Package: mie (via r-universe)

October 30, 2024

Type Package

Title Mie scattering

Version 1.0

Date 2014-06-22

License Mozilla Public License Version 2.0

Description Numerical implementation of Mie scattering theory for light scattering by spherical particles.

URL https://github.com/nano-optics/mie

DOI http://dx.doi.org/10.5281/zenodo.11421

VignetteBuilder knitr

Encoding UTF-8

Depends dielectric

Imports Bessel

Suggests ggplot2, purrr, dplyr, tidyr, testthat, knitr, rmarkdown

LazyLoad yes

RoxygenNote 7.1.2

Repository https://nano-optics.r-universe.dev

RemoteUrl https://github.com/nano-optics/mie

RemoteRef HEAD

RemoteSha 604c4f4d295aa32b0d6db1991a5c085e7ca95457

Contents

`mie-package` *Mie theory*

Description

Scattering of light by a spherical object

Author(s)

baptiste Auguie <baptiste.auguie@gmail.com>

References

Etchegoin, P. Le Ru, E., Principles of Surface-Enhanced Raman Spectroscopy, Elsevier, Amsterdam (2009). L. Novotny, E. Hecht, Principles of Nano-optics Cambridge University Press, 2006

See Also

Other user: `mie_approximation()`, `mie_bh()`, `mie_ml()`, `mie()`

`average_Mloc` *average_Mloc*

Description

Average Mloc

Usage

```
average_Mloc(wavelength, epsilon, radius, medium = 1, n_max = 10)
```

Arguments

`wavelength`	real vector
`epsilon`	complex vector
`radius`	scalar
`medium`	scalar, refractive index of surrounding medium
`n_max`	truncation order

Details

Enhancement factor averaged over the surface

Value

data.frame with wavelength and Mloc

Author(s)

Baptiste Auguie

`efficiencies` *efficiencies*

Description

Efficiencies

Usage

```
efficiencies(x, GD, mode = c("EM", "Magnetic", "Electric"), order = NULL)
```

Arguments

`x`	real vector, size parameter
`GD`	list with Gamma, Delta, A, B
`mode`	type of mode
`order`	order of multipoles

Details

Calculates the far-field efficiencies for plane-wave illumination

Value

matrix of Qext, Qsca, Qabs

Author(s)

Baptiste Auguie

mie *mie*

Description

Far-field cross-sections

Usage

```
mie(
  wavelength,
  epsilon,
  radius,
  medium = 1,
  n_max = ceiling(2 + max(x) + 4 * max(x)^(1/3)),
  efficiency = FALSE,
  mode = c("EM", "Magnetic", "Electric"),
  order = Inf
)
```

Arguments

wavelength	real vector
epsilon	complex vector
radius	scalar
medium	scalar, refractive index of surrounding medium
n_max	truncation order
efficiency	logical, scale by geometrical cross-sections
mode	type of mode
order	order of multipoles

Details

Homogeneous sphere illuminated by a plane wave

Value

data.frame

Author(s)

Baptiste Auguie

See Also

Other user: mie-package, mie_approximation(), mie_bh(), mie_ml()

Examples

```
gold <- epsAu(seq(400, 800))
cross_sections <- with(gold, mie(wavelength, epsilon, radius=50, medium=1.33, efficiency=FALSE))
matplot(cross_sections$wavelength, cross_sections[, -1], type="l", lty=1,
        xlab=expression(lambda/mu*m), ylab=expression(sigma/mu*m^2))
legend("topright", names(cross_sections)[-1], col=1:3, lty=1)
```

`mie_approximation` *mie_approximation*

Description

Analytical approximation

Usage

```
mie_approximation(
  radius,
  wavelength,
  epsilon,
  medium = 1.33,
  order = Inf,
  efficiency = FALSE,
  ...
)
```

Arguments

`radius`	scalar
`wavelength`	real vector
`epsilon`	complex vector
`medium`	scalar, refractive index of surrounding medium
`order`	truncation order
`efficiency`	logical, scale by geometrical cross-sections (unused)
`...`	unused

Details

Sphere illuminated by a plane wave

Value

data.frame

Author(s)

Baptiste Auguie

See Also

Other user: mie-package, mie_bh(), mie_ml(), mie()

---

mie_bh *mie_bh*

Description

Far-field cross-sections

Usage

```
mie_bh(
  wavelength,
  epsilon.core,
  epsilon.coating = medium^2,
  radius,
  thickness = 0,
  medium = 1,
  lmax = ceiling(2 + max(y) + 4 * max(y)^(1/3)),
  efficiency = TRUE
)
```

Arguments

wavelength	real vector
epsilon.core	complex vector
epsilon.coating	complex vector
radius	scalar
thickness	scalar
medium	scalar, refractive index of surrounding medium
lmax	truncation order (unused)
efficiency	logical, scale by geometrical cross-sections

Details

Coated sphere illuminated by a plane wave

Value

data.frame

Author(s)

Baptiste Auguie

See Also

Other user: mie-package, mie_approximation(), mie_ml(), mie()

Examples

```
gold <- epsAu(seq(400, 800))
coated <- with(gold, mie_bh(wavelength, epsilon, radius=50, medium=1.33,
efficiency=FALSE))
bare <- with(gold, mie(wavelength, epsilon, radius=50, medium=1.33,
efficiency=FALSE))
matplot(coated$wavelength, coated[, -1], type="l", lty=1,
        xlab=expression(lambda/nm), ylab=expression(sigma/nm^2))
matlines(bare$wavelength, bare[, -1], type="l", lty=2)
legend("topright", c(names(coated)[-1], "bare"), col=1:3, lty=c(1,1,1,2))
```

---

mie_ml *mie_ml*

Description

Far-field cross-sections

Usage

```
mie_ml(
  wavelength,
  epsilon,
  radii,
  n_max = 10,
  efficiency = FALSE,
  mode = c("EM", "Magnetic", "Electric"),
  order = Inf
)
```

Arguments

wavelength	real vector
epsilon	list of dielectric functions, from inner to outer medium
radii	concentric radii of each interface, from smaller to larger
n_max	truncation order
efficiency	logical, scale by geometrical cross-sections
mode	type of mode
order	order of multipoles

Details

Multilayered sphere illuminated by a plane wave

Value

data.frame

Author(s)

Baptiste Auguie

See Also

Other user: mie-package, mie_approximation(), mie_bh(), mie()

Examples

```
library(dielectric)
library(mie)
gold <- epsAg(seq(300, 800))
a <- 30
b <- 34
c <- 35

bare <- mie(gold$wavelength, gold$epsilon, radius=a, medium=1.33, efficiency=FALSE)

leps <- list(gold$epsilon, 1.33^2, 1.5^2, 1.33^2)
# leps <- list(1.5^2, gold$epsilon,  1.33^2)
la <- list(a,b,c)
coated <- mie_ml(gold$wavelength, leps, radii=la, efficiency=FALSE)

matplot(bare$wavelength, bare[, -1], type="l", lty=1,
        xlab=expression(lambda/mu*m), ylab=expression(sigma/mu*m^2))
matlines(coated$wavelength, coated[, -1],  type="l",  lty=2)

legend("topright", c(names(bare)[-1], "coated"), col=1:3, lty=c(1,1,1,2))
```

---

psi *psi*

Description

Riccati-Bessel function psi and its derivative

Usage

```
psi(rho, n_max)
```

Arguments

rho	complex vector, argument
n_max	integer, maximum order

Details

Obtained from BesselJ, converted to spherical Bessel, and scaled

Value

a list with psi_n and psi'_n

Author(s)

Baptiste Auguie

`susceptibilities` *susceptibilities*

Description

Generalised susceptibility for multilayer Mie theory

Usage

```
susceptibilities(ls, lx, n_max)
```

Arguments

`ls`	list of relative refractive index
`lx`	list of size parameters
`n_max`	integer, maximum order

Details

Corresponds to the usual coefficients a_n, b_n, c_n, d_n

Value

list with Gamma, Delta, A, B

Author(s)

Baptiste Auguie

susceptibility *susceptibility*

Description

Generalised susceptibility for the Mie theory

Usage

```
susceptibility(s, x, n_max)
```

Arguments

s	complex vector, relative refractive index
x	real vector, size parameter
n_max	integer, maximum order

Details

Corresponds to the usual coefficients a_n, b_n, c_n, d_n

Value

list with Gamma, Delta, A, B

Author(s)

Baptiste Auguie

xi *xi*

Description

Riccati-Bessel function xi and its derivative

Usage

```
xi(rho, n_max)
```

Arguments

rho	complex vector, argument
n_max	integer, maximum order

Details

Obtained from BesselH (Hankel function), converted to spherical Hankel, and scaled

Value

a list with psi_n and psi'_n

Author(s)

Baptiste Auguie

Index