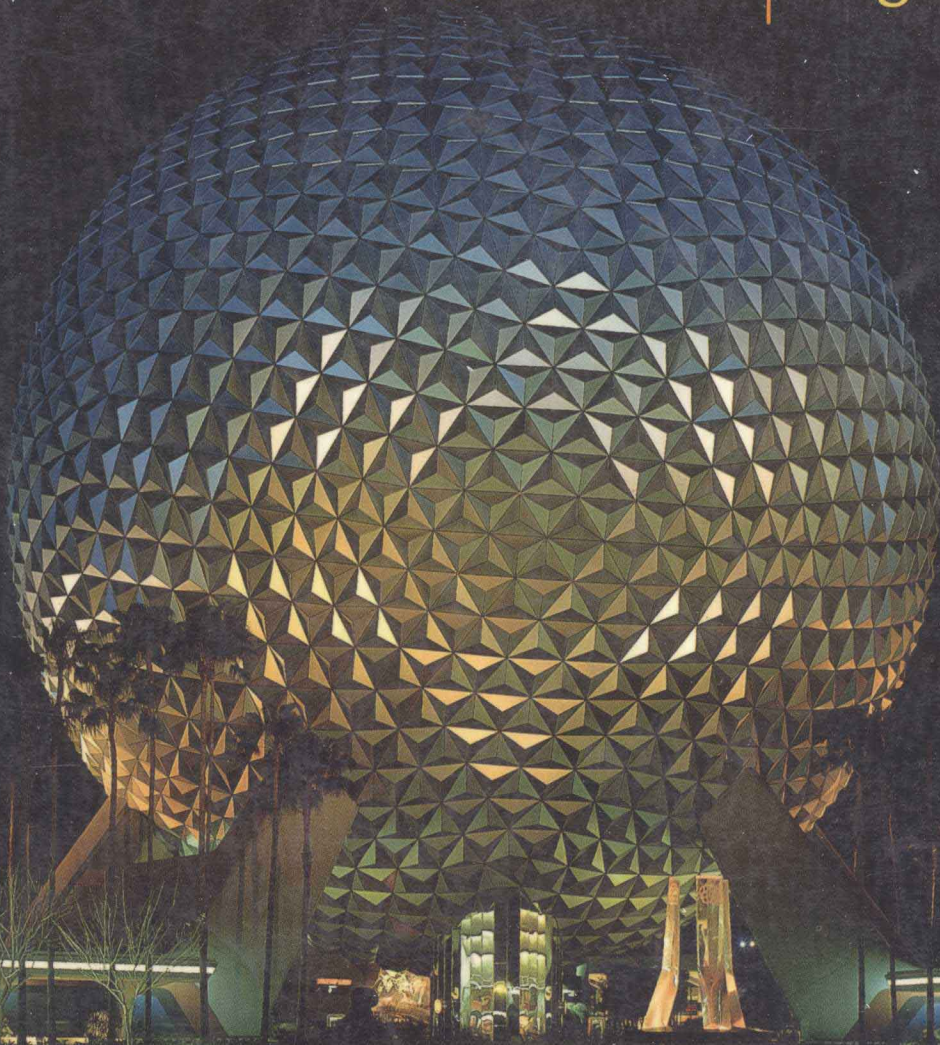


FORTRAN FOR THE '90s

Problem
Solving
for
Scientists
and
Engineers



Stacey L. Edgar

FORTRAN FOR THE '90s

Problem Solving for Scientists and Engineers

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COMPUTER SCIENCE PRESS
An imprint of W. H. Freeman and Company
New York

Library of Congress Cataloging-in-Publication Data

Edgar, Stacey L.

Fortran for the '90s : problem solving for scientists and engineers / Stacey L. Edgar.

p. cm.

Includes bibliographical references and index.

ISBN 0-7167-8247-2

I. FORTRAN (Computer program language) I. Title.

QA76.73.F25E35 1992

005.13'3—dc20

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Printed in the United States of America

Computer Science Press

An imprint of W. H. Freeman and Company

41 Madison Avenue, New York, NY 10010

20 Beaumont Street, Oxford OX1 2NQ, England

1 2 3 4 5 6 7 8 9 0 VB 9 9 8 7 6 5 4 3 2

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PREFACE

The object of this textbook is to provide science and engineering students with a modern introduction to programming in the major scientific language, FORTRAN. After its creation in the 1950s, FORTRAN developed many different dialects as it was continually modified. The current American National Standards Institute (ANSI) FORTRAN standard is ANSI X3.9–1978, widely known as FORTRAN 77. This book presents a thorough discussion of FORTRAN 77 and provides an introduction to the next standard of the language, Fortran 90, currently under development.

This text is oriented toward a first course in scientific programming in FORTRAN, and it can also be used in a FORTRAN-as-a-second-language course. Since it is the practical scientific applications that will keep FORTRAN the major scientific language for years to come, these aspects are featured, preparing students for the reality of solving problems efficiently. There are other, more advanced FORTRAN texts, which deal with the more sophisticated features of the language and large-scale problems; this text is designed to be a good foundation for such advanced work.

Because FORTRAN's strength is its utility in scientific problem solving, this text emphasizes applications. A wide range of fields is covered in a variety of programming problems—from physics to music, chemistry to sports. The main goal of the text is to give students the working knowledge of FORTRAN that they will need to solve problems creatively in their schoolwork and in their careers. The book thoroughly covers all of the basics of the language and includes special emphasis on scientific features such as vectors, matrices, and complex numbers. It then branches out into exciting application areas such as simulations and models, pattern recognition, numeric integration, queues, scientific visualization, and fractals.

This book has undergone extensive class testing at SUNY-Geneseo, making the book more accessible to students and more effective in its scope and approach.

GOALS

This text has five primary goals.

1. To provide clear explanations of concepts through an accessible writing style and the extensive use of examples and exercises
2. To provide a thorough introduction to the wide range of FORTRAN applications by supplying programming problems in a variety of disciplines, giving students a compendium of FORTRAN tools and techniques
3. To emphasize problem solving in a practical software engineering environment
4. To provide a “bridge” between FORTRAN 77 and Fortran 90 by introducing key features of the new standard as they apply to the topics discussed
5. To give comprehensive coverage to important topics not often found in introductory FORTRAN texts such as scientific visualization and fractals

In summary, the text strives to be a clear exposition of all the essential tools of the FORTRAN language, an adventure into their use in many different problems, and a guide to developing programming expertise through example and practice.

SPECIAL FEATURES

To reach its goals, the book provides several special features.

Chapter Openers: The paragraphs on the first page of each chapter serve two purposes: to briefly describe the contents of the chapter and to motivate the students to study the chapter by describing the skills and knowledge to be gained.

Chapter Summaries: Each chapter ends with an informative, concise summary of the important concepts introduced.

Worked Problems: The “Answers to Selected Exercises” section at the back of the book contains fully worked programming answers for approximately one quarter of the problems in the book.

Linkage with Fortran 90 Throughout: Fortran 90 is not just covered in an appendix. Fortran 90 features are introduced in nearly every chapter and directly applied to the topic being covered.

Emphasis on Problem-Solving Techniques: Chapter 1 thoroughly describes the art of problem solving and clearly explains how each step of

the process works. Examples and problems throughout the book further emphasize the importance of using problem-solving techniques logically in a variety of applications.

Early Introduction to Subroutines: In Chapter 4, “Repetition Structures,” subroutines are previewed in a manner that beginning students can comprehend. In Chapter 9, subroutines are explored in depth.

Special Chapter on Errors: Because errors can be such a frustrating problem, especially for beginners, Chapter 8 is devoted exclusively to dealing with them.

Coverage of Visual Output: Chapter 12 discusses the creation of visual output with FORTRAN, including coverage of histograms, scientific visualization, fractals, and screen graphics.



SUPPLEMENTS

Instructor's Manual

The Instructor's Manual that accompanies the text contains several valuable aides to the instructor.

Teaching suggestions based on the use of this material in several semesters of class testing

Suggested course structure also based on previous use of this material

Additional examples of a variety of problems on topics throughout the text

Answers to problems not given in the back of the text, to allow the instructor greater flexibility in assigning homework

Exam questions based on the material

Programming Aptitude Test, similar to those given to prospective employees in industry, which has proved an interesting and informative exercise for students

Data Disks

Diskettes containing all the programs in the text and solutions to some exercises are also available from the publisher.



ACKNOWLEDGMENTS

I would like to thank two reviewers who contributed valuable suggestions for the improvement of this book: Charles Redecker of the University of Washington and Nan C. Schaller of the Rochester Institute of Technology. I would also like to thank my editor, Nola Hague, for her efforts in seeing this project through to completion. Thanks to Larry Marcus for his work in finding some excellent photographs. And, lastly, I'd like to extend a special thank you to all the students I've taught over the years. Without them, this book never would have been possible.

Stacey L. Edgar