The Gurobi Optimizer 5.0

For GAMS

The Gurobi Optimizer 5.0

The Gurobi Optimizer was designed from the ground up to be the fastest, most powerful solver available for your continuous (LP, QP, and QCP) and mixed-integer programming (MILP, MIQP, and MIQCP) problems. Just a few of the advances in their state-of-the-art design, for example, include:

- Gurobi's code was built to fully exploit parallelism. It's not a sequential code that was parallelized, but a fundamentally parallel code that you can also choose to run sequentially
- Gurobi's MIP cutting plane routines are second to none. Not only does Gurobi have cutting-edge versions of all the standard cutting planes, but they've gone beyond that to develop new classes of cuts available only with their optimizer
- Gurobi's advanced MIP heuristics for quickly finding feasible solutions often produce good quality solutions where other solvers fall flat, leading to some of their biggest wins vs. competitors
- Gurobi's barrier algorithms fully exploit the features of the latest computer architectures

The result is Gurobi outperforms its competitors, with that performance gap growing as your problems get harder. Not only does Gurobi lead in industry standard **benchmark results**, but they also recently solved 11 previously unsolvable models in the MIPLIB2010 library.

In addition, since reliability is just as important as performance, every feature and version of Gurobi is fully tested against literally thousands of real-world instances, including both standard public benchmark test sets and extremely challenging, large-scale, industrial models from customers. For information on what is new in Gurobi 5.0 see Gurobi's **What's New in 5.0** page.

Solving Continuous Models with the Gurobi Optimizer

For continuous models, Gurobi includes advanced implementations of the latest algorithms including: primal and dual simplex algorithms, a parallel barrier algorithm with crossover, concurrent optimization, and a sifting algorithm.

To help you optimize even your largest models more quickly and easily than with competing alternatives, the Gurobi Optimizer includes:

- Deterministic and non-deterministic concurrent optimizers that allow you to exploit all the cores in your machine
- Multiple simplex pricing options, including steepest edge, devex, and partial pricing
- Multiple barrier fill-reducing ordering options, including approximate minimum degree and vertex separator nested dissection
- Both homogeneous and standard barrier algorithms
- Multiple options for selecting the initial barrier crossover basis
- Simplex warm starting using advanced bases or solution vectors
- Automated sifting approach for large aspect ratio models
- Efficient Irreducible Infeasible Subsystem (IIS) detection
- Feasibility relaxation feature for minimizing constraint violations for infeasible models
- Unbounded ray computation for unbounded models
- Infeasibility proof computation for infeasible models
- Detailed sensitivity information
- QCP solver supports second-order cone constraints, rotated second-order cone constraints, and more general convex quadratic constraints

GUROBI
OPTIMIZATION

Solving Mixed-Integer Programming Models with the Gurobi Optimizer
For MIP models, Gurobi includes advanced implementations of the latest MIP algorithms including: deterministic, parallel branch-and-cut, non-traditional tree-of-trees search, multiple default heuristics, solution improvement, cutting planes, and symmetry detection.

Gurobi goes well beyond just offering a feature to delivering the most advanced implementation possible of that feature. Each feature was designed to help get you the best answers to your most important problems in the least amount of time:

- Sixteen different types of cutting planes
- Fourteen different MIP feasibility heuristics, including advanced sub-MIP methods
- Support for user cuts and lazy constraints
- Non-disjoint subtree detection
- Symmetry detection
- Support for Special-Ordered Set constraints
- Support for semi-continuous and semi-integer variables
- Efficient Irreducible Infeasible Subsystem (IIS) detection
- MIQCP solver automatically chooses between an outer-approximation approach or a QCP relaxation approach
- Node presolve
- Feasibility relaxation feature for minimizing constraint violations for infeasible models
- Solution pool provides access to multiple feasible solutions
- Extensive callback capabilities
- Support for MIP starts

Advanced Presolve Capabilities
To help simplify a given model, identify any obvious errors or problems, and identify likely useful approaches for getting the best answer in the least amount of time, Gurobi takes advantage of the broadest range of advanced presolve capabilities available. These include:

- Six (6) major categories of reductions for LP models
- Over fifteen (15) different categories of additional reductions for MIPs
- Example reductions include: aggregation, bound strengthening, coefficient reduction, reduced-cost fixing, probing, and domination.
- Automatic dualization of continuous models
- Automatic linearization of quadratic objective and quadratic constraints

Strategies That Automatically Adapt to Your Models
Benchmarks routinely show Gurobi finding feasible solutions and the optimal solution faster than competitors. In addition, while there are no benchmarks for speed to finding good feasible solutions, Gurobi users routinely say they appreciate how much faster Gurobi is at doing so relative to other solvers they have used. One key reason for this performance is Gurobi automatically adapts the strategies it uses to fit the unique characteristics of the model being solved. These advanced capabilities help ensure good performance “out-of-the-box”, saving work, speeding solution times and enhancing confidence in results.

About Gurobi
GUROBI is developed and supported by GUROBI Optimization, Inc. a company founded in 2008 by Robert Bixby, Zonghao Gu and Edward Rothberg.
Website: http://www.gurobi.com