Book Review

Critica rațiunii algoritmilor de optimizare fără restricții

by Dr. Neculai Andrei

This important monograph addresses in a comprehensive way the theory and practice of unconstrained optimization covering theory, convergence as well as practical behavior of the most commonly used unconstrained optimization algorithms developed during the last 50 years.

What distinguishes this monograph is the comprehensive smooth combination of theory, computational complexity, numerical tests and software package availability – presenting to the community of potential users a complete in-depth panoramic perspective of the field of unconstrained optimization algorithms.

The book contains a wealth of all the modern fundamental advanced mathematical methods employed in unconstrained optimization presented with full mathematical rigor along with an up to date survey of literature references.

Historical perspectives are presented in many of the chapters of this remarkable monograph accompanied by the photographs of the most relevant scientists that contributed to the methods surveyed.

Written by a world expert and innovator in methods of conjugate gradient, Dr Neculai Andrei, chapter 8 of the monograph is an outstanding rendition of the history of developments in the fascinating topic of conjugate gradient algorithms in particular the survey of modern and novel methods of conjugate gradient applications and concluding with a summary of open unsolved problems of conjugate gradient algorithms that is illustrative of the breadth of this valuable original survey.

Chapter 9, dedicated to the quasi-Newton methods is masterfully written providing an up-to-date coverage of the theory including the limited memory L-BFGS as well as actual test cases taken from a variety of large-scale application domains including inverse realistic problems.

Chapter 10 is dedicated to the truncated Newton method also called Hessian free Truncated Newton and is also illustrated with powerful applications.

The trust region method chapter is dedicated only a very comprehensive theoretical presentation of its essential properties, since a full account of it and its applications would have required an entire additional volume.

A very cogent well presented Chapter 14 deals with least square methods namely the Gauss-Newton and Levenberg-Marquardt algorithms along with their relevant applications.

Chapter 16 considers various derivative free methods such as Hooke-Jeeves, Powell conjugate directions and the Nelder-Mead so called simplex method to cite but a few, illustrated with nice examples and accompanied by a survey of modern literature relevant to this domain.

Importantly Chapter 17 addresses the issue of software packages implementing the aforementioned techniques as well as their availability to the user and the salient characteristics of each software package. This impressive work concludes with a list of the algorithms along with a list of the applications and a well documented list of test functions employed to assess each unconstrained minimization algorithm.

All these make this monograph a welcome enriching addition to the optimization literature, and it is the view of this reviewer that this work deserves and should be

translated in English, so that the entire community of users of unconstrained optimization algorithms may benefit.

The publication of this monograph by the Romanian Academy Press is indeed an example where Romania lives up to its rich tradition of excellence in applied mathematics and I would strongly recommend this book to be present on the shelf of every user of unconstrained minimization algorithms.

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