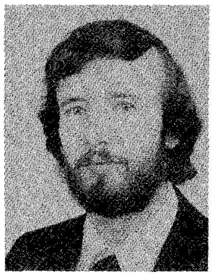
Reviews and Abstracts



Allen Glisson
Dept. of Electrical Engineering
University of Mississippi
University, MS 38677
(601) 232-5353
aglisson@sunset.backbone.olemiss.edu (e-mail)

An Introduction to Optimization, by Edwin K. P. Chong and Stanislaw H. Zak, 1996, Wiley-Interscience, xii + 408 pages, $59.95, ISBN 0471-08949-4.

The book is written as an introductory textbook at a senior undergraduate or beginning graduate level. It contains problems at the end of each chapter, and it has a solution manual, available to instructors who adopt this text. The material is divided into four parts, each being several chapters long. Part I is a mathematical review, with a very useful, compact collection of definitions from vector spaces, transformations, concepts from geometry, and elements of differential calculus.

The second part deals with unconstrained optimization. It is divided into chapters on one-dimensional searches, gradient methods, Newton's method, conjugate-direction methods, quasi-Newton methods, solution of over-determined linear equations, unconstrained optimization and feedforward neural networks, and genetic algorithms. The last two topics are not found in standard textbooks, and their basic principles are explained very clearly in mathematical terms.

Part III deals with linear programming, and it consists of chapters on the simplex method, duality, and non-simplex methods, like Khachiyan's algorithm and Karmarkar's algorithm. The non-simplex methods are of more recent origin, attempting to find a solution in an amount of time which grows more slowly than the simplex method, when the number of variables is increased.

Part IV describes the nonlinear-constrained optimization, with chapters on equality constraints, inequality constraints, convex problems, and on algorithms for constrained optimization.

The book follows a rigorous style, consisting of definitions, theorems, and proofs. The undergraduate students and other novices to optimization methods should be helped by many examples, worked out in detail, interspersed between theorems. These examples make it easier to understand the tight-lipped definitions and theorems. In brief, this is a book written by mathematicians, for mathematicians. To illustrate the need and the use of optimization, an engineering instructor will have to provide his students with supplemental problems, and with some supplemental reading. However, he may find the book very useful as a reference, because each little step is mathematically justified, and the theorems and proofs are all neatly collected in a single book.

Reviewed by:

Darko Kajfez
Department of Electrical Engineering
Anderson Hall, Room 302
University of Mississippi
University, MS 38677

Electromagnetic Pulse Propagation in Causal Dielectrics, by K. E. Oughstun and G. C. Sherman, 1995, Springer-Verlag, Heidelberg, 465 pages, Hardback, $198.00, ISBN 3-540-57892-7.

The book deals with the propagation of transients in linear homogenous media which exhibit dispersion (i.e., frequency dependence of both the conductivity and the permittivity). The magnetic permeability is assumed to be the same as free space, throughout. The authors have studied this problem in a general context for the past twenty years, and this treatise is a comprehensive and complete account of their efforts. A great deal of attention has been paid to the validity of approximate asymptotic methods that have been used in the past. In a very cogent fashion, they point out the need for uniform-asymptotic methods that allow one to cope with critical transition points in the complex frequency plane, such as where saddle points are near pole singularities. As the authors indicate in a very convincing fashion, the need for these very sophisticated (and complicated) methods is evident when purely numerical procedures are employed for the determination of the inverse transforms, and validation is desirable.

The first part of the book (190 pages) is expository, and some classical electromagnetics theory is covered from the authors' viewpoint and put in a rigorous mathematical setting. The angular-spectrum representation for pulsed fields and advanced saddle-point methods are treated in detail, and the clarity of the material is outstanding. This part of the book has been used in graduate lectures at the University of Vermont. To appeal to both electrical engineers and physicists, the authors use a dual system, where all equations are written using both Gaussian (cgs) and MKSA (SI) units. This feature may be distracting to some readers.

The second part of the book deals with the authors' original research, as mentioned above. They adopt a Lorenzian dispersion model, with a single resonance, and a simple phenomenological damping term. Much attention is paid to cases where a carrier source is modulated by a special shape function. They clarify the roles of the precursors that were treated over eighty years ago by Sommerfeld and Brillouin.