

# Package ‘interfr’

July 13, 2017

**Title** Interference Color Charts for Polarized Light Microscopy

**Version** 0.1.0

**Description** Computes interference color tables and plots customized Michel-Levy or Raith-Sorensen charts. Automatic interpretation of polarized-light microscopy images is still under development and will come soon.

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**Depends** R (>= 3.4.0), colorSpec, CircStats, plotrix

**License** GPL (>= 2)

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.0.1

**NeedsCompilation** no

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**Repository** CRAN

**Date/Publication** 2017-07-13 15:34:42 UTC

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interfr-package

*Interference colors for polarized light microscopy*

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### Description

Based on a 2013 paper by Sorensen, this package automates computation and plotting of interference colors produced when a transparent material is observed between crossed polarizer and analyzer. Two kinds of plots may be produced: the classical Michel-Levy chart (parallel color boundaries and oblique iso-birefringence lines in a rectangular plot with thickness and retardation axes) and the more recent Raith-Sorensen chart (hyperbolic color boundaries in a thickness-birefringence rectangular plot). Functions for automatic extraction of birefringence profiles from images, and their spatial or statistical interpretation are still under development.

### Details

Using the interfr package, users can compute and display their own interference chart, customizing sample thickness and birefringence ranges. This may be of special interest when dealing with thick samples (that exceed the 20-40 micrometers range of classical thin plates). It makes use of the colorSpec package for physically realistic representation of colors. A function is provided to illustrate the color shifts given by the use of quarter and lambda plates.

### References

Sorensen, B.E. (2013) A revised Michel-Levy interference colour chart based on first-principles calculations. *Eur. J. Mineral.*, 2013, 25, 5-10. DOI:10.1127/0935-1221/2013/0025-2252

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AddCompensators

*Shows the color changes when using sensible and quarter compensators*

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### Description

AddCompensators takes coordinates of one point on the interference chart (either provided as a named list or interactively selected on the chart using locator) and adds five circles to the plot: a black one centered on the selected interference color, and four that correspond to adding or subtracting the retardations of a quarter plate (grey circles) and a sensible plate (red circles).

### Usage

```
AddCompensators(loc = locator(1), type = "RS", quarter = 147.3,  
sensible = 530)
```

**Arguments**

loc	A named list with members x and y , or an interactive selection.
type	Chart type (Raith-Sorensen or Michel-Levy), see <a href="#">PlotChart</a> .
quarter	Numeric, the retardation of the quarter slab (in nanometers).
sensible	Numeric, the retardation of the lambda slab (in nanometers).

**Value**

Called for its side effect of adding circles to an existing plot

**Author(s)**

Olivier Etteradossi, <olivier.etteradossi@mines-ales.fr>

**See Also**

[locator](#), [PlotChart](#)

**Examples**

```
## Not run:
PlotChart(IC=IC1,type="RS",x.lims=range(IC1[,2]),Thickness = 4000)
AddCompensators()
# the same without interactive selection:
PlotChart(IC=IC1,type="RS",x.lims=range(IC1[,2]),Thickness = 4000)
AddCompensators(loc=list("x"=0.0002566569,"y"=3999.757))

## End(Not run)
```

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IC1 *sample interference dataset*

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**Description**

Low-resolution computed interference data

**Usage**

```
IC1
```

**Format**

IC1 is a data frame with 10000 cases (rows) and 6 variables (columns) named thickness, biref, R, G, B and retardation.

**Details**

Low-resolution data that would be obtained by running the InterferenceTable function with `thickVect = seq(0.01, 50, length.out = 50)` micrometers and `birefVect = seq(2e-4, 1e-2, by = 5e-4)`

**Author(s)**

Olivier Etteradossi, <olivier.etteradossi@mines-ales.fr>

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InterferenceTable      *Computes the Interference Table*

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**Description**

InterferenceTable is the package workhorse. It computes retardations for specified sets of wavelength, birefringence and thickness values and turns the corresponding transmission matrix into color coordinates in the sRGB colorspace. For now the colorimetric setting is nested into the function. It makes use of D65 illuminant and CIE 1931 2 degrees Color Matching Functions in order to reproduce Sorensen's paper setting. Computations may be slow for high resolutions.

**Usage**

```
InterferenceTable(spectr = seq(360, 830, by = 5), birefVect = seq(2e-04,
  0.1, by = 5e-04), thickVect = seq(0.01, 50, length.out = 50))
```

**Arguments**

spectr	A vector of wavelengths (in nanometers).
birefVect	A vector of birefringence values.
thickVect	A vector of thickness values (in micrometers).

**Value**

A data frame with 6 variables (columns) named thickness, biref, R, G, B and retardation

**Author(s)**

Olivier Etteradossi, <olivier.etteradossi@mines-ales.fr>

**References**

Sorensen, B.E. (2013) A revised Michel-Levy interference colour chart based on first-principles calculations. Eur. J. Mineral., 2013, 25, 5-10. DOI:10.1127/0935-1221/2013/0025-2252

**See Also**

[sRGB](#), [D65](#), [xyz1931](#), [colorSpec](#)

**Examples**

```
## Not run:  
test.IC<- InterferenceTable(spectr=seq(360,830,by=5),  
birefVect=seq(0.0002,0.1,by=0.0005),thickVect=seq(0.01,50,length.out=50))  
  
## End(Not run)
```

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L *Computes the degree of transmission under crossed polarizer and analyzer*

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**Description**

L is called internally to fill the spectral transmission matrix needed for interference color calculation

**Usage**

```
L(lambda = 550, d = 30, biref)
```

**Arguments**

lambda	Wavelength (nanometers).
d	Thickness (micrometers).
biref	Birefringence .

**Value**

a single transmission value

**Author(s)**

Olivier Eterradosi, <olivier.eterradossi@mines-ales.fr>

**References**

Bloss, F.D. (1999) Optical Cristallography. Mineralogical Society of America Monograph Series, Washington DC, Publication #5. ISBN 0-939950-49-9

**Examples**

```
## Not run:  
test.L<-L(lambda=550,d=30,biref=0.00025)  
  
## End(Not run)
```

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PlotChart *plots the interference chart*

---

### Description

PlotChart plots the result of a call to [InterferenceTable](#)

### Usage

```
PlotChart(IC, type = "Sorensen", Thickness = 30, x.lims = NULL,
          radials = FALSE)
```

### Arguments

IC	Dataframe from <a href="#">InterferenceTable</a> .
type	Chart type (see Details).
Thickness	If not NULL, a horizontal line is drawn at h= Thickness (in micrometers).
x.lims	Plotting range, horizontal axis (when NULL, defaults to c(0, 0.05) for Raith-Sorensen plots and to c(0, 2500) for Michel-Levy plots).
radials	If TRUE iso-birefringence lines will be plotted (on Michel-Levy chart only).

### Details

If type belongs to c("Sorensen", "S", "Raith-Sorensen", "RS"), the function plots interference colors on a grid with birefringence as horizontal axis and thickness as vertical axis. If type belongs to c("Michel-Levy", "ML", "MichelLevy", "M"), the horizontal axis is retardation (in nanometers) as in the classical Michel-Levy plot. When radials is set to TRUE, birefringence appears as oblique lines with rounded values printed at their end

### Value

a Sorensen or Michel-Levy plot

### Author(s)

Olivier Etteradossi, <olivier.etteradossi@mines-ales.fr>

### References

Sorensen, B.E. (2013) A revised Michel-Levy interference colour chart based on first-principles calculations. Eur. J. Mineral., 2013, 25, 5-10. DOI:10.1127/0935-1221/2013/0025-2252

**Examples**

```
## Not run:  
PlotChart(IC=IC1, type="RS")  
PlotChart(IC=IC1, type="ML")  
PlotChart(IC=IC1, type="ML", radials=TRUE)  
PlotChart(IC=IC1, type="ML", x.lims=range(IC1[,6]), Thickness = 35)  
  
## End(Not run)
```

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