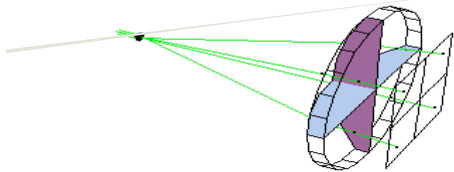


ADDRESSING THE OPTICAL DESIGN AND ANALYSIS NEEDS OF CORPORATE, BUSINESS, EDUCATIONAL, GOVERNMENTAL AND INDIVIDUAL USERS.



A view of our building in Champaign, IL. Optica Software is division of I-Cyt Mission Technology



## Optica News

We had a wonderful time at the Wolfram Technology Conference 2006 in Champaign IL. The presentations and training were great! Donald and Ann gave a talk on the new **Rayica/Wavica Graphical User Interface**. Theodore Gray, co-founder of Wolfram Research, presented a real-time *Rayica*<sup>TM</sup> example in his talk showing new *Mathematica*<sup>TM</sup> features. We met with one of our former Optica software developers, **Stephan Leibbrandt**. Stephan has since authored a new software package: **Objecta, a Mathematica Package for Object Orientation**: <http://www.objectica.net/index.html>.

Our salesperson, Lorenzo Kindle, has moved on and is now working as a sales executive at Time-O-Matic. We appreciate his service and wish him luck. We have loved working with him.

Debbie Cassels started working at Optica Software. She is helping to make improvements to the Optica Software website. If you have any suggestions for improvements please email us! Debbie previously worked for the University of Illinois as a project manager. She recently came back from missionary service in the Dominican Republic, working for a medical team that helped over two thousand patients in rural communities.

We have added several new International Optica Software resellers to the list. This includes Dahan Tech from Korea, CreActive from Italy, and Jyoti Electronics from India. Most of the certified *Mathematica*<sup>TM</sup> international resellers now carry Optica Software products.

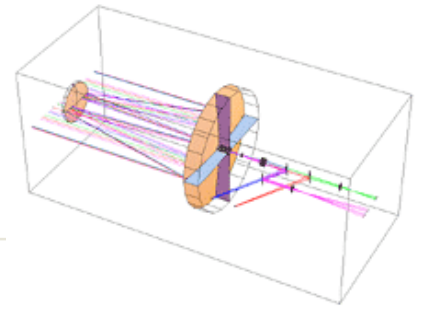
## Need help with projects? Sign up for our annual support plans

Annual Support Plans are becoming increasingly popular. Users have found these plans to be helpful in providing technical assistance for roadblocks they encounter or for a special project they are working on. Users with ASP, also enjoy access to the support and download area of the [www.opticasoftware.com](http://www.opticasoftware.com) website; which enables them **free product upgrades** over a 12-month period. The bottom right section of our home page shows the latest “build date” for our software. At the time of this newsletter the most current version of our software was Jan 23, 2007. Make sure you stay updated by referring to this section on a regular basis. Look for Annual Support Plans under the Store tab on our website: <http://www.opticasoftware.com/store/> for more details.



# Notes from the Developer

Donald Barnhart, Ph.D. – Optica Software Lead Developer  
[donald@opticasoftware.com](mailto:donald@opticasoftware.com)



*Rayica*<sup>™</sup> can be used to optimize nearly every optical set-up. First we assign symbolic values to accompany each numeric parameter. These symbolic parameters are used in the optimization procedure. We do not assign symbolic values to parameters that are not relevant to the optimization procedure.

For example:

```
AsphericLens[{{curva,0.9},{ka,0.696917},{ca1,0},{ca2,0},
{ca3,-0.0869628},{ca4,0.0133304},{ca5,0.153352},1.3},
{{curvb,-0.9},{kb,-6.99529},{cb1,0},{cb2,0},
{cb3,-0.171893},{cb4,-0.0409008},{cb5,0.0885435},1.13},
2.4,1.03,{ComponentMedium -> C0550}]
```

This component function can be part of a system with light sources and other optical elements that later gets optimized by calling the **OptimizeSystem** function to determine the best focus.

See the user tip below for details about using symbolic values for input to optimizations.

## Back by popular demand. Optica 1 GratingSurface function.

For thickness =0, the Rayica Grating component function now uses the old *Optica 1* GratingSurface routine.

## User Testimonial

"I am really enjoying playing with the software since I have it, although I had to stop because the lady at home was a bit fed up with me staying up too late and forgetting to feed the kids... First thing I did was to model a delay line for which we applied for a patent a year ago, previous modeling was done with a more than primitive and dedicated ray tracing notebook that I made for this problem long time ago. Within a day I had the delay line modeled in Rayica and could generate frames to animate its working. I have never been courageous enough to model it in Oslo or Zemax. It was rather easy with Rayica. It has made good impression on many of my coworkers."

**Guy Lamouche**  
National Research Council Canada, Quebec, Canada

## CONTACT US:

Donald Barnhart, Lead Developer  
[donald@opticasoftware.com](mailto:donald@opticasoftware.com)

Ann Williamson, Software Developer  
[annw@opticasoftware.com](mailto:annw@opticasoftware.com)

Support/Sales  
[support@opticasoftware.com](mailto:support@opticasoftware.com)

Website  
[www.opticasoftware.com](http://www.opticasoftware.com)

Phone  
217.693.4463

Fax  
217.328.9692

## Using Rayica to Optimize the Curvature and Conic Constants of an Asymmetric Conic Mirror

(Submitted by user Michael Goldstein, Intel Corp. and the Optica Software team)

The *Mathematica* source in notebook form for this example can be found at: [www.opticasoftware.com/support/](http://www.opticasoftware.com/support/)

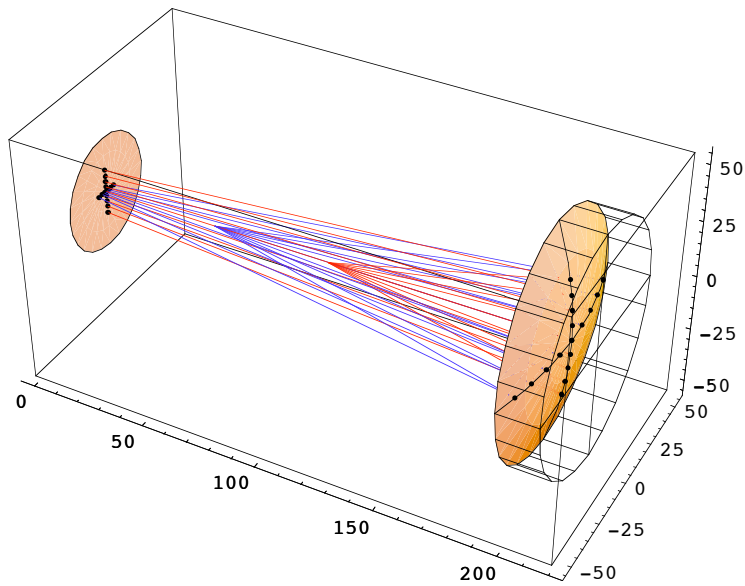
**Q:** How can a CustomMirror[] system be optimized? I have a design with an asymmetric conic mirror and need to optimize the system. A simple example is shown below. Can you show how to optimize the curvature and conic constants (shown in red) below?

**A:** We need to associate a symbolic variable for each variable we want to optimize: {Symbolic-variable, variable} We also need to add options SymbolicValues, SymbolicSurfaceApproximation and SymbolicSurfaceFunction to CustomMirror, a Rayica component function. The first argument of CustomMirror[surfacefunction, aperture, thickness, objectlabel, options] is a function that defines the component shape. The options are the arguments with arrows. See Options[CustomMirror]. AsymmetricConicMirror is a function defined by the user. After we define the optical system we can use OptimizeSystem to get the best focus. OptimizeSystem[system, options] optimizes the performance of an optical system for a specified set of input parameters. The Mathematica output gives the optimized curvature and conic constants.

```
AsymmetricConicMirror[{symcurvx_, curvx_}, {symkx_, kx_},
  {symcurvy_, curvy_}, {symky_, ky_}, diam_, thickness_] :=
  CustomMirror[
    Function[{x, y},  $\frac{\text{curvx } x^2 + \text{curvy } y^2}{1 + \sqrt{1 - \text{curvx}^2 (1 + kx) x^2 - \text{curvy}^2 (1 + ky) y^2}}$ ],
    diam, thickness, CustomMirror, SurfacePoints -> 21,
    SymbolicValues -> {symcurvx -> curvx, symkx -> kx, symcurvy -> curvy, symky -> ky},
    SymbolicSurfaceApproximation -> {SphericalShape -> 1 / symcurvx},
    SurfaceApproximation -> {SphericalShape -> 1 / curvx},
    SymbolicSurfaceFunction ->
      Function[{x, y},  $\frac{\text{symcurvx } x^2 + \text{symcurvy } y^2}{1 + \sqrt{1 - \text{symcurvx}^2 (1 + \text{symkx}) x^2 - \text{symcurvy}^2 (1 + \text{symky}) y^2}}$ ],
    SurfaceRayIntersections -> Numeric ];

sys = {
  Move[WedgeOfRays[30, NumberOfRays -> 9], 50],
  Move[WedgeOfRays[30, NumberOfRays -> 9], 100, TwistAngle -> 90],
  Move[AsymmetricConicMirror[
    {cx,  $\frac{-1}{175}$ }, {kx, -1.5}, {cy,  $\frac{-1}{150}$ }, {ky, -1.5}, 100, 10], 200],
  Baffle[50] (*The baffle is placed last,
    since we are doing a sequential ray-trace in this example.*)
};
```

```
plot = TurboPlot[{sys, Boundary[{-1, -55, -55}, {220, 55, 55}]},  
  SequentialTrace → True, Axes → True, ColorView → SourceID];
```



```
In[54]:=
```

```
sol = OptimizeSystem[sys, SequentialTrace → True]
```

```
Out[54]= {SymbolicValues → {cx → -0.00593107, cy → -0.0075, kx → -0.875407, ky → -0.111111},  
  NumberOfCycles → 580, FinalMerit → 0.407737}
```

```
In[57]:= TurboPlot[plot, sol, SequentialTrace → True, PlotType → Full3D, ShowRange → All, Axes →  
  True, ColorView → SourceID];
```

