Opticstudio Narcissus Effect Analysis's Macro

Goal of the script:

1) Check stop position and dummy surfaces

This part of the macro verifies the stop position and dummy surfaces. Indeed, to work properly this macro has some restrictions and assumptions about the stop position and supported surfaces. So, this part ensures that all those restrictions and assumptions are respected and stop the macro if it's not the case.

2) Count the number of ghost files

This part of the macro loads all the ghost files and counts them to use them after. There is also a condition to stop the macro with an error message if there aren't ghost files.

3) Check coatings

This part of the macro checks if every lens has coatings. If no coatings are detected on a lens, an error message is displayed saying that no coating is assigned to the surface.

4) User Inputs (temperature)

This part of the macro asks the user to input the temperature of different parts of the system (housing, detector, ambient). Those inputs are going to be used after that in the calculation of the narcissus vector. There are also some conditions on the temperature authorized for each component, with error message if the user input doesn't meet the requirements.

5) Generate field vector, vignetting vector, transmission vector

6) Calculate narcissus vector

This part of the macro calculates the NITD vector, which is then used to generate the graphical result.

   a. determine wavelength

   This section gets the used wavelengths in the Zemax Opticstudio file.

   b. generate trans_coef vector

   This section is devoted to generating the vector of transmission coefficients.

c. generate narc_coef

This section generates the narcissus coefficient of the housing, detector and ambient temperature.

$$\int_0^{\lambda} M_{e,\lambda}(\lambda,T)d\lambda = f_e(\lambda,T)\sigma_e T^4$$

where

$$if\ \lambda T < 2{,}500:\ f_e(\lambda,T) = \frac{90}{\pi^4} e^{-x}\left(1 + x + \frac{x^2}{2} + \frac{x^3}{6}\right)\left(1 + \frac{\lambda T - 2{,}500}{150{,}000}\right)$$
$$if\ \lambda T > 2{,}500:\ f_e(\lambda,T) = \frac{90}{\pi^4} e^{-x}\left(1 + x + \frac{x^2}{2} + \frac{x^3}{6}\right)$$

where

$$x = \frac{hc}{\lambda kT}$$

d. calc NITD vector

This section finally generates the NITD vector using the narcissus coefficient of the housing, detector and ambient temperature

$$NITD_{ij} = \frac{\int_{\lambda_1}^{\lambda_2}\{N(\lambda,T_H) - N(\lambda,T_D)\}\, R_d(\lambda)t_j(\lambda)^2 R_j(\lambda)d\lambda}{\int_{\lambda_1}^{\lambda_2}\frac{\partial N(\lambda,T_{MS})}{\partial T}\, A(\lambda)R_d(\lambda)t_0(\lambda)d\lambda}\,\sigma_{ij}$$

where

$$\sigma_{ij} = \frac{\Omega_{Rij}}{\Omega_{CSi}}$$

$N(\lambda,T_H) = Spectral\ Radiance\ of\ Housing$

$N(\lambda,T_H) = Spectral\ Radiance\ of\ Housing$

$N(\lambda,T_H) = Spectral\ Radiance\ of\ Detector$

$R_D(\lambda) = normalized\ detector\ spectral\ response$

$R_j(\lambda) = surface\ spectral\ reflectivity$

$A(j) = atmospheric\ transmittance$

e. calc maximum of NITD vector

f. calc total surface NITD contributions vector

7) Graphic plot
   a. plot NITD Surface contributions (off-axis reference)
   b. plot NITD Surface contributions (on-axis reference)
   c. plot total NITD(off-axis and on-axis reference)
   d. plot2d NITD(on-axis reference)
   e. …
8) Generate textfile

   This last part of the macro synthesizes all the main information used and produced by the macro. The first section of the text file contains the user-defined temperatures for the various parts of the system, as well as the operating wavelength range, the number of cold return surfaces and the transmission optical index. A second, more detailed section shows the contribution per surface of NITD data, cold-return vignetting data and transmission data.

ZPL Glossary :

- surf = surface
- vec = vector
- spro = surface property
- pwav = primary wavelength
- nsur = number of surface
- vec1(23) = 23 is the stop surface index
- poltrace = trace a particular ray through the system. (POLTRACE Hx, Hy, Px, Py, wavelength, vec, surf)
- LOADLENS = will load a lens file. If the filename contains the complete path, such as C:\MYDIR\MYLENS.ZM then the specified file will be loaded. If the path is left off, then the default folder for lenses will be used
- SVAL(A$) = To convert strings to numbers.
- POWR(x,y) = Computes the absolute value of x to the power of y