SYNOPSYS®

LightTools Modules

Core Module

The LightTools Core Module provides graphical 3D solid modeling functionality and interactive optical ray tracing for creating and visualizing optical and opto-mechanical systems, including the capability to specific properties for materials and optical surfaces.

Productivity-enhancing features include an intuitive user interface, libraries of task-and-application-specific utilities and example systems, programming extensions for automating workflow, and photorealistic renderings of mechanical models.

All other LightTools modules are fully integrated with the Core Module.

For more information about LightTools modules, visit https://www.synopsys.com/optical-solutions.html

Illumination Module

Enables designers to simulate and analyze light as it traverses the optical and mechanical components in a model. Includes state-of-the-art Monte Carlo ray tracing for accurate predictions of intensity, luminance, and illuminance throughout the model, as well as powerful illumination analysis capabilities.

Optimization Module

Automatically improves the performance of virtually any type of illumination system. Full integration with the LightTools 3D solid modeling environment ensures practical, realistic solutions in a fraction of the time it would take to accomplish manually.

Advanced Design Module

Provides a set of specialized tools to enable fast, robust modeling of reflective and refractive freeform optics in both single-surface and segmented configurations for a diverse set of illumination applications.

Advanced Physics Module

Extends optical modeling capabilities in LightTools for custom optical parts and advanced illumination subsystems. Includes modeling of phosphors, user-defined optical properties, and gradient index materials.

SOLIDWORKS Link Module

Dynamically links SOLIDWORKS mechanical models to LightTools, where you can assign optical properties, optimize, and directly update your SOLIDWORKS design.

Data Exchange Modules

Provide import and export capabilities for industry-standard CAD file formats, including IGES, STEP, SAT, CATIA V4 and V5, and Parasolid formats.

Imaging Path Module

Defines an imaging path based on sequential optical surfaces and perform lens analyses. The Imaging Path capability can be used directly in LightTools or in conjunction with CODE V.

Core Module

Geometry Creation and Editing

- Lens primitives (rectangular or circular apertures)
- Spline sweep and patch surfaces
- Polyline sweeps and extrusions
- Conic trough and revolved reflectors
- Cylinders, blocks, spheres, toroids, and skinned solids
- Union, intersection, subtraction boolean operations
- Object trim operation
- Move, rotate, scale, align
- Copy, rectangular, and circular pattern copy
- Multiple and partial immersion and cementing for solid objects
- Pickups for parametric modeling
- Grouping of model entities

Optical Properties

- Specular reflection/transmission/TIR with Fresnel losses
- Diffuse transmission/reflection
- Scatter models: mixed diffuse, narrow angle, and angle of incidence (AOI)
- Volume scattering (Mie, user defined)
- Scattering aim regions
- User-defined coatings
- Probabilistic ray splitting and importance sampling
- Constant or varying optical density or transmittance vs. length
- Index of refraction (constant, interpolated, standard dispersion formulas)
- Surface patterns of 2D or 3D elements
- Photorealistic rendering (Illumination Module needed for lit appearance)

User Interface and Other Features

- ActiveX interface for macro programming in MS Excel, VB, VC++, Matlab, Mathematica, and others
- OpenGL-rendered graphics
- Tabbed windows and editable spreadsheets
- Multiple design views and navigation windows
- Point-and-click, copy-and-paste, moving and resizing of windows
- Extensive help features

Point-and-Shoot Ray Tracing

- Parallel, diverging, or converging sets of rays
- Individual rays, 2D ray fans, 3D ray grids
- Sequential and non-sequential ray propagation

Libraries

- LED sources
- Display films
- Application and feature examples
- Utilities

Illumination Module

Powerful illumination analysis capabilities, such as photorealistic renderings that show the luminance effects of light sources in the model, simulate real-world conditions and reduce the need for physical prototypes.

Illumination Analysis

- Photorealistic Rendering
- Photometric or radiometric analysis using forward and backward ray tracing
- Illuminance, luminance, luminous intensity
- Line charts, raster, contour, and surface charts
- Colorimetric analysis: 1931 and 1976 CIE coordinates, correlated color temperature
- RGB output display, CIE chromaticity chart
- Post-processing of output data
- Receiver data filtering using over a dozen filter types
- Encircled and ensquared energy
- Spectral power distribution
- Multi-CPU processing

Sources and Receivers

- Point sources
- Volume and surface emitters (spheres, cylinders, blocks, toroids)
- User-defined spatial, volume, and angular distributions
- Source emittance aim regions
- Spectral distributions: Blackbody, Gaussian, continuous, discrete, and user defined
- Angular and spatial importance sampling
- Ray data sources and Radiant Imaging source model support
- Surface and far field receivers
- Angular and spatial luminance meters
- Receiver aperture sub-sampling

Optimization Module

The Optimization Module 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.

Illumination Optimization

- Optimize illumination uniformity and/or flux on a receiver
- Match target illumination distributions
- Collimate and focus merit functions for non-sequential rays
- Lagrange constraint handling
- User-defined variables, constraints, and performance criteria
- Vary any floating point model parameter
- User-defined combinations of parameters
- Bounded and unbounded variables
- Backlight pattern optimization utility
- Parameter sensitivity utility
- Point-and-shoot ray merit functions

Advanced Design Module

The Advanced Design Module leverages proprietary algorithms from Synopsys' LucidShape products that automatically calculate and construct optical geometries based on user-defined illuminance and intensity patterns. This unique, functional approach gives designers the freedom to focus on overall design objectives rather than the implementation details of complex optical components.

- Freeform Design features for modeling freeform reflective and refractive surfaces that are automatically shaped to form the resulting light pattern.
- MacroFocal Reflector tool for designing multi-surface segmented reflectors, with different spreads for each facet.
- Procedural Rectangle Lens tool for designing surfaces with pillowed optical arrays.
- LED Lens tool for creating various types of freeform LED collimator lenses.

Advanced Physics Module

- Designers can take advantage of programming extensions to develop custom optical parts and advanced illumination subsystems using:
- Phosphor particle modeling (single and multiple)
- Gradient Index (GRIN) materials - used in copiers, scanners, and fiber optic telecommunication systems.
- User-defined optical properties (UDOPs) - such as proprietary polarization components, scatterers, coatings, and other specialty optical materials.
- Birefringent (uniaxial) materials - used in advanced applications such as AR/VR headsets and biomedical instruments.

The results for UDOPs and birefringent materials can be packaged into a portable format and exchanged with your project team, customers, suppliers, and subcontractors.

SOLIDWORKS Link Module

The SOLIDWORKS Link Module enables you to link SOLIDWORKS 3D opto-mechanical models to LightTools, where you can assign optical properties and use the Optimization Module to optimize your design. This module provides complete parametric interoperability between LightTools models and SOLIDWORKS.

Data Exchange Modules

Supporting features for the Data Exchange Modules include the ability to group and simplify imported geometry and perform geometry repairs to maintain CAD model integrity and improve ray trace speed.

Translators

- SAT version 1.0 through 7.0
- STEP AP 203 and AP 214
- IGES version 5.3, including surfaces and solids
- Parasolid
- CATIA V4 and V5 (import and export)
- Grouping and simplification of imported surfaces
- Geometry repair

Imaging Path Module

- Sequential ray tracing
- Paraxial solves
- Image path view
- Spot diagram and transverse aberration plots

Distributed Simulation Module

The Distributed Simulation Module allows you to distribute Monte Carlo ray tracing over multiple computers to speed simulations of complex optical models.

02/10/21.CS639238650-OSG-LT Modules 2 pgs.