

Package ‘catenary’

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Type Package

Title Fits a Catenary to Given Points

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Description Gives methods to create a catenary object and then plot it and get properties of it. Can construct from parameters or endpoints. Also can get catenary fitted to data.

License GPL-3

Depends R (>= 2.15.0),

Imports ggplot2, boot, methods, tidyverse, dplyr, broom

RoxygenNote 6.0.1

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

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R topics documented:

catenary	2
catenary-class	3
ctesiphon	3
fittedCatenary	4
fittedCatenary-class	4
gof	5
L	6
minmax	6
plot	7

show	7
vertex	8

Index	9
--------------	----------

catenary	<i>Creates a catenary object</i>
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Description

First constructor that takes $c1$, $c2$, λ , x_0 and x_1 Second constructor takes endpoints and either length or gives natural or maximum catenary (one that just touches the ground)

Contains methods to fit catenary to observed points, also can compare to parabola.

Usage

```
catenary(c1 = 1, c2 = 0, lambda = 0, x0 = -1, x1 = 1,
         endpoints = NULL, L = NULL, type = "natural")
```

Arguments

$c1$	shape parameter
$c2$	x-location parameter
λ	y-location parameter
x_0	left point
x_1	right point
endpoints	2 x 2 matrix or data frame with column x and y and rows left and right
L	length of catenary
type	max or natural if length not given

Value

an instance of catenary class

Author(s)

Jono Tuke, Matthew Roughan

Examples

```
cat1 <- catenary()
plot(cat1)
cat2 <- catenary(c1=1,c2=2,lambda=3,x0=0,x1=4)
plot(cat2)
x <- c(-1,1)
y <- c(2,2)
endpoints <- data.frame(x=x,y=y)
```

```
cat3 <- catenary(endpoints=endpoints,L=5)
plot(cat3)
cat4 <- catenary(endpoints=endpoints,type='natural')
plot(cat4)
cat5 <- catenary(endpoints=endpoints,type='max')
plot(cat5)
```

catenary-class *Create a class for catenary*

Description

Creates a basic catenary with endpoints

Value

an object of class catenary

Slots

c1 shape parameter
c2 x-location parameter
lambda y-location parameter
endpoints left and right endpoint in data frame
L length of catenary

Examples

```
getSlots("catenary")
```

ctesiphon *Coordinates of external and internal edge of the Ctesiphon*

Description

Using an image of the Ctesiphon, the x and y coordinates of the internal and external edge were recorded. The original image and the image with the points overlaid can be found in the inst folder

Format

A list with two data frames

Details

- internal dataframe with x and y point for internal part of arch
- external dataframe with x and y point for external part of arch

fittedCatenary *Creates a fittedCatenary object*

Description

Takes observed points and fits catenary and parabola

Usage

```
fittedCatenary(x, y, R = 1000)
```

Arguments

x	values of x coordinates of observed values
y	values of y coordinates of observed values
R	number of iterations in bootstrap for function envelopes

Value

an instance of fittedCatenary class

Author(s)

Jono Tuke, Matthew Roughan

Examples

```
x <- runif(100,0,4)
y <- f(x,c1=1,c2=2,lambda=3) + rnorm(100,sd=0.1)
tmp <- fittedCatenary(x,y)
```

fittedCatenary-class *Create a class for fittedCatenary*

Description

Creates a catenary object from observed data

Value

an object of class fittedCatenary

Slots

- c1: shape parameter
- c2: x-location parameter
- lambda: y-location parameter
- endpoints: left and right endpoint in data frame
- L: length of catenary
- obs: data frame of observed data
- fitted: fitted points for plots and prediction
- ss: sum of squares for fitted parabola and catenary

Author(s)

Jono Tuke, Matthew Roughan

Examples

```
getSlots("fittedCatenary")
```

gof

Get goodness of fit statistics for fitted catenary

Description

Returns data frame of summary stats for models

Arguments

x A fittedCatenary object

Value

data frame of summary statistics

L

Get length for catenary

Description

Returns the length of catenary

Arguments

x A catenary object

Value

length

Examples

```
tmp <- catenary(c1=1,c2=2,lambda=3,x0=0,x1=3)
L(tmp)
```

minmax

Method to get min and max of catenary

Description

Gives min or max

Arguments

object a catenary object

Value

gives min or max values of catenary

Examples

```
cat <- catenary(c1=1,c2=1,lambda=1)
minmax(cat)
```

plot	<i>Set generic plot</i>
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Description

Overload plot
 Generic plot
 Method that can plot fits and function envelopes

Arguments

x	x-coordinate
y	y-coordinate
...	extra
x	x-coordinate
y	y-coordinate
fit	type of fit to show at present two choices "cat" and "para"
envelope	type of envelope to show at present two choices "cat" and "para"

Author(s)

Jono Tuke, Matthew Roughan

Examples

```
tmp <- catenary(c1=1,c2=3,lambda=1,x0=0,x1=4)
plot(tmp)
```

show	<i>summary function</i>
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Description

gives pretty summary
 show method for fitted Catenary

Arguments

x	catenary object
...	extra
na.rm	boolean to remove NAs
object	fittedCatenary object

Author(s)

Jono Tuke, Matthew Roughan

vertex *Method to get vertex for catenary*

Description

Gives vertex point

Arguments

object a catenary object

Value

coordinates of vertex

Examples

```
cat <- catenary(c1=1,c2=1,lambda=1)
vertex(cat)
```


Index

*Topic **datasets**

ctesiphon, [3](#)

catenary, [2](#)

catenary-class, [3](#)

catenary-package (catenary), [2](#)

ctesiphon, [3](#)

fittedCatenary, [4](#)

fittedCatenary-class, [4](#)

gof, [5](#)

gof, fittedCatenary-method (gof), [5](#)

L, [6](#)

L, catenary-method (L), [6](#)

minmax, [6](#)

minmax, catenary-method (minmax), [6](#)

plot, [7](#)

plot, catenary-method (plot), [7](#)

plot, fittedCatenary-method (plot), [7](#)

show, [7](#)

show, catenary-method (show), [7](#)

show, fittedCatenary-method (show), [7](#)

vertex, [8](#)

vertex, catenary-method (vertex), [8](#)