Package ‘Carlson’

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Type Package

Title Carlson Elliptic Integrals and Incomplete Elliptic Integrals

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Description Evaluation of the Carlson elliptic integrals and the incomplete elliptic integrals with complex arguments. The implementations use Carlson's algorithms <doi:10.1007/BF02198293>. Applications of elliptic integrals include probability distributions, geometry, physics, mechanics, electrodynamics, statistical mechanics, astronomy, geodesy, geodesics on conics, and magnetic field calculations.

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URL https://github.com/stla/Carlson

BugReports https://github.com/stla/Carlson/issues

Imports Rcpp

LinkingTo Rcpp

Suggests gsl, testthat

Encoding UTF-8

RoxygenNote 7.2.3

NeedsCompilation yes

Repository CRAN

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R topics documented:

`Carlson_RC` *Carlson elliptic integral RC*

Description

Evaluate the Carlson elliptic integral RC.

Usage

```
Carlson_RC(x, y, minerror = 1e-15)
```

Arguments

`x, y`	real or complex numbers, with `y` different from `0`
`minerror`	bound on the relative error passed to `Carlson_RF`

Value

A complex number, the value of the Carlson elliptic integral $R_C(x, y)$.

Note

The function returns a value when `x` or `y` are negative real numbers, but this value is not the one of the Carlson integral.

Examples

```
Carlson_RC(5, 2)
gsl::ellint_RC(5, 2)
```

Carlson_RD *Carlson elliptic integral RD*

Description

Evaluate the Carlson elliptic integral RD.

Usage

```
Carlson_RD(x, y, z, minerror = 1e-15)
```

Arguments

x, y, z	real or complex numbers; at most one can be 0
minerror	bound on the relative error

Value

A complex number, the value of the Carlson elliptic integral $R_D(x, y, z)$.

Note

The function returns a value when x, y or z are negative real numbers, but this value is not the one of the Carlson integral.

Examples

```
Carlson_RD(5, 2, 3)
gsl::ellint_RD(5, 2, 3)
```

Carlson_RF *Carlson elliptic integral RF*

Description

Evaluate the Carlson elliptic integral RF.

Usage

```
Carlson_RF(x, y, z, minerror = 1e-15)
```

Arguments

x, y, z	real or complex numbers; at most one can be 0
minerror	bound on relative error

Value

A complex number, the value of the Carlson elliptic integral $R_F(x, y, z)$.

Note

The function returns a value when `x`, `y` or `z` are negative real numbers, but this value is not the one of the Carlson integral.

Examples

```
Carlson_RF(5, 2, 3)
gsl::ellint_RF(5, 2, 3)
```

`Carlson_RG` *Carlson elliptic integral RG*

Description

Evaluate the Carlson elliptic integral RG.

Usage

```
Carlson_RG(x, y, z, minerror = 1e-15)
```

Arguments

`x, y, z`	real or complex numbers; they can be zero
`minerror`	bound on the relative error passed to `Carlson_RF` and `Carlson_RD`

Value

A complex number, the value of the Carlson elliptic integral $R_G(x, y, z)$.

`Carlson_RJ` *Carlson elliptic integral RJ*

Description

Evaluate the Carlson elliptic integral RJ.

Usage

```
Carlson_RJ(x, y, z, p, minerror = 1e-15)
```

Arguments

`x, y, z, p`	real or complex numbers; at most one can be 0
`minerror`	bound on the relative error

Value

A complex number, the value of the Carlson elliptic integral $R_J(x, y, z, t)$.

Note

The function returns a value when `x`, `y`, `z` or `p` are negative real numbers, but this value is not the one of the Carlson integral.

Examples

```
Carlson_RJ(5, 2, 3, 4)
gsl::ellint_RJ(5, 2, 3, 4)
```

`elliptic_E` *Incomplete elliptic integral of the second kind*

Description

Evaluate the incomplete elliptic integral of the second kind.

Usage

```
elliptic_E(phi, m, minerror = 1e-15)
```

Arguments

`phi`	amplitude, real or complex number/vector
`m`	parameter, real or complex number/vector
`minerror`	the bound on the relative error passed to `Carlson_RF` and `Carlson_RD`

Value

A complex number or vector, the value(s) of the incomplete elliptic integral $E(\phi, m)$.

Examples

```
elliptic_E(1, 0.2)
gsl::ellint_E(1, sqrt(0.2))
```

elliptic_F — *Incomplete elliptic integral of the first kind*

Description

Evaluate the incomplete elliptic integral of the first kind.

Usage

```
elliptic_F(phi, m, minerror = 1e-15)
```

Arguments

phi	amplitude, real or complex number/vector
m	parameter, real or complex number/vectot
minerror	the bound on the relative error passed to Carlson_RF

Value

A complex number or vector, the value(s) of the incomplete elliptic integral $F(\phi, m)$.

Examples

```
elliptic_F(1, 0.2)
gsl::ellint_F(1, sqrt(0.2))
```

elliptic_PI — *Incomplete elliptic integral of the third kind*

Description

Evaluate the incomplete elliptic integral of the third kind.

Usage

```
elliptic_PI(phi, n, m, minerror = 1e-15)
```

Arguments

phi	amplitude, real or complex number/vector
n	characteristic, real or complex number/vector
m	parameter, real or complex number/vector
minerror	the bound on the relative error passed to Carlson_RF and Carlson_RJ

Value

A complex number or vector, the value(s) of the incomplete elliptic integral $\Pi(\phi, n, m)$.

Examples

```
elliptic_PI(1, 0.8, 0.2)
gsl::ellint_P(1, sqrt(0.2), -0.8)
```

`elliptic_Z` *Jacobi zeta function*

Description

Evaluate the Jacobi zeta function.

Usage

```
elliptic_Z(phi, m, minerror = 1e-15)
```

Arguments

`phi`	amplitude, real or complex number/vector
`m`	parameter, real or complex number/vector
`minerror`	bound on relative error passed to `elliptic_E` and `elliptic_F`

Value

A complex number or vector, the value(s) of the Jacobi zeta function $Z(\phi, m)$.

`Lambda0` *Heuman Lambda function*

Description

Evaluates the Heuman Lambda function.

Usage

```
Lambda0(phi, m, minerror = 1e-14)
```

Arguments

`phi`	Jacobi amplitude, a complex number/vector
`m`	parameter, a complex number/vector
`minerror`	the bound on the relative error passed to `elliptic_F` and `elliptic_Z`

Value

A complex number or vector.

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