

LENS NOTES

Help notes for using the Optics Module

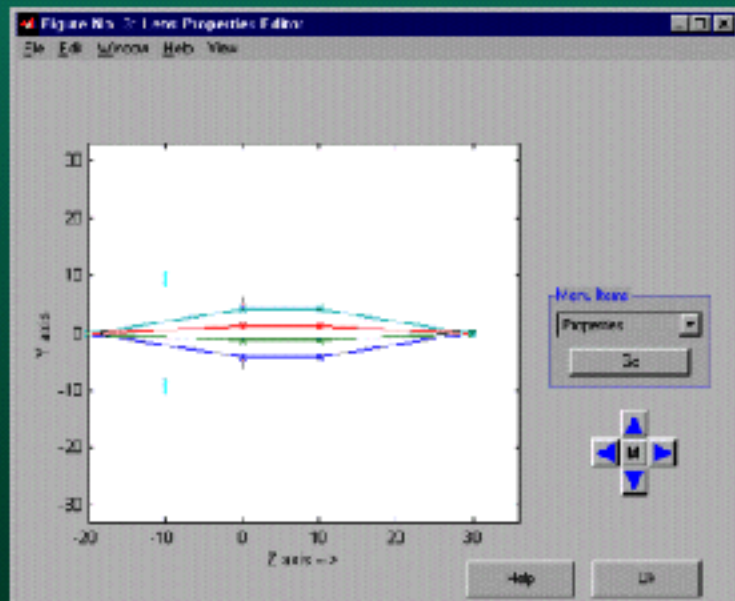
Auxillary Functions

General Description

- The user can type a simple statement in the MATLAB command line to examine proerties of an OPTICS module in more detail.
- To use these functions, simply open an OPTICS module edit window and type the command at the MATLAB prompt.

Auxillary Functions

Usage



- Immediately after an OPTICS module has been selected for editing, several functions can be entered in the MATLAB Command Window in order to query properties of the lens.
- If changes are made to the lens in the LENS Editor, the new lens can be queried if the user returns to the view window as shown on the left.
- On-line help is available by typing *help "functionname"* at the command line.

pupil

First-order pupil information

» pupil;

----- Aperture Information -----

STON=2 STOD=8.16497;

ENPD=8.16497 EXPD=16.3299;

ENPZ(fr obj)=20 or ENP THI(fr first element)=0;

EXPZ(fr img)=-40.005 or EXP THI(fr last element)=-40;

FNO(at used)=2.5 NA(img, at used)=0.2;

FNO(Inf)=1.63299

- STON - stop number
- STOD - stop diameter
- ENPD - entrance pupil diameter
- EXPD - exit pupil diameter
- ENPZ - ENP distance from object
- EXPZ - EXP distance from image
- ENP THI - ENP distance from first element
- EXP THI - EXP distance from last element
- NOTE: all distances are in lens units (usually millimeters)

fir

First-order lens information

» fir;

----- First order optics -----
EFL=13.3333, BFL=6.66667, FFL=-6.66667
MAG=-1, IMD=20, OAL=10, TT=50.005

- EFL - efective focal length
- BFL - back focal length
- FFL - front focal length
- MAG - system transverse magnification
- IMD - image distance

- OAL - overall length (of lens elements)
- TT - total track (from object to image)
- NOTE: all distances are in lens units (usually millimeters)

sur

Surface information

```
» sur;  
No.   Radius Thickness  Index  
Sur. 1: Inf  20    1  
Sur. 2: Inf  0    1  
Sur. 3: 20   10   1  
Sur. 4: 20   20.005 1  
Sur. 5: Inf  0    1
```

- NOTE: all distances are in lens units (usually millimeters)

field

Object and image field information

» field;

----- Field Information -----
YOB=0 YAN=0 YIM=0

- YOB - object height along y axis
- YAN - chief-ray angle in y z plane
- YIM - image height along y axis

- NOTE: all distances are in lens units (usually millimeters)

seidel

Displays the Seidel aberrations

» Seidel;

----- Seidel Coef. etc. -----

LARG_INV=0 check:IMD= 20

SI = 3.472222e-002 ; W040 = 4.340278e-003; SA=-8.505173e-002

SII = 0.000000e+000 ; W131 = 0.000000e+000; TCO=0.000000e+000

SIII = 0.000000e+000 ; W222 = 0.000000e+000

SIV = 0.000000e+000 ; W220p = 0.000000e+000

SV = 0.000000e+000 ; W311 = 0.000000e+000

CL = 0.000000e+000 ; W020C = 0.000000e+000

CT = 0.000000e+000 ; W111C = 0.000000e+000

- LARG_INV - Lagrange invariant
- SI-SV - Seidel coefficients
- W's - wavefront aberration coefficients
- CL&CT - longitudinal and transverse color
- NOTE: all distances are in lens units (usually millimeters)

rayfan

Displays a plot of ray intercepts in a figure window

`function [X, Y, Z, L, M, N, Rho]=rayfan(XOB,YOB,Nray,SURN, way, plotflag)`

-input

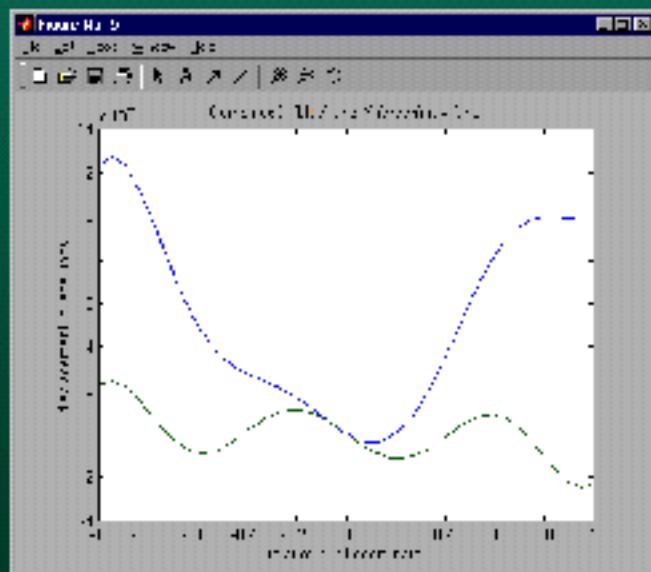
SURN = surface number of ray intersections
way = 0 for combined x and y fans, 1 for x fan, 2 for y fan
XOB = x object height (LENSUNITS)
YOB = y object height (LENSUNITS)
plotflag= 1 for plot, 0 to suppress plot

-output

XYZ = intersection coordinates
LMN = direction cosines (to next surface)
Rho = pupil coordinate reference
A plot of the fan(s) in a new figure window is provided.

-DEFAULTS:

XOB = 0
YOB = 0
Nray = 40
SURN = image surface (also can input SURN=0
for image surface)
way = 0
plotflag= 1



rayfan - notes

- NOTES:

The simplest way to use this function is to open an "optics" object for editing and type "rayfan;". If numerical output is desired, put in leading brackets, e.g.,

`"[myX, myY, myZ, myL, myM, myN, myRho]=rayfan;"`.

If specific object heights, number of rays, etc, are desired, put in the argument of the function, e.g., "rayfan(0,10);" for a y-direction object height of 10 lens units. (The lens units are usually millimeters.)

The outputs of way = 0 (the combined fans) are column vectors in which the first half is the y fan and the second half is the x fan.

type "help rayfan" for online help in the MATLAB command window.

wavefan

Displays a plot of OPD profiles in a figure window

```
function [OPD, Rho]=wavefan(XOB,YOB,Nray way, plotflag)
```

-input

way = 0 for combined x and y fans, 1 for x fan, 2 for y fan

XOB = x object height (LENSUNITS)

YOB = y object height (LENSUNITS)

plotflag= 1 for plot, 0 to suppress plot

-output

OPD in wavelengths of the lens (see lens editor panel). OPD is relative to the chief ray in the exit pupil.

Rho = pupil coordinates

A plot of the fan(s) in a new figure window is provided.

-DEFAULTS:

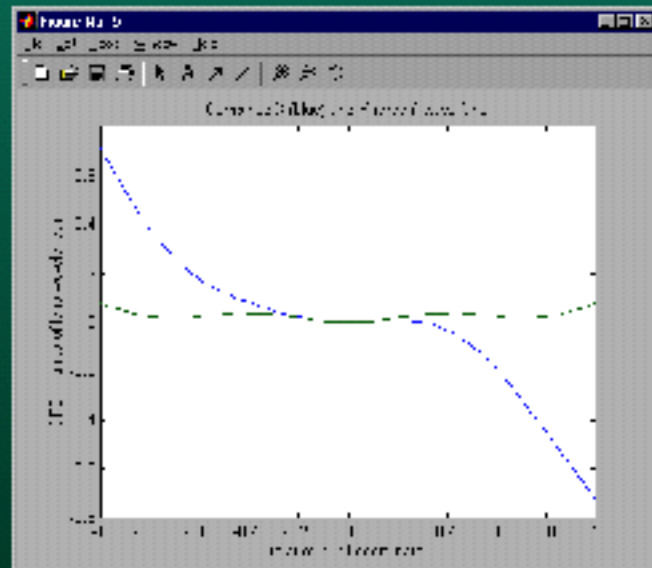
XOB = 0

YOB = 0

Nray = 40

way = 0

plotflag= 1



wavefan - notes

- NOTES:

The simplest way to use this function is to open an "optics" object for editing and type "wavefan;". If numerical output is desired, put in leading brackets, e.g.,

`"[myOPD, myRho]=wavefan;"`.

If specific object heights, number of rays, etc, are desired, put in the argument of the function, e.g., "wavefan(0,10);" for a y-direction object height of 10 lens units. (The lens units are usually millimeters.)

The outputs of way = 0 (the combined fans) are column vectors in which the first half is the y fan and the second half is the x fan.

type "help wavefan" for online help in the MATLAB command window.

spot_diagram

Displays a spot diagram of the ray intercepts in a figure window.

function [X, Y, Z, L, M, N, Tflag]=spot_diagram(XOB,YOB,Nray,SURN, way, plotflag)

-input

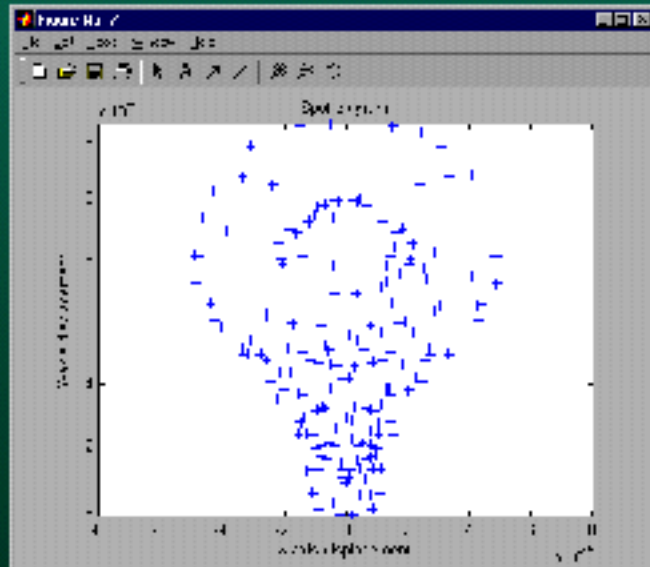
SURN = surface number of ray intersections
way = 0 for all rays way = 1 for rays passing stop
XOB = x object height (LENSUNITS)
YOB = y object height (LENSUNITS)
plotflag = 1 for plot, 0 to suppress plot

-output

XYZ = intersection coordinates
LMN = direction cosines (to next surface)
Tflag= ray transmission through stop surface
A plot of the fan(s) in a new figure window is provided.

-DEFAULTS:

XOB = 0
YOB = 0
Nray = 20
SURN = image surface (also can input SURN = 0
for image surface)
way = 1
plotflag = 1



spot_diagram - notes

- NOTES:

The simplest way to use this function is to open an "optics" object for editing and type "spot_diagram;". If numerical output is desired, put in leading brackets, e.g.,

`"[myX, myY, myZ, myL, myM, myN, myTflag]=spot_diagram;"`.

If specific object heights, number of rays, etc, are desired, put in the argument of the function, e.g., "`spot_diagram(0,10);`" for a y-direction object height of 10 lens units. (The lens units are usually millimeters.)

type "`help spot_diagram`" for online help in the MATLAB command window.

find_chiefray_intercepts

Displays the real chief-ray intercepts at the last surface

```
function [XCI, YCI] = find_chiefray_intercepts(LENSstruct);
```

notes:

To use this function, simply type

```
"[XCI YCI] = find_chiefray_intercepts;"
```

if an optics module edit window is open.