



## NUOPT for S-PLUS®

NUOPT for S-PLUS is a powerful extension of the S-PLUS statistical and data analysis software. With NUOPT for S-PLUS, you can tackle the most challenging nonlinear optimization problems involving tens of thousands of variables and constraints.

NUOPT for S-PLUS is a cutting-edge software package capable of solving very large optimization problems. Designed for analysts and researchers, NUOPT for S-PLUS is used for a wide range of applications including portfolio optimization, nonlinear and robust statistical modeling, and circuit optimization. The full power of the S-PLUS language is integrated with NUOPT. No other package can match this combination of powerful statistics and graphics with large-scale optimization problem solving.

### The Premier Package for Numerical Optimization

NUOPT, developed by Mathematical Systems, Inc., is a premier optimization package with the ability to efficiently solve nonlinear optimization problems with tens of thousands of variables and constraints. NUOPT can solve a wide range of problems, from linear programming to mixed

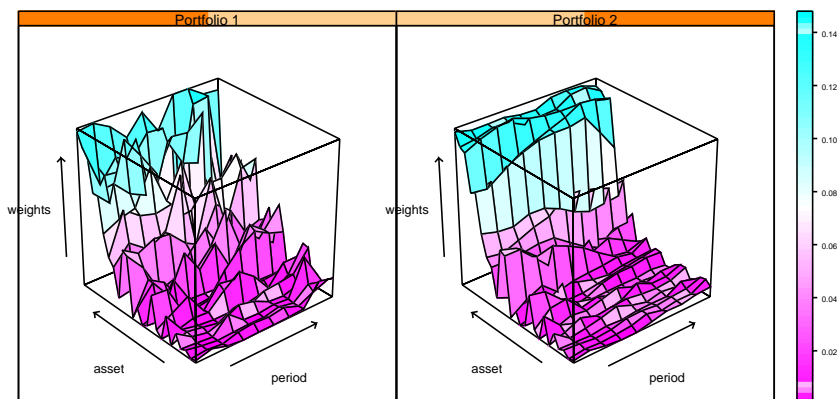
integer programming to constrained nonlinear optimization. NUOPT is designed and implemented to be efficiently applied to large-scale problems, with no software limitation on the problem size to be solved. Offering state-of-the-art primal dual interior point methods as well as the simplex method, it ensures efficient solutions for both small and large problems.

### Unsurpassed Flexibility and Robustness

Using NUOPT's SIMPLE modeling language in S-PLUS you can specify complex nonlinear models. Because NUOPT is embedded in S-PLUS, your optimization modeling seamlessly integrates with graphical analysis and statistical modeling. Most importantly, you can trust your results — NUOPT has been tested on hundreds of standard problems, and can solve virtually all of these problems without any parameter tuning.

### Types of Problems Handled

- Linear programming
- Transportation
- Quadratic programming
- Unconstrained nonlinear optimization
- Constrained nonlinear optimization



NUOPT for S-PLUS allows you to explore different portfolio optimization methods and build in features that reflect real-world constraints. The above figure displays optimized portfolio weights computed using two different methods. The weights on the left are rebalanced during each time period independently of the weights during the previous time period. The weights on the right are constrained to smoothly evolve from one time period to the next, resulting in a more stable portfolio allocation.

## Features

**Wide range of applicability:** Solve a very large set of real-world problems without having to make simplifying assumptions or reformulate the problem.

**Efficiency:** Solve very large-scale problems on desktop PCs and Unix workstations.

**Robustness:** Trust your results. You don't need to tune the optimizer to solve complex problems.

**Flexible modeling language:** Express problems in NUOPT's SIMPLE modeling language.

**Automated differentiation:** Automatically avoid convergence problems caused by numerical derivatives

**Interior point and simplex methods:** Ensures that the fastest method is used for both large and small problems; it also allows crossover from interior to simplex near the solution.

**Integration with S-PLUS:** Use the full range of statistical and graphical tools in S-PLUS to help solve your optimization modeling problems.

## Sample Applications

### Portfolio optimization

- Optimize portfolios of assets incorporating a variety of realistic constraints, going well beyond the classical Mean-Variance (Markowitz) formulation.
- Build complex models that combine different classes of assets and subgroups of assets simultaneously.
- Solve problems involving large portfolios efficiently.

### Nonlinear and robust statistical modeling

- Apply new penalized and robust regression methods, traditionally only applicable to small data sets, to very large problems.
- Find better parameter estimates for nonparametric models using global fitting criterion.

### Circuit optimization

- Minimize power consumption by circuit elements in an LSI circuit subject to timing constraints. ...and much, much more!

## Optimization Methods

- Primal-dual interior point method with higher-order correction for linear programming
- Simplex method for linear programming
- Primal-dual interior point method based on line search for general convex Programming models including convex quadratic programming models
- Primal-dual interior point method based on trust region for general non-linear programming models
- Primal-dual interior point method based on quasi-Newton method for general non-linear programming models
- Active set method for convex quadratic programming models and mixed integer quadratic programming models

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## System Requirements

- NUOPT for S-PLUS requires the S-PLUS data analysis package.

### Windows System Requirements

- Pentium processor with 96MB of memory running Microsoft Windows NT, ME, 95, 98, 2000.

### UNIX/Linux System Requirements

- Sun Solaris 2.6 or later on SPARC 32-bit architecture, Sun Solaris 2.7 or later on SPARC 64-bit architecture, SGI IRIX 6.5 or later, Compaq Alpha running Tru64 UNIX 4.0F or later, HP-UX 11.0 or later, Red Hat Linux 6.1 or later or SuSE Linux 6.4 or later.



Indian Partners : Binary Semantics Ltd □  
Plot Number-38, Electronic City, Sector-18 □  
Gurgaon-122015, Haryana □  
Tel: (91)-(124)-239 7660, 239 7858/659 □  
sales@binarysemantics.com □