Computer Program Descriptions

MINOPT—An Optimization Program Based on Recent Minimax Results

PURPOSE: To solve design problems in which the objective is to best satisfy a given set of design specifications or constraints in the least pth or minimax sense, assuming the availability of first partial derivatives of the functions concerned with respect to the design parameters.

LANGUAGE: Fortran IV; 512 cards, including comments.

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AVAILABILITY: ASIS/NAPS Document No. NAPS 02812. Listing and user's manual also available from J. W. Bandler at $15.00. Source deck available for $50.00.

DESCRIPTION: This program, called MINOPT, was used to generate some of the results presented in a recent paper [1]. The aim is to meet or exceed design specifications using the least pth approach [1]–[7], in particular, by an implementation of further results by Charalambous [7]. We assume the availability of first partial derivatives of the functions concerned with respect to the design parameters.

Essentially, a single least pth approximation with $1 < p < \infty$ can be done, or a sequence of least pth approximations with finite constant p can be carried out to produce highly accurate minimax solutions, if desired. The algorithm employs a lower bound on the minimax solution based on convexity assumptions and estimated after each least pth solution is reached. This lower bound can also be optionally used to provide a basis for successively dropping functions likely to be inactive at the solution, to reduce computational effort. Furthermore, gradient evaluations are usually not required for all the functions retained at any one time. Fletcher's quasi-Newton program [8] is used to minimize the unconstrained objective resulting from our formulation.

Restarting or rerunning the program making use of the results of a previous run with the same problem is a simple and useful feature. If the problem involves meeting certain design specifications, the first optimization will indicate whether such specifications can be satisfied [4]–[6]. An option is provided to halt the optimization process if the specifications cannot be met. A small value of p such as 2 is recommended. If a large value of p is used, much effort will be spent in the initial optimizations which usually involve more functions.

In the documented report associated with this program [9] the algorithm is described in considerable detail, an example illustrating MINOPT's various features is included, along with the full listing. The program is readily incorporated into other automated computer-aided design packages. The organization is such that the designer can achieve minimax designs or conduct feasibility checks in an efficient and flexible way.

The program has been extensively tested on a CDC6400.

ACKNOWLEDGMENT

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FLOPT2—A Program for Least pth Optimization with Extrapolation to Minimax Solutions

PURPOSE: To solve least pth optimization problems, featuring an extrapolation procedure for minimax designs and a scheme for dropping inactive functions, assuming the availability of first partial derivatives with respect to the design parameters.

LANGUAGE: Fortran IV; 570 cards, including comments.

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See NAPS document No. 02813 for 51 pages of supplementary material. Order from ASIS/NAPS c/o Microfiche Publications, 440 Park Ave. S., New York, NY 10016. Remit in advance for each NAPS accession number, $12.75 for photocopies, $3.00 for microfiche. Outside of the U.S. and Canada, postage is $2.00 for a photocopy or $1.00 for a microfiche. Make checks payable to Microfiche Publications.

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AVAILABILITY: ASIS/NAPS Document No. NAPS 02813. Listing and user's manual also available from J. W. Bandler at $30.00. Source deck available for $50.00.

DESCRIPTION: FLOPT2 is a package of subroutines primarily for solving least pth optimization problems. It was used to generate some of the results presented in a recent paper [1]. Its main features include Fletcher's quasi-Newton subroutine [2], a least pth objective formulation subroutine, an extrapolation procedure, and a scheme for dropping inactive functions [1]. With appropriate utilization of these features, the program can solve a wide variety of optimization problems. These may range from unconstrained problems, problems subject to inequality/equality constraints, to minimax problems in general.

In solving constrained problems, the user may employ the Fiacco–McCormick method with extrapolation [3] or use the Bandler–Charalambous minimax formulation [4] and least pth approximation. Using the p-algorithm [1], the program solves minimax problems that can be formulated with a least pth objective.

Any number of least pth optimizations can be conducted with geometrically increasing values of p in the range $1 < p < \infty$. In anticipation of premature termination, pertinent information can be stored, for example, to be utilized in future runs so as to implement extrapolation as if there had been no interruption in the process.

In the documented report associated with this program [5] there are several examples presented in detail along with the full listing.

The program FLOPT2 is an improved version of the program FLOPT1 [6]. It may functionally replace the program FLNLP2 [7]. The program has been extensively tested on a CDC 6400 computer.

References

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