

TOMLAB - for Large-Scale Robust Optimization

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Abstract

The Tomlab Optimization Environment is the most powerful optimization package available in MATLAB. TOMLAB of today has grown to include more than 70 different algorithms for linear, discrete, global and nonlinear optimization and also includes a large number of C and Fortran solvers ¹ implemented as MEX interfaces. A growing number of companies like ILOG S.A., Dash Optimization Ltd, and Stanford Business Software Inc. are joining the TOMLAB partner network to provide better software for the practitioners. The overall objective is to provide the best modeling and optimization tools for the MATLAB user and thereby enable a wide range of opportunities for large-scale robust optimization for practically every area of optimization. The TOMLAB environment is call-compatible with MathWorks' Optimization Toolbox and supports problems formulated in the AMPL modeling language. This gives the MATLAB user unique functionality for model building and a conversion tool to the TOMLAB format. The call-compatibility is an important feature as a larger number of solvers can be evaluated for a specific problem area. Tomlab Optimization emphasizes the great importance of using high-quality numerical software and a uniform approach in the solution process of optimization problems. The procedure for solving large-scale optimization problems in TOMLAB can be viewed as a five step process.

1. Define your problem in MATLAB by using the TOMLAB tools applicable to your area of optimization. This will create a standardized problem structure to work with.
2. By using the TOMLAB driver routine, *tomRun*, evaluate every solver that can potentially solve your problem. The routine will automatically make sure that the solvers have the correct format.
3. Exclude the solvers that do not perform or cannot solve the problem.
4. Tune the solvers, add problem patterns, and make sure that the tolerance levels are equivalent.
5. Continue to evaluate the solvers, and select the one that fit your needs.

This paper aims to describe how TOMLAB has enabled more options and necessary tools for the user in their solution process. The TOMLAB *gateway* and *driver* routines for automatic format mapping to different solver types, as well as the integration with other MATLAB toolboxes will be described in detail. The paper also exemplifies how customers have used this added functionality to embed parts of the TOMLAB solver portfolio in their products and systems. The following list shows some of the current application areas.

- TOMLAB has been selected as the optimization platform in DOTS, a 3 year European Commission project for the pulp and paper industry led by KCL, Finland.
- Halliburton Energy Services uses TOMLAB for application development of NMR technology in their MCC-compiled NMRStudio package.
- Philips and Lumileds uses MCC compiled Tomlab /Xpress for on-site plant production planning systems.
- TOMLAB has been embedded in portfolio optimization software.
- Many financial institutions now solve their problem faster with Financial Toolbox using TOMLAB.
- Claremont University in cooperation with JPL/NASA uses TOMLAB to optimize the dataflow from a Mars lander through the orbits and back to earth. To be embedded in mission planning system.

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¹The following solver packages are available in TOMLAB: TOMLAB BASE, MINOS, NPSOL, SNOPT, SOL, CGO, Xpress, CPLEX, MINLP, PENSDP, PENBMI, KNITRO, OQNLP, CONOPT, NLPQL, and shortly Xpress-MISLP, PDEFIT, MODFIT, DECIS, PORTF and PENNLP