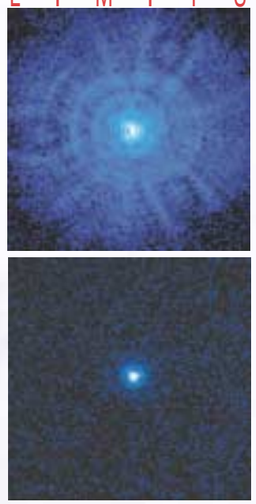
OSLO

OPTICS SOFTWARE

FOR PEOPLE

WHO EXPLORE

THE LIMITS



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Optical Design for Today's Applications

OSLO® is a powerful optical design program with the scope needed to meet today's optical requirements. In addition to classical lens design features, OSLO combines advanced ray tracing, analysis, and optimization methods with a high-speed macro language to solve a wide variety of new problems.

OSLO provides an integrated software environment that helps you complete almost any task in contemporary optical design. More than a lens design program, OSLO provides advanced tools for designing medical instrumentation, illumination systems, and telecommunications equipment, to name typical applications.

OSLO is available in three levels called OSLO Premium, OSLO Standard, and OSLO Light. Each is a full-featured program that can help you design superior systems.

OSLO is straightforward to learn and easy to use. Developed exclusively for desktop computers, its speed, power, and flexibility are unmatched by other software. And, its advanced technology is available at reasonable cost.

Some Applications for OSLO

Imaging Systems

- Photolithography
- Optical Metrology
- Laboratory Instruments
- Optical Testing
- Spectrographs
- Astronomical Telescopes

Nonimaging Optics

- Illumination Systems
- Interferometers
- Solar Collectors
- Faceted Reflectors
- Condensers
- Light Concentrators

Laser Systems

- Fiber Couplers
- Laser Focusing
- Collimators
- Scanners
- Cavity Design
- Beam Delivery

Visual Systems

- Microscopes
- Telescopes
- Refractometers
- Low Vision Aids
- Endoscopes
- Virtual Reality
- Night Vision

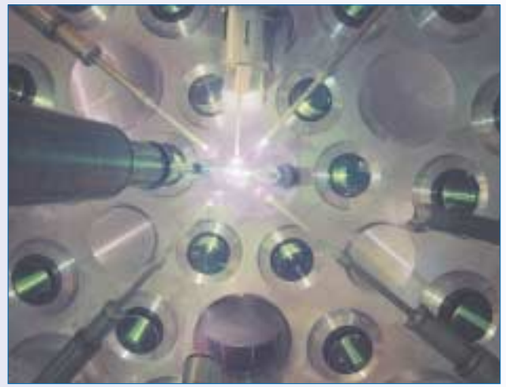
Zygo Corporation, a world leader in interferometric test equipment and long-time user of OSLO, was chosen by Ball Aerospace to supply the system needed to test the Costar optics for the 1993 Hubble Space Telescope upgrade.

Zygo engineers designed the test lens shown below using OSLO, taking advantage of its superior ray tracing and optimization algorithms to produce a successful design for this important mission.

The cover of this brochure shows enhanced images of a star taken with the HST Faint Object Camera before and after the Costar correction. These and other HST images can be obtained from the web site http://oposite.stsci.edu/pubinfo.

Eastman Kodak Company uses OSLO to design the lenses for many of its consumer products, such as the Advantix™ camera below, which is part of the new Advanced Photo System. OSLO's flexible optimization and tolerancing routines, coupled with its extensive analysis features, allow Kodak engineers to understand the tradeoffs between various design solutions for high-volume production.

Kodak was one of the first companies to use OSLO's Adaptive Simulated Annealing technology in practical optical design, employing this global optimization method to improve the tolerances in a complex lens containing aspheric surfaces.



The University of Rochester Laboratory for Laser Energetics uses OSLO extensively in the development of its Omega laser. Currently the world's most powerful system for studying laser fusion, the Omega laser uses hundreds of optical components to split and amplify a nanosecond, millijoule optical pulse to more than 30,000 joules that are focused uniformly on a tiny deuterium pellet.

The image above shows a view from inside the final target chamber. Some of the 60 aspheric final focusing lenses designed using OSLO can be seen in the background, along with various diagnostic instruments that surround the pellet.

Leupold & Stevens, the preeminent manufacturer of sports optics in the United States, uses OSLO to design almost all of its products. The binoculars shown above are a new design, the first binoculars produced in the United States in more than twenty years.

OSLO provides full support for afocal systems, which allows Leupold designers to assess the performance of visual instruments quickly and easily, without the need for fictitious lenses that convert afocal systems to equivalent focal systems.

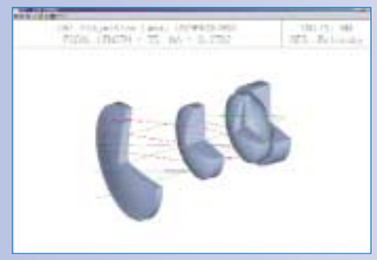
The Technology Leader

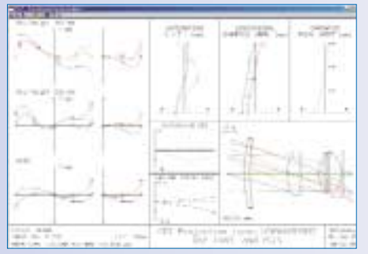
OSLO was the first software to demonstrate that serious optical design could be carried out using desktop computers. Today, OSLO has been accepted as a practical tool by companies throughout the world that use it to create better, lower-cost designs and manufacture them more efficiently. But optical design today goes far beyond the range of problems handled in the past. Now, optical systems are often integrated with electronics and image-processing software, which creates new design alternatives. OSLO's technological leadership is more valuable today than ever before.

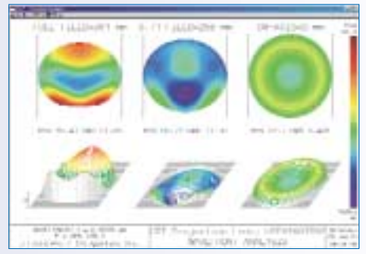
From a technical viewpoint, OSLO is much more than a lens design program. Because of its powerful ray-tracing routines and far-field diffraction analysis that computes amplitude and phase distributions near foci, practically any optical system that utilizes free-space propagation can be designed using OSLO.

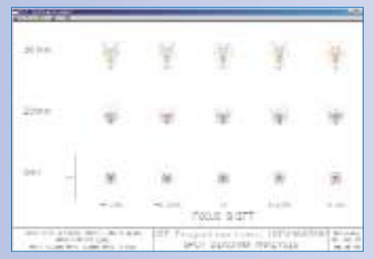
OSLO's optimization is its most powerful built-in feature. Often you can optimize a system by clicking a few toolbar icons. When you need extra power, however, OSLO goes beyond typical optical design software to provide the extra control that you need. For example, in addition to several default error functions, OSLO provides extremely flexible methods for building custom internal or external error functions. These allow you to solve virtually any optimization problem that uses continuous variables.

Efficient, user-friendly programmability has become an essential tool for the professional optical designer. CCL, OSLO's programming language, provides high-speed compilation, standard C syntax, and full internal-accuracy data communication with OSLO. With its extensive support library, CCL allows you to extend OSLO's capabilities in new application areas.



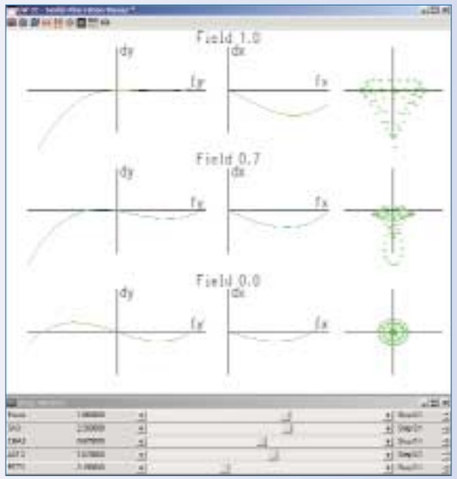






OSLO PLACES SPECIAL EMPHASIS ON HIGH QUALITY graphical output in either color or black and white. The images shown here can be produced by a single click on a toolbar icon, and represent a few of the dozens of graphical plots that can be produced using menu commands.

Using OSLO's graphics routines, you have full capability to customize your output or to create entirely new plots using the CCL graphics library. In addition, you can export OSLO lens drawings to CAD programs using either DXF or IGES files.

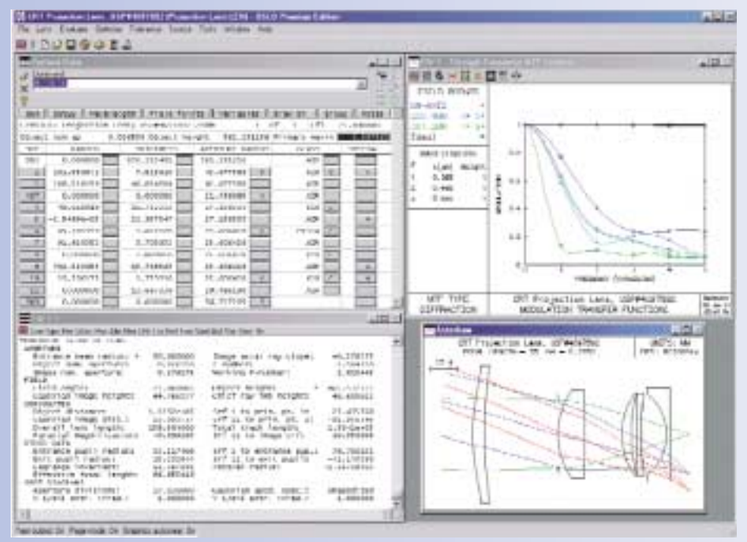


OSLO'S HIGH-SPEED GRAPHICS SUBSYSTEM provides interactive design windows that allow you to attach graphical sliders to lens parameters and see the performance change instantly as the sliders are dragged. In this tutorial example, the Seidel aberrations are adjusted with the sliders and the performance curves are updated dynamically. OSLO allows you to carry out complete optimization iterations while dragging a slider.

The example shown here was produced by a built-in interactive demo routine.

The full power of this exciting feature can be obtained using automatic callback functions in CCL. Using CCL, you can set up a graphic slider window that contains up to 32 sliders. These can control almost any OSLO function, or another CCL function that you write yourself.

Interactive design windows were first introduced to optical design by OSLO, and are a vibrant example of the leading role of OSLO in new optical design technology.



OSLO USES AN INTERFACE BASED ON MENUS, toolbars, spreadsheets, and text and graphics windows. OSLO's objects are lens surfaces, wavelengths, operands, etc. You manipulate these using the same cut-copy-paste techniques that you use with your other windows programs. This means that you can concentrate on the optical details of your problem, since the user interface is already familiar to you.

OSLO also has a command-line interface that provides full prompting for missing arguments. You can use either the windows or command interfaces to match your preferences.

Features that Help You Explore the Limits

OSLO Premium is the top level of OSLO and includes features such as ray tracing and optimization of non-sequential groups, lens arrays, thin-film coatings, polarization ray tracing, vector diffraction calculations, true global optimization, high-speed MTF/Wavefront tolerancing, an enhanced CCL library, and optimization of eikonal functions.

OSLO Standard provides optimization and tolerancing tools needed to support contemporary lens design. Its features include a very flexible automatic error function generator, multiconfiguration optimization, the CCL macro development language, an expanded range of special surface types, and the Warren Smith, Arthur Cox, and Optics Toolbox libraries of starting designs.

OSLO Light is designed to model and perform basic optimization on a wide variety of systems, including those with aspheric, tilted or decentered surfaces, gradient index elements or diffractive surfaces. Analysis capabilities include all the basic routines for both geometrical and diffraction-based evaluation, including Gaussian beam propagation and fiber coupling. OSLO Light also includes several glass catalogs and a database containing more than 3,000 stock lenses.

OSLO is available for computers running Intel CPUs (Pentium or above recommended) and Microsoft Windows (95 or NT recommended), HP workstations running HP-UX, or Sun Workstations running Solaris. Program usage is licensed according to the number of simultaneous users of the software.

OSLO is supported by a support subscription or update service. The support subscription is available for OSLO Premium and OSLO Standard and provides automatic updates, technical support, and upgrade discounts. All OSLO software is supplied with a 30-day, no-charge return policy and a 90-day warranty.

Lambda Research offers training classes on the use of OSLO and Modern Lens Design. Please request a schedule.

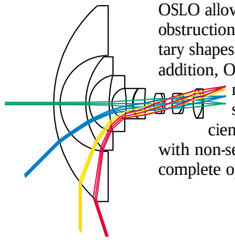
Lens and Material Databases

OSLO includes one of the industry's largest libraries of materials, catalog lenses, and starting designs. In addition to materials data from all major glass suppliers, there's a database containing more than 3,000 stock lenses for setting up prototypes, and three libraries containing over 1000 starting designs for optimization. The Arthur Cox library from the book *A System of Optical Design*, and the Warren Smith library, from the book *Modern Lens Design*, are uniquely available with OSLO.

Special Surface Data

The data that OSLO uses to describe optical surfaces are complete and easily managed. Tilted and decentered surfaces are described properly, with no need for extra dummy surfaces in either local or global coordinates. Polynomial aspheric and diffractive surfaces are not limited as to order. The range of surface types available meets the state of the art and includes aspheres, splines and gradient index, diffractive, user-defined, and eikonal surfaces. Each surface type is supported by a spreadsheet to enhance ease of use, as well as a high-speed command mode that permits efficient data entry.

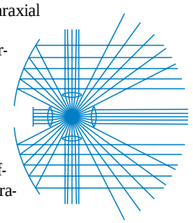
Special Apertures



OSLO allows you to define multiple apertures, holes or obstructions on a single surface using combinations of elementary shapes. Almost any conceivable shape can be created. In addition, OSLO's special aperture types allow you to simulate most optical elements that can be handled in a solids program while retaining the speed and efficiency of surface modeling. This feature, combined with non-sequential ray tracing, allows OSLO to serve as a complete optical design tool.

Ray Tracing

The ray trace in OSLO sets new standards for scope, speed, and solidity. OSLO permits both paraxial and aplanatic ray aiming, with six modes that provide unmatched versatility for defining pupils in wide-angle systems, as well as extreme systems that handle more than 180-degree fields or 360-degree apertures. OSLO handles ordinary rays, iterated rays and complete differential rays, and has special generators for random ray tracing.

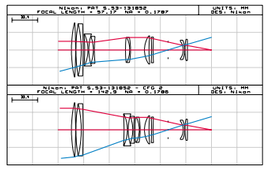


Arrays and Non-Sequential Groups

In most optical systems, the order in which surfaces are hit by a ray is predetermined. In lens arrays and sundry other systems, this is not possible. OSLO has the data structures and ray-tracing routines needed to handle groups of non-sequential surfaces. This allows OSLO to optimize the performance of systems that contain lens arrays, prisms, light pipes, faceted surfaces, and many illumination systems. Special codes handle a wide variety of ray actions at surfaces in non-sequential groups.

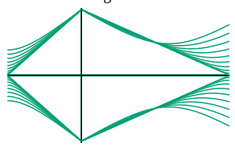
Zoom lenses and Multiconfiguration Systems

Many ordinary lenses that are being designed today are zoom lenses having variable magnification. OSLO is designed to work with such systems routinely, and allows you to enter zoom data on the main spreadsheet. Switching configuration data is extremely efficient in OSLO. This feature is very general, and allows you to perform ensemble optimization on any system that can be set up in multiple configurations.



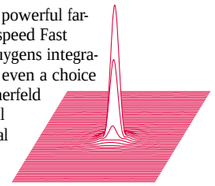
Lasers, Fibers, and Gaussian Beams

OSLO has several features that allow you to design systems for use with lasers. A special interactive spreadsheet solves ABCD propagation problems easily. A ray trace is available for full astigmatic beam tracing, and the astigmatism of diode sources can be entered directly. OSLO calculates far-field diffraction patterns of truncated Gaussian beams and overlap integrals between laser and fiber modes. You can even optimize stable curved-mirror laser cavities!



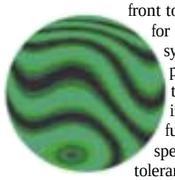
Diffraction and Partial Coherence

OSLO's diffraction analysis is the most powerful far-field analysis available, including high-speed Fast Fourier Transform routines, flexible Huygens integration methods, and for advanced users, even a choice between Kirchhoff and Rayleigh-Sommerfeld diffraction integrals. In addition, special routines provide an evaluation of partial coherence effects in trans-illuminated images such as those found in microscopy or lithography.



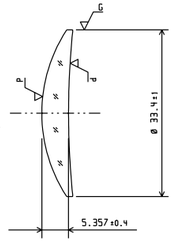
Tolerance Analysis

OSLO has three built-in tolerancing routines. MTF or wavefront tolerancing uses the Hopkins-Tiziani method for maximum speed, and is preferred for most system tolerancing. Change-table tolerancing is particularly useful for lens tolerancing during the design phase, and user-defined tolerancing allows you to construct the tolerancing function for maximum flexibility in handling special systems. All three schemes use default tolerances based on ISO 10110.



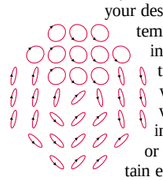
Tolerance and Element Data

OSLO's tolerance data is expressed in a format compatible with the ISO 10110 drawing standard so you can be sure that your design can be manufactured using contemporary standards. In addition, OSLO contains spreadsheets for simple entry of element data with default or custom tolerances, and routines that automatically generate element drawings, which makes it easy to prepare your design work for the optics shop.



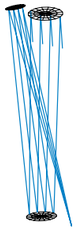
Polarization and Thin Film Coatings

In OSLO, you can include multilayer or metallic coatings in your designs and evaluate their effect on optical system performance. A polarization ray trace is included that determines the reflectance and transmittance of your system when it is used with partially or completely polarized light, as well as vector diffraction effects. You can also include ideal elements such as linear polarizers or wave plates, and optimize systems that contain either real or ideal elements.



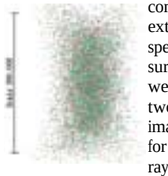
Optimization

OSLO provides multiple methods for local optimization, including a damped-least-squares method that can solve almost any local optimization problem. OSLO's Adaptive Simulated Annealing is the only true global optimization method available in optical design software, and is often claimed to be the best algorithm for highly complex global optimization tasks.



Illumination Analysis

The high speed of current desktop computers permits the computer-aided design of systems that use extended sources for illumination. OSLO's high-speed non-sequential ray trace, broad range of surface types, and CCL macro language make it well suited for this application. OSLO includes two built-in routines for illumination analysis in imaging systems, plus a CCL template routine for solving illumination problems using random ray tracing.



Perfect Lenses and Eikonal Functions

Sometimes it is useful to include a perfect lens as a component without knowing its exact construction. OSLO allows you to use true perfect lenses specified by both focal length and magnification, not just paraxial lenses. In addition, you can design real systems that contain elements specified by eikonal functions. Advanced users can even optimize eikonal functions, a technique that is at the very forefront of optics research!