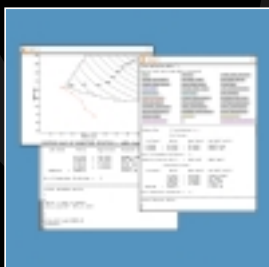


What is OPTIONS ?

OPTIONS is a design exploration and optimization package that may be used to study and compare a large range of optimization methods when applied to design problems. The user provides routines describing his or her problem plus entries in a problem-specific data base.

It is then possible to manipulate the design manually, systematically map out the effects of design changes, or, having specified design variables, constraints and an objective function, invoke one of the many optimizers within the package. The software includes a basic GUI for use under X-Windows and a plotting facility for showing how results vary, either on-line or as traces on pre-prepared contour maps. The software is fully described in the user manual which is available at <http://www.soton.ac.uk/~ajk/options.ps> and for which the index and contents pages are available separately.

OPTIONS GUI Example



OPTIONS Design Exploration System

Search Methods

The package contains, or has interfaces to, the following search methods:

- NAg Methods (E04UCF and E04UAF)
- Bit Climbing (BC)
- Dynamic Hill Climbing (DHC)
- Population Based Incremental Learning (PBIL)
- Numerical Recipes Methods (Num_Rcp)
- Method of Successive Linear Approximation (APPROX)
- Random Exploration with Shrinkage (RANDOM)
- Adaptive Random Search (ADRANS)
- Davidon, Fletcher, Powell Strategy (DAVID)
- Fletcher's 1972 Method (FLETCH)
- Jacobson and Oksman Method (JO)
- Powell's Direct Search (PDS - Siddall's implementation)
- Hooke and Jeeves Direct Search (SEEK - Siddall's implementation)
- Simplex Method (SIMPLX - Siddall's implementation)
- Rosenbrock's Rotating Coordinate Search (ROSE)
- Complex Strategy of M.J. Box (COMP)
- Two-membered Evolution Strategy (EVOL)
- Multi-membered Evolution Strategy (KORR)
- Repeated Fibonacci Search (FIBO)
- Repeated Golden Section Search (GOLD)
- Repeated Lagrangian Interpolation (LAGR)
- Hooke and Jeeves Direct Search (HOJE - Schwefel's implementation)
- Davies, Swann and Campey Search Method with Gram-Schmidt Orthogonalization (DSCP)
- Davies, Swann and Campey Search Method with Palmer Orthogonalization (DSCP)

- Powell's Direct Search (POWE - Schwefel's implementation)
- Davidon, Fletcher, Powell Strategy (DFPS)
- Simplex Method (SIMP - Schwefel's implementation)
- Genetic Algorithm (GA)
- Simulated Annealing (SA)
- Evolutionary Programming (EP)
- Evolution Strategy (ES)

OPTIONS Internal Structure



When using OPTIONS the designer interacts with the system by evaluating, mapping or optimizing the design and by manipulating the data base which records the current status of the design.

OPTIONS Command Menus



The OPTIONS interface provides a principal command menu with three sub-menus for access to themed collections of search methods. The system also provides a dedicated data presentation and manipulation facility via three further sub-menus.

Application Areas and Examples

We have applied/are applying OPTIONS to:

- Structural Dynamics (mainly aircraft/satellite structures) A summary paper may be found at <http://www.soton.ac.uk/~ajk/plym1.ps>.

A poster illustrating the design of an optimized truss structure may be found at <http://www.soton.ac.uk/~ajk/truss/welcome.html>. A digitized photograph of an optimized structure on test may be found at <http://www.soton.ac.uk/~ajk/1ab.gif>. A paper describing satellite boom design may be found at <http://www.soton.ac.uk/~ajk/plym2.ps>.

- Aircraft Wing Design A poster illustrating the design of optimized aircraft wings may be found at <http://www.soton.ac.uk/~gmr2/wing.html>.
- Ship Design An image of an optimized hull form may be found at <http://www.soton.ac.uk/~ajk/fat.gif>. A poster illustrating the design of optimized hull-forms may be found at <http://www.soton.ac.uk/~ajk/ship/welcome.html>.
- Towed Array Sonar Data Processing A paper describing sonar data processing may be found at <http://www.soton.ac.uk/~ajk/sonar.ps>.
- Neural Network Design A paper describing neural network topology design may be found at <http://www.soton.ac.uk/~ajk/gann1.ps>.
- Various Test Problems A poster illustrating work on approximate and noisy functions may be found at <http://www.soton.ac.uk/~elbtag/posters/post1.htm>. A description of the 'bump' problem may be found at <http://www.soton.ac.uk/~ajk/bump.html>.

Full references for papers describing this work and a number of related subjects may be found on the home page of Prof. A.J. Keane (<http://www.soton.ac.uk/~ajk/welcome.html>).

This article may be found at <http://www.soton.ac.uk/~ajk/options/welcome.html>

Correspondence to Andy.Keane@soton.ac.uk, or Prof. A.J. Keane, Department of Mechanical Engineering, University of Southampton, Highfield, Southampton, SO17 1BJ, U.K.
Tel +44-1703-592944,
Fax +44-1703-593230



University
of Southampton