

Premium Solver Pro Guided Mode

The Guided Mode help users understand and use the software's advanced capabilities, especially for stochastic optimisation. Features of the Guided Mode are described in detail below.

Automatic Model Diagnosis

Guided Mode's first benefit is automatic diagnosis of the type of model defined by the user's Excel worksheet. Optimisation models can range from *linear*, and other *convex* problems that are easy to solve, and easy to "scale up" to large size (hundreds of thousands of decision variables or more), to *non-convex* and *non-smooth* problems that are intrinsically very difficult to solve ("NP-hard") and that cannot be "scaled up" beyond a few hundred variables. Since any kind of model can be created easily in Excel, users who don't know the difference can sabotage their own efforts by using Excel functions such as IF and LOOKUP that make an otherwise "easy" model very hard to solve, causing solution times to go from seconds to hours.

Guided Mode analyses the user's Excel formulas and dependencies among them, and explains the type of problem the user has defined: LP (linear programming -the easiest), QP, QCP, SOCP, NLP (nonlinear programming), or NSP (non-smooth programming -- the most difficult), and its use of other features which strongly impact solvability. For optimisation models with uncertainty, Guided Mode determines whether the user has defined a stochastic linear programming (LP) or stochastic QP model, and whether the model includes decision-dependent uncertainties, chance constraints, and recourse decision variables, which strongly impact the solution process. Although Risk Solver Platform does handle all of these model types, the difference in solution time can be huge -- a factor of 1,000 times or more.

Automatic Model Transformation

For non-smooth models that are very difficult to solve, because they use Excel functions such as IF, AND, OR, NOT, MIN or MAX, Guided Mode will automatically attempt to *transform* the model into a form that is much more practical to solve. It does this by adding to the model new integer and real-valued decision variables and linear constraints that enforce the same conditions as these Excel functions, and removing the non-smooth, non-convex Excel functions from the model. When this transformation is successful, the result is a linear mixed-integer (LP/MIP) model -- for such models, very advanced solution methods can be applied, such as those in the Gurobi Solver Engine, to find optimal solutions in a reasonable amount of time.

For optimisation models with uncertainty, Guided Mode will automatically attempt to *transform stochastic* LP and QP models into equivalent, conventional optimisation models, that be solved quickly and scaled up to large size, without using the much slower method of simulation optimisation. This includes the ability to automatically create robust counterpart models, a powerful facility introduced by Frontline in late 2007 that

still has not been matched by other commercial products. For models that cannot be so transformed, Risk Solver Platform offers the industry's fastest, fully parallelised simulation optimisation methods, using the latest improvements in Frontline's nonlinear Solvers and its hybrid Evolutionary Solver.

Automatic Solver Engine Selection

Risk Solver Platform includes five Solver Engines for optimisation, and Frontline offers eight more plug-in Solver Engines that work with Risk Solver Platform. Each Solver Engine is best-suited for certain types and sizes of models, can be used for certain other types of models, and should *not* be used for still other types of models. Users who don't read the User Guide or Help often do not know which Solver Engine to select, or may not pay attention to the selection. Guided Mode can automatically select the best Solver Engine for the type and size of model that the user has defined, from the set of Solver Engines currently installed. It can also warn the user when he or she manually selects a Solver Engine that should *not* be used for the current model.

Explanation of Solution Results

Risk Solver Platform can produce dozens of Solver Result messages that provide very specific information about the results of an optimisation. These messages appear in the Task Pane Output tab and in a status bar area at the bottom of the Excel window; they are colour-coded to reflect normal and error conditions, and since V9.5 they have been hyperlinked to quickly accessible full-text Help explanations. But users who did not pay attention to, or click the messages for Help did not gain the benefit of this specific information. In Guided Mode, dialog boxes appear that highlight the Solver Result message and also include the essential Help text for the message, so these users will be more likely to learn from these messages and make improvements to their models.

Easily Turned On and Off

Guided Mode is deliberately designed to interrupt the optimisation process and focus the user's attention on what he or she needs to know, and what Risk Solver Platform is doing. For an experienced user who has learned its lessons, Guided Mode can "get in the way." But it is *very* easy to turn Guided Mode off -- every dialog box that it displays includes a check box to "Exit Guided Mode," that immediately and permanently turns off the feature. Guided Mode can be turned on or off via an option at the bottom of Risk Solver Platform's Task Pane Platform tab.