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**Donald E. Knuth**

The TEX Manual describes in Knuth's inimitable style a new system for technical typesetting which makes possible, and even easy, composition and typesetting of the most complex scientific displays of difficult mathematical notation by authors and technical typists.

METAFONT, a system for alphabet design, is Knuth's solution to the problem of limited character sets on raster-based typesetting machines. Like TEX, it is a tool for simplifying technical typesetting and is designed to prepare alphabets and special characters to be used by TEX.

The TEX and METAFONT systems, being implemented in PASCAL, are in the public domain and available to all who typeset.

This volume, containing manuals for both systems, introduces TEX and METAFONT to anyone concerned with typesetting\*. Only a knowledge of high school mathematics is required to master the systems.

Foreword by Gordon Bell.

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\*Part I is a reprint of the Gibbs Lecture given in January 1979, and Part II is a reprint of *TEX, A Manual for Technical Text*. Part III, METAFONT, has not been previously published.

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# NUMERICAL ANALYSIS

*edited by*

**Gene H. Golub and Joseph Oliger**

*Lecture Notes from the Short Course*

*sponsored by the AMS, Atlanta, January 3–4, 1978*

This is the collection of texts prepared by the lecturers of the Numerical Analysis Short Course given at the A.M.S. meeting in Atlanta, Georgia in January 1978. Computational linear algebra, optimization and the solution of nonlinear equations, the approximation of functions and functionals, and approximations for initial and boundary value problems for ordinary and partial differential equations are discussed. Methods such as the QR factorization, singular value decomposition, quasi-Newton and secant methods, finite difference, finite element and collocation methods are included in these discussions.

The subject matter was chosen to emphasize prominent research areas and attitudes in numerical analysis. These are introductory lectures on the subject matter for presentation to an audience of scientists from other areas or disciplines. Typically, there is an introduction to a given problem area and to techniques used, an application to applied problems, and a discussion of current research questions or directions.

Several trends in modern numerical analysis are discussed in these lectures. There has always been the quest to find the best way to do things. More realistic notions of "best" are evolving which in-

corporate the classical notions and realistic costs of producing the desired result. The discussion of good vs. best approximation is an example. More attention is being given to providing not only an answer, but a computed guarantee that it is a good answer—or a poor one. Easily computed and sharp a posteriori estimates are needed. The discussion of estimates of condition numbers is an example. There is progress being made in algorithm design based on operator splittings which allow one to take advantage of being able to solve simpler sub-problems very efficiently. Updating strategies for optimization and splitting methods for differential equations are examples.

These texts should be useful to the practicing users of numerical methods, programmers, scientists, and engineers who would like to know what progress is being made on the theoretical and developmental side of the subject. They should be useful to numerical analysts to review progress in areas other than their own, and to mathematicians in general who would like to understand what the concerns of numerical analysts are. The texts should be useful for the development of seminars and reading courses in the academic environment. Many will probably find the bibliographies of current work most useful.

## THE LECTURERS AND TITLES

CLEVE MOLER, Three Research Problems in Numerical Linear Algebra

J. E. DENNIS, JR., A Brief Introduction to Quasi-Newton Methods

CARL De BOOR, The Approximation of Functions and Linear Functionals:  
Best vs. Good Approximation

JAMES M. VARAH, Numerical Methods for the Solution of Ordinary Differential Equations

JOSEPH E. OLIGER, Methods for Time Dependent Partial Differential Equations

GEORGE J. FIX, Variational Methods for Elliptic Boundary Value Problems

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