

LightTools Illumination Optimization

Increase Your Engineering Productivity

Features at a Glance

- Automatically improves illumination system performance based on the criteria that you specify, such as uniformity and maximum energy on a specified area
- Can significantly shorten your design cycle, providing optimal solutions in a fraction of the time it would take to accomplish manually
- Allows nearly any database parameter to be varied
- Supports optimization constraints, which are the boundaries established for an allowable optimization solution
- Provides multiple optimization engines so that you can exercise the most efficient approach for your design problem
- Supports programmable variables and merit functions for maximum flexibility. User-defined optimization merit functions allow you to set the criteria for performance improvement
- Optimizes ray-based (noise-free) merit functions and Monte Carlo-based (noisy) merit functions to handle a variety of illumination systems at various stages of design
- Allows for optimization for user-defined parametric expressions, giving you the power of programming with far less effort

Overview

The LightTools® Optimization Module automatically improves the performance of virtually any type of illumination system and gives designers tremendous flexibility to choose from hundreds of system parameters to designate as variables, constraints, and performance criteria in order to achieve the desired system performance.

Full integration with the LightTools 3D solid modeling environment ensures that the Optimization Module delivers practical, realistic solutions in a fraction of the time it would take to accomplish manually.

“We consider the LightTools optimizer to be a groundbreaking feature that provides substantial improvements over our traditional illumination design procedures. We have designed several different light pipes using the LightTools optimizer, and were able to reduce our design cycle by one-third. We plan to use the optimizer for all our light pipe designs.”

~E.H., LightTools user at a leading Japanese consumer electronics manufacturer

Quick Convergence on the Design that Best Meets Your Goals

The LightTools Illumination Optimization feature is the first of its kind, allowing you to quickly converge on the design that best meets your goals. This fully integrated optimization tool supports Monte Carlo simulation data and ray fans or ray grids. A point-and-shoot ray trace updates interactively as you change the model, providing immediate feedback on the implication of each change made to the design as it progresses. This is an invaluable tool that provides ongoing insight into the relationship between the geometry and the paths of light through the geometry.

LightTools combines its superior design and analysis features with optimization algorithms specially tailored to solve illumination and stray light problems, allowing you to develop solutions previously unreachable. For example, you can optimize your system to match a target illumination distribution, maximize flux on the receiver, or meet other user-defined criteria.

Adding variables, constraints, and merit functions is easy to do from LightTools dialog boxes, using pop-up menus displayed when you right-click the mouse. Almost any numeric field within the LightTools user interface can be added as a variable, constraint, or used as part of the merit function. Additionally, all of the optimization components are conveniently organized for viewing and editing in the Optimization Manager.

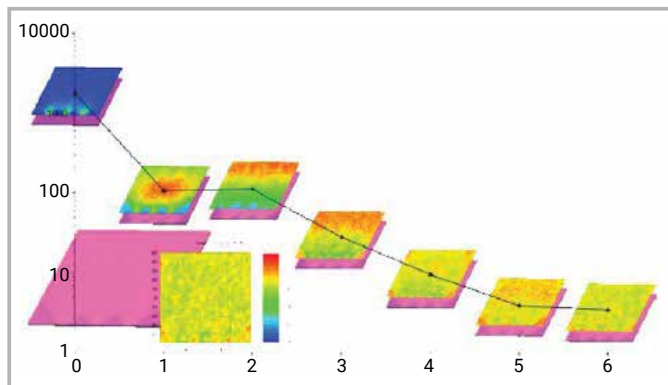


Figure 1: LightTools Optimization greatly improved the illuminance uniformity of this edge-lit LED backlight system in six iterations, with minimal user input

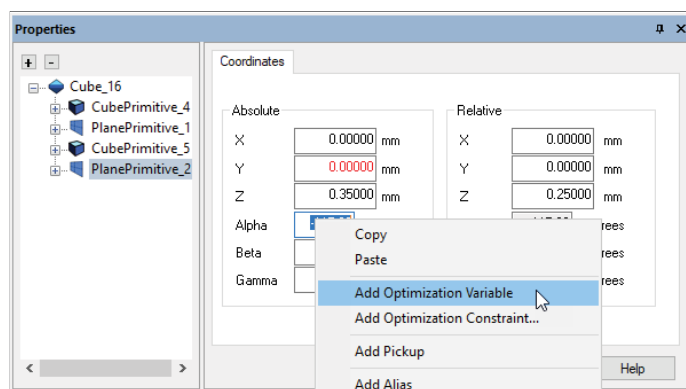


Figure 2: Almost any numeric field within the LightTools user interface can be added as a variable or a constraint or used as part of the merit function

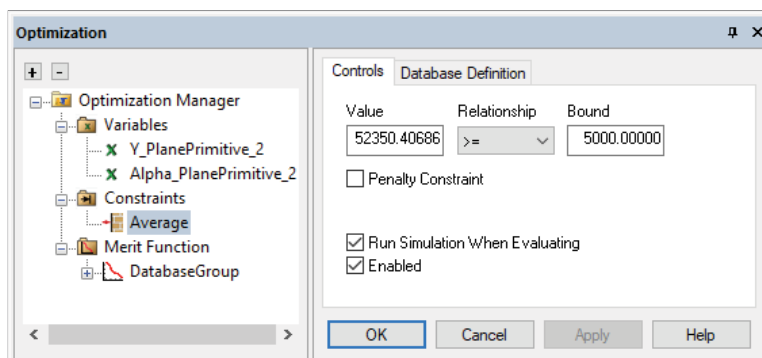


Figure 3: All optimization components—including variables, constraints, and merit functions—can be viewed and edited in the Optimization Manager

Once you add a variable as an active component of the optimization, LightTools helps you select appropriate variable boundaries and increments by providing intelligent defaults, a hallmark of the software. Constraints are defined in terms of a mathematical relationship (i.e., $<$, $=$, or $>$) between the value of a parameter and a target value. Constrainable parameters include both model parameters (such as the position and orientation of entities) and analysis results (such as receiver total power or CIE coordinates).

The optimization merit function sets the criteria for performance improvement. You specify the criteria that represent the system performance you want to improve using a weighted sum of the squares of individual performance values. A merit function item is added to the optimization problem as easily as a variable or constraint – by right-clicking the desired field and selecting an option on the pop-up menu. Merit function items can have different targets and weights, and you can enable or disable them to control their influence on the optimization solution.

Merit function information is displayed in a well-organized summary table that allows rapid access to all of the components of the merit function at once. LightTools manages the optimization progress using built-in criteria such as exit controls and noise calculations, which intelligently balance accuracy and efficiency.

The proprietary algorithms that drive LightTools optimization engines use all of the optimization components to find a solution to the problem. Optimization essentially minimizes the merit function by changing the defined variables and simultaneously satisfying the specified constraints.

LightTools optimization engines provide a sophisticated approach to finding a good solution across a wide range of potential solutions: two local optimization engines, which find the nearest optimal point, and a global optimization engine, which aims to identify the absolute best solution in the entire design space. This is particularly useful in complex illumination systems where multiple variables and constraints must be considered. The global optimization algorithm is designed to handle the intricacies of large-scale design problems, ensuring that you achieve the highest possible performance for your illumination system.

The features in the LightTools Optimization Module permit a level of flexibility no other optimizer possesses.

For more information or to start your free 30-day evaluation, please contact Synopsys Optical Solutions at (626) 795-9101, visit [synopsys.com/optical-solutions/lighttools](https://www.synopsys.com/optical-solutions/lighttools) or send email to optics@synopsys.com.