

# 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
- 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 or ray fans/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 context 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.

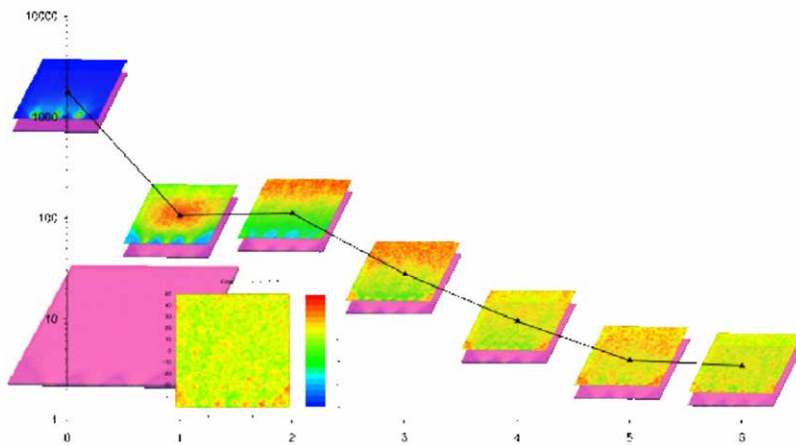


Figure 1: LightTools Optimization greatly improved the illuminance uniformity of this edge-lit LED backlight system in six iterations, with minimal user input

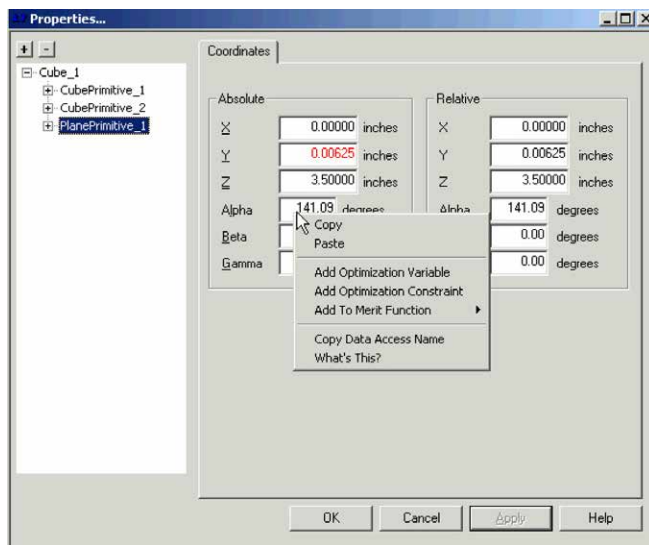


Figure 2: Almost any numeric field within the LightTools user interface can be added as a variable, constraint, or used as part of a merit function

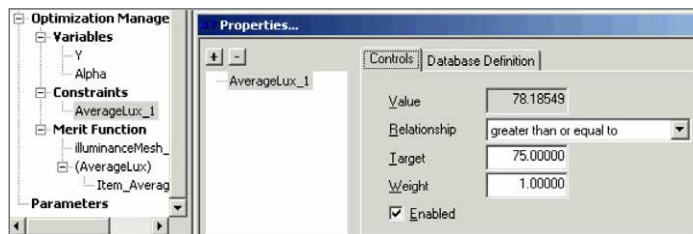


Figure 3: All optimization components—including variables, constraints, and merit functions—can be viewed and edited in the Optimization Manager

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 positions and orientations of entities) and analysis results (such as receiver total power or CIE coordinates).

The user-defined 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 in the same easy way a variable or constraint is added: by selecting the desired field and right-clicking to display the context menu. Merit functions can be comprised of more than one group, and each group can include multiple items. Each item in a group can have a different target and weight, and you can enable or disable individual items. Each group can also be weighted and enabled or disabled to control its influence on the optimization solution.

These options allow for a degree of flexibility no other optimizer possesses. In addition, all of the merit function groups are displayed in a well-organized summary table. This allows rapid access to all of the components of the merit function at once.

The proprietary algorithms within the LightTools optimization engine 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 manages the optimization progress using built-in criteria such as exit controls and noise calculations, which intelligently balance accuracy and efficiency.

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