# Package ‘VecStatGraphs2D’

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**Type** Package

**Title** Vector analysis using graphical and analytical methods in 2D.

**Version** 1.0

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**Depends** R (>= 2.10.1), MASS

**Description** A vector is defined by comparing the coordinates between the origin position and the ending position in a 2D or 3D reference system. A vector has two properties, module and azimuth. To deal properly with a set of vectors, we can analyze modules and azimuths. This package performs statistical analysis and graphics of modules and azimuths distributions. The azimuths are treated as circular data. The joint analysis of modules and azimuths by means of a density maps, is due to the limitation of circular statistics in analyzing vectors with non-unitary modules.



## R topics documented:

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`VecStatGraphs2D-package`

*Vector analysis using graphical and analytical methods in 2D.*

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## Description

A vector is defined by comparing the coordinates between the origin position and the ending position in a 2D or 3D reference system. A vector has two properties, module and azimuth. To deal properly with a set of vectors, we can analyze modules and azimuths. This package performs statistical analysis and graphics of modules and azimuths distributions. The azimuths are treated as circular data. The joint analysis of modules and azimuths by means of a density maps, is due to the limitation of circular statistics in analyzing vectors with non-unitary modules.

## Details

| | |
|---|---|
| Package: | VecStatGraphs2D |
| Type: | Package |
| Version: | 1.0 |
| Date: | 2010-05-25 |
| License: | GPL-3 |
| LazyLoad: | yes |

## Author(s)

Juan Carlos Ruiz Cuetos, Maria Eugenia Polo Garcia, Pablo Garcia Rodriguez.

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### References


Bachelet E. (1981) Circular statistics in biology. London. London Academic Press.

Dixon K. R., Chapman J. A. (1980) Harmonic mean measure of animal activity areas. Ecology 61, 1040-1044.

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Jammalamadaka S.R., Sengupta A. (2001) Topic in circular statistics. Singapore. World Scientific Publihing.

Mardia K.V. , Jupp, P.E. (2000) Directional statistics. Chichester. Wiley.

Russell G.S. , Levitin D.J. (1995) An expanded table of probability values for Rao´s spacing test. Communications in Statistics: Simulation and Computation, 24(4), 879-888.

`http://fegtepinta.byethost11.com/index.html`


### See Also

`AllAzimuthStatistics`, `AllModuleStatistics`, `DrawHistogram`, `DrawPoints`, `DrawModuleAndAzimuthDistribution`, `DrawDensityMap`, `DrawVectors`, `DrawDistribution`, `RaoTest`, `RayleighTest`, `ValuationOfUniformity`.

---

`AllAzimuthStatistics` *Calculation of All Statistics of the Azimuths*

---

### Description

This function calculates several circular data statistics from a set of input azimuths.

### Usage

```
AllAzimuthStatistics(azimuths)
```

### Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

### Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

The statistics calculated are: `Mean Azimuth, Mean Module, Circular Variance, Circular Standard Deviation, Circular Dispersal, Von Mises Parameter, Kurtosis Coefficient, Skewness Coefficient.`

### Value

The value All Azimuth Statistics of all input azimuths.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References


Bachelet E. (1981) Circular statistics in biology. London. London Academic Press.

Dixon K. R., Chapman J. A. (1980) Harmonic mean measure of animal activity areas. Ecology 61, 1040-1044.

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Jammalamadaka S.R., Sengupta A. (2001) Topic in circular statistics. Singapore. World Scientific Publihing.

Mardia K.V. , Jupp, P.E. (2000) Directional statistics. Chichester. Wiley.

Russell G.S. , Levitin D.J. (1995) An expanded table of probability values for Rao´s spacing test. Communications in Statistics: Simulation and Computation, 24(4), 879-888.

Website `http://fegtepinta.byethost11.com/`


## See Also

`MeanModule`, `MeanAzimuth`, `CircularVariance`, `CircularStandardDeviation`, `CircularDispersal`, `KurtosisAzimuthCoefficient`, `VonMisesParameter`, `SkewnessAzimuthCoe`

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
AllAzimuthStatistics(azimuths)
```

---

`AllModuleStatistics` *Calculation of All Statistics of the Modules.*

---

## Description

This function calculates several statistics from a set of input modules.

## Usage

```
AllModuleStatistics(modules)
```

## Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

## Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

The statistics calculated are: `Number Of Elements, Max Value, Min Value, Range, Module Sum, Mean Arithmetic, Standard Error, Standard Deviation Module, Variance Module, Variance Module Population, Standard Deviation Module Population, Skewness Module Coefficient, Kurtosis Module Coefficient.`

## Value

The value All Module Statistics of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Website http://fegtepinta.byethost11.com/

## See Also

NumberOfElements, MaxValue, MinValue, Range, ModuleSum, ArithmeticMean, StandardError, ModuleStandardDeviation, ModuleVariance, ModulePopulationVariance, ModulePopulationStandardDeviation, SkewnessModuleCoefficient, KurtosisModuleCoeffi

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
AllModuleStatistics(modules)
```

---

# ArithmeticMean *Calculation of Mean Arithmetic modules*

---

## Description

This function calculates the Arithmetic Mean of a set of modules

## Usage

```
ArithmeticMean(modules)
```

## Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

## Value

The arithmetic mean value of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Website http://fegtepinta.byethost11.com/

### See Also

NumberOfElements, MaxValue, MinValue, Range, ModuleSum, StandardError, ModuleStandardDev
ModuleVariance, ModulePopulationVariance, ModulePopulationStandardDeviation, SkewnessModuleCoefficient, KurtosisModuleCoefficient, AllModuleStatistics.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
ArithmeticMean(modules)
```

---

## CircularDispersal    *Calculation of the Circular Dispersal of the Azimuths*

---

### Description

This function calculates the Circular Dispersal from a set of input azimuths.

### Usage

```
CircularDispersal(azimuths)
```

### Arguments

| | |
|---|---|
| azimuths | Vector containing the values of the azimuths |

### Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

In the case of uniform distribution this value is infinite, and with values close to 0, a highly concentrated data distribution is expected.

### Value

The value ciruclar Dispersal of all input azimuths.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website http://fegtepinta.byethost11.com/

## See Also

MeanModule, MeanAzimuth, CircularVariance, CircularStandardDeviation, KurtosisAzimuthCoefficient, VonMisesParameter, SkewnessAzimuthCoefficient, AllAzimuthStatistics.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
CircularDispersal(azimuths)
```

---

# CircularStandardDeviation

*Calculation of the Circular Standard Deviation of the azimuths*

---

## Description

This function calculates the Circular Standard Deviation from a set of input azimuths.

## Usage

```
CircularStandardDeviation(azimuths)
```

## Arguments

| | |
|---|---|
| azimuths | Vector containing the values of the azimuths |

## Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

## Value

The value of the Circular Standard Deviation of all input azimuths.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website http://fegtepinta.byethost11.com/

## See Also

MeanModule, MeanAzimuth, CircularVariance, CircularDispersal, KurtosisAzimuthCoefficient, VonMisesParameter, SkewnessAzimuthCoefficient, AllAzimuthStatistics.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
CircularStandardDeviation(azimuths)
```

---

## CircularVariance — *Calculation of the Circular Variance of the azimuths*

---

### Description

This function calculates the Circular Variance from a set of input azimuths.

### Usage

```
CircularVariance(azimuths)
```

### Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

### Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

### Value

The value of the Circular Variance of all input azimuths. This value ranges between 0 and 1.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website http://fegtepinta.byethost11.com/

### See Also

`MeanModule`, `MeanAzimuth`, `CircularStandardDeviation`, `CircularDispersal`, `KurtosisAzimuthCoefficient`, `VonMisesParameter`, `SkewnessAzimuthCoefficient`, `AllAzimuthStatistics`.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
CircularVariance(azimuths)
```

DrawDensityMap *Graphic representation of a point Density Map*

## Description

The density map was built as follows: a) vectors are moved to a common origin without changing its azimuth and module, b) end position perform a point cloud of varying density that depends on the accumulation of vectors with similar properties, c) end positions are used for to calculate the "density map" as a surface with values depending on the end-position accumulation per area unit. The density map gives us information about the joint distribution of modules and azimuths and allows the detection of errors or outliers. Areas where there is a greater number of points (end position of the vectors) will have a deeper color (red), while the areas a lesser density will have a less intense color (white). The outliers can be calculated by the higher value of the Modules or the Harmonic Mean.

## Usage

```
DrawDensityMap(data_x, data_y)
DrawDensityMap(data_x, data_y, Div = 100)
DrawDensityMap(data_x, data_y, PaintPoint = TRUE, HarmonicMean = TRUE, PaintAxis
DrawDensityMap(data_x, data_y, PercentajeOutliers = 5, PaintPoint = TRUE, Div =
...
```

## Arguments

`data_x` Vector containing the values of the X coordinate

`data_y` Vector containing the values of the Y coordinate

`PercentajeOutliers`
Integer value that indicates the percentage of outliers. The default value is 5

`PaintPoint` Logical value, if PaintPoint=TRUE samples represented by points, if PaintPoint=FALSE samples not represented by points. The defaul is FALSE

`Div` IntegerValue that indicates the number of divisions that will have the density map. The default value is 250

`HarmonicMean` Logical value, if HarmonicMean=FALSE the module is used for the calculation of outliers, if HarmonicMean=TRUE the Harmonic Mean is used for the calculation of outliers. The default value is FALSE

`PaintAxis` Logical value, if PaintAxis=TRUE draw axis, if PaintAxis=FALSE draw not axis. The default value is FALSE

## Details

To create the density map, are used "Kernel descriptors", to perform these calculations is required the `MASS` package.

The parameter Div is very important because a very large value will cause the creation of the slow density map, and a very small value would create a ineffective density map.

One way to get a vector of X and Y coordinate from modules and azimuths of the origin position and end position (coordinates X, Y of the error), it is using the `LoadData` function.

## Value

This function returns no value, creates a graph that represents a density map of the input values.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Dixon K. R., Chapman J. A. (1980) Harmonic mean measure of animal activity areas. Ecology 61, 1040-1044.

Website http://fegtepinta.byethost11.com/

## See Also

DrawHistogram, DrawDistribution, DrawPoints, DrawModuleAndAzimuthDistribution, DrawVectors.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
X_coordinate<-dat[,3]
Y_coordinate<-dat[,4]
DrawDensityMap(X_coordinate, Y_coordinate, PaintPoint = TRUE, Div=200)
```

---

# DrawDistribution — *Graphic representation of the Distribution of the azimuths*

---

## Description

This function creates a graph that represents the azimuths distribution. Every azimuth is plotted as a blue point in a unit circle. The color red is representation of the Mean Azimuth that is in the center of the confidence interval

## Usage

```
DrawDistribution(azimuths)
DrawDistribution(azimuths, Direction = 2)
```

## Arguments

| | |
|---|---|
| azimuths | Vector containing the values of the azimuths |
| Direction | Integer value that indicates the direction of the data. Direction 1 = Mathematical direction (0 ° E anticlockwise), direction 2 = Topographical direction (0 ° N clockwise). The default value is 2 |

### Details

It is very important to work always with the same direction, because if the data are loaded in Topographical direction, and Graphic representation of the distribution in Mathematical direction, the resulting graph is wrong.

With this function you can see in detail where the largest and smallest concentrations of points are.

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

### Value

This function returns no value, creates a graph that represents the distribution of the input data.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Website http://fegtepinta.byethost11.com/

### See Also

`DrawHistogram`, `DrawPoints`, `DrawModuleAndAzimuthDistribution`, `DrawDensityMap`, `DrawVectors`.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
DrawDistribution(azimuths, Direction = 2)
```

---

## `DrawHistogram` *Graphic representation of the histogram of the azimuth distribution*

---

### Description

This function creates a graph, that represents a circumference divided in sectors of different radius. The radius represents the percentage of azimuth data which belongs to each sector. Each portion represents the azimuths that exist between the angles formed by the sides of the portion.

### Usage

```
DrawHistogram(azimuths)
DrawHistogram(azimuths, TamClasses = 20)
DrawHistogram(azimuths, TamClasses = 15, Direction = 2)
```

### Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |
| `TamClasses` | Integer value that represents the size of each portion. The default value is 15. |
| `Direction` | Integer value that indicates the direction of the data. Direction 1 = Mathematical direction (0 ° E anticlockwise), direction 2 = Topographical direction (0 ° N clockwise). The default value is 2 |

### Details

It is very important to work always with the same direction, because if the data are loaded in Topographical direction, and Graphic representation of the Histogram in Mathematical direction, the resulting graph is wrong.

This function allows seeing where the more concentrated points are.

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

### Value

This function returns no value, creates a graph that represents a circular histogram of the input data.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Website http://fegtepinta.byethost11.com/

### See Also

`DrawDistribution`, `DrawPoints`, `DrawModuleAndAzimuthDistribution`, `DrawDensityMap`, `DrawVectors`.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
DrawHistogram(azimuths, TamClasses=15)
```

---

## DrawModuleAndAzimuthDistribution

*Graphic representation of Module and Azimuth Distribution*

---

### Description

This function creates a graph, that allows us to check the angular and linear magnitudes simultaneously, also indicated the Mean Azimuth (red color).

### Usage

```
DrawModuleAndAzimuthDistribution(data_x, data_y)
DrawModuleAndAzimuthDistribution(data_x, data_y, Direction = 2)
```

### Arguments

| | |
|---|---|
| `data_x` | Vector containing the values of the X coordinate |
| `data_y` | Vector containing the values of the Y coordinate |
| `Direction` | Integer value that indicates the direction of the data. Direction 1 = Mathematical direction (0 ° E anticlockwise), direction 2 = Topographical direction (0 ° N clockwise). The default value is 2 |

### Details

The graph draws a line for each of the samples. The lines will have origin in (0,0) and end at coordinates (X, Y). The concentric circumferences allow us to identify linear magnitudes, and the legend of the angles allows to know the angular magnitudes value.

It is very important to work always with the same direction, because if the data are loaded in Topographical direction, and Graphic representation of the module and azimuth distribution in Mathematical direction, the resulting graph is wrong.

One way to get a vector of X and Y coordinate from modules and azimuths of the origin position and end position (coordinates X, Y of the error), it is using the `LoadData` function.

### Value

This function returns no value, creates a graph that represents module and azimuth distribution

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Website http://fegtepinta.byethost11.com/

### See Also

`DrawHistogram`, `DrawDistribution`, `DrawPoints`, `DrawDensityMap`, `DrawVectors`.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
X_coordinate<-dat[,3]
Y_coordinate<-dat[,4]
DrawModuleAndAzimuthDistribution(X_coordinate, Y_coordinate, Direction=2)
```

`DrawPoints` *Graphic representation of Points*

## Description

This function creates a graph, that represents one point for each sample in the final coordinates of each vector assuming that initials are at the origin (0,0), also shows a percentage of discordant points (red color), selected from the module or Harmonic Mean, called "outliers".

## Usage

```
DrawPoints(data_x, data_y)
DrawPoints(data_x, data_y, PercentajeOutliers = 3)
DrawPoints(data_x, data_y, HarmonicMean = TRUE)
DrawPoints(data_x, data_y, PercentajeOutliers = 3, HarmonicMean = TRUE)
DrawPoints(data_x, data_y, PercentajeOutliers = 5, HarmonicMean = FALSE)
...
```

## Arguments

| | |
|---|---|
| `data_x` | Vector containing the values of the X coordinate |
| `data_y` | Vector containing the values of the Y coordinate |
| `PercentajeOutliers` | Integer value that indicates the percentage of outliers. The default value is 5 |
| `HarmonicMean` | Logical value, if HarmonicMean=FALSE the module is used for the calculation of outliers, if HarmonicMean=TRUE the HarmonicMean is used for the calculation of outliers. The default value is FALSE |

## Details

All vectors are moved to a common origin (0,0) without changing its azimuth and module The graph represents the situation of the end nodes of the vectors.

One way to get a vector of X and Y coordinate from modules and azimuths of the origin position and end position (coordinates X, Y of the error), it is using the `LoadData` function.

## Value

This function returns no value, creates a graph that represents the end nodes of the vectors.

## Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

## References

Website `http://fegtepinta.byethost11.com/`

## See Also

`DrawHistogram`, `DrawDistribution`, `DrawModuleAndAzimuthDistribution`, `DrawDensityMap`, `DrawVectors`.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
X_coordinate<-dat[,3]
Y_coordinate<-dat[,4]
DrawPoints(X_coordinate, Y_coordinate, PercentajeOutliers=8)
```

---

## DrawVectors *Graphic representation of the Vectors*

---

### Description

This function creates a graph, which shows an arrow for each sample. The graph represents the situation of the origin and end nodes of the every vector. In order to represent this graph, the input data must be of the measured and real type (type=3).

### Usage

```
DrawVectors(measured_data_, real_data_)
```

### Arguments

| | |
|---|---|
| `measured_data_` | Matrix containing the coordinates measured |
| `real_data_` | Matrix containing the coordinates real |

### Details

The measured values and real values can not be calculated, must be introduced as input data, although it is advisable to use `LoadData` for obtain vector of X coordinate and Y coordinate and azimuths of measured values.

### Value

This function returns no value, creates a graph that represents the vectors of the input data.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Website http://fegtepinta.byethost11.com/

### See Also

`DrawHistogram`, `DrawDistribution`, `DrawPoints`, `DrawModuleAndAzimuthDistribution`, `DrawDensityMap`.

### Examples

```
FileName<-system.file("data/MeasuredRealData.txt", package="VecStat")
dat<-LoadData(FileName, Type=3, Direction=2)
measured_data_<-dat[,6:7]
real_data_<-dat[,8:9]
DrawVectors(measured_data_, real_data_)
```

---

## KurtosisAzimuthCoefficient

*Calculation of the Kurtosis Coefficient of the azimuths*

---

### Description

This function calculates the Kurtosis Coefficient from a set of the input azimuths.

### Usage

```
KurtosisAzimuthCoefficient(azimuths)
```

### Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

### Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

### Value

The value Kurtosis Coefficient of all input azimuths.

### Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

### References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press

Website http://fegtepinta.byethost11.com/

### See Also

`MeanModule`, `MeanAzimuth`, `CircularVariance`, `CircularStandardDeviation`, `CircularDispersal`, `VonMisesParameter`, `SkewnessAzimuthCoefficient`, `AllAzimuthStatisti`

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
KurtosisAzimuthCoefficient(azimuths)
```

KurtosisModuleCoefficient
*Calculation of the Kurtosis Coefficient of the modules*

## Description

This function calculates the Kurtosis coefficient, which characterizes the shape of the distribution from a set of input modules.

## Usage

```
KurtosisModuleCoefficient(modules)
```

## Arguments

| | |
|---|---|
| modules | Vector containing the values of the modules |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

The Kurtosis coefficient indicates how of sharp or flat is a distribution.

## Value

The value Kurtosis coefficient of all input modules

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Website http://fegtepinta.byethost11.com/

## See Also

NumberOfElements, MaxValue, MinValue, Range, ModuleSum, ArithmeticMean, StandardError, ModuleStandardDeviation, ModuleVariance, ModulePopulationVariance, ModulePopulationStandardDeviation, SkewnessModuleCoefficient, AllModuleStatistics.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
KurtosisModuleCoefficient(modules)
```

`LoadData` *Data loading and conversion of polar coordinates, rectangular coordinates, and measured and real coordinates*

## Description

This function reads data from a "txt" file containing data of coordinates. Data can be read as polar coordinates, rectangular coordinates or measured and real coordinates. This functions returns a matrix with all possible data conversions according to Mathematical direction (0 ° E anticlockwise) or Topographical direction (0 ° N clockwise).

## Usage

```
LoadData(FileName)
LoadData(FileName, Type=2)
LoadData(FileName, Type = 1, Direction = 2)
```

## Arguments

| | |
|---|---|
| `FileName` | File name to load data |
| `Type` | Integer value that indicates the type of data contained in the file. Type 1 = Rectangular, Type 2= Polar, Type 3 = Measured and Real |
| `Direction` | Integer value that indicates the direction of the data. Direction 1 = Mathematical direction (0 ° E anticlockwise), Direction 2 = Topographical direction (0 ° N clockwise) |

## Details

Input files must be in a certain format for the data type. By default the type is Rectangular with Topographical direction.

The rectangular type contains two columns, the first column is the X coordinate and the second column is the Y coordinate, and each row corresponds to one of the data. The X coordinate and Y coordinate are obtained from the difference of the coordinates measured coordinates with respect to the real coordinates.

The polar type contains two columns, the first column represents the module and the second column represents the azimuth, and each row corresponds to one of the data.

The measured and real type contains four columns, the first two columns represent the X and Y coordinates of the measured data and the last two columns represents the coordinates of the actual data, and each row corresponds to one of the data.

It is very important to choose the correct sense of direction, because the output data depend on this variable. The Mathematical direction chooses the origin of the degrees in the X coordinate axis, growing anticlockwise. The Topographical direction chooses the origin of the degrees in the Y coordinate axis, growing clockwise. Mathematical direction and Topographical direction follow sexagesimal angular system.

### Value

The function returns a nx9 matrix size , where n is the number of data. The column 1 represents the module,the column 2 represents the azimuth, the column 3 represents the X coordinate, the column 4 represents the Y coordinate, the column 5 represents the direction and type of input data, the column 6 and 7 represent the X and Y coordinates of the measured data, the column 8 and 9 represent the X and Y coordinates of the real data.

The columns 6,7,8 and 9 will only have value if the input data are of type 3 (measured and real).

### Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

### References

Website `http://fegtepinta.byethost11.com/`

### See Also

`DrawHistogram`, `DrawModuleAndAzimuthDistribution`, `DrawDensityMap`, `AllAzimuthStatistic`
`AllModuleStatistics`, `ValuationOfUniformity`.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
LoadData(FileName, Type=1, Direction=2)
```

---

## `MaxValue` *Calculation of the Maximum Value of the modules*

---

### Description

This function calculates the maximum value of a set of modules.

### Usage

```
MaxValue(modules)
```

### Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

### Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

### Value

The max value of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Website http://fegtepinta.byethost11.com/

## See Also

NumberOfElements, MinValue, Range, ModuleSum, ArithmeticMean, StandardError, ModuleStandardDeviation, ModuleVariance, ModulePopulationVariance, ModulePopulationS SkewnessModuleCoefficient, KurtosisModuleCoefficient, AllModuleStatistics.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
MaxValue(modules)
```

---

`MeanAzimuth` *Calculation of the Mean Azimuth of the azimuths*

---

## Description

This function calculates the Mean Azimuth a set of input azimuths.

## Usage

```
MeanAzimuth(azimuths)
```

## Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

## Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

## Value

The Value Mean Azimuth of all input azimuths. The value is expressed in sexagesimal.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website http://fegtepinta.byethost11.com/

## See Also

MeanModule, CircularVariance, CircularStandardDeviation, CircularDispersal, KurtosisAzimuthCoefficient, VonMisesParameter, SkewnessAzimuthCoefficient, AllAzimuthStatistics.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
MeanAzimuth(azimuths)
```

---

`MeanModule` *Calculation of the Mean Module of the azimuths*

---

## Description

This function calculates the Mean Module from a set of input azimuths.

## Usage

```
MeanModule(azimuths)
```

## Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

## Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

## Value

The value Mean module of all input azimuths.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website http://fegtepinta.byethost11.com/

### See Also

MeanAzimuth, CircularVariance, CircularStandardDeviation, CircularDispersal, KurtosisAzimuthCoefficient, VonMisesParameter, SkewnessAzimuthCoefficient, AllAzimuthStatistics.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
MeanModule(azimuths)
```

---

## MinValue — *Calculation of the Minimum Value of the modules*

---

### Description

This function calculates the minimum value of a set of modules.

### Usage

```
MinValue(modules)
```

### Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

### Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

### Value

The min value of all input modules.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Website http://fegtepinta.byethost11.com/

### See Also

NumberOfElements, MaxValue, Range, ModuleSum, ArithmeticMean, StandardError, ModuleStandardDeviation, ModuleVariance, ModulePopulationVariance, ModulePopulationS SkewnessModuleCoefficient, KurtosisModuleCoefficient, AllModuleStatistics.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
MinValue(modules)
```

---

## ModulePopulationStandardDeviation
*Calculation of the Population Standard Deviation of the modules*

---

### Description

This function calculates the population standard deviation of a set of input modules.

### Usage

```
ModulePopulationStandardDeviation(modules)
```

### Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

### Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

### Value

The population standard deviation of all input modules.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Website http://fegtepinta.byethost11.com/

### See Also

`NumberOfElements`, `MaxValue`, `MinValue`, `Range`, `ModuleSum`, `ArithmeticMean`, `StandardError`, `ModuleStandardDeviation`, `ModuleVariance`, `ModulePopulationVariance`, `SkewnessModuleCoefficient`, `KurtosisModuleCoefficient`, `AllModuleStatistics`.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
ModulePopulationStandardDeviation(modules)
```

---

`ModulePopulationVariance` *Calculation of the Population Variance of the modules*

---

## Description

This function calculates the population variance of a set of input modules.

## Usage

```
ModulePopulationVariance(modules)
```

## Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

## Value

The population variance of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Website `http://fegtepinta.byethost11.com/`

## See Also

`NumberOfElements`, `MaxValue`, `MinValue`, `Range`, `ModuleSum`, `ArithmeticMean`, `StandardError`, `ModuleStandardDeviation`, `ModuleVariance`, `ModulePopulationStandardDevi` `SkewnessModuleCoefficient`, `KurtosisModuleCoefficient`, `AllModuleStatistics`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
ModulePopulationVariance(modules)
```

---

ModuleStandardDeviation *Calculation of the Standard Deviation of the modules*

---

## Description

This function calculates the standard deviation of a set of input modules.

## Usage

```
ModuleStandardDeviation(modules)
```

## Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

## Value

The standard deviation of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

## References

Website `http://fegtepinta.byethost11.com/`

## See Also

`NumberOfElements`, `MaxValue`, `MinValue`, `Range`, `ModuleSum`, `ArithmeticMean`, `StandardError`, `ModuleVariance`, `ModulePopulationVariance`, `ModulePopulationStandardDev` `SkewnessModuleCoefficient`, `KurtosisModuleCoefficient`, `AllModuleStatistics`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
ModuleStandardDeviation(modules)
```

ModuleSum — *Calculation of the Sum of the Modules*

## Description

This function calculates the sum of all modules.

## Usage

```
ModuleSum(modules)
```

## Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the module |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

## Value

The sum of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Website http://fegtepinta.byethost11.com/

## See Also

`NumberOfElements`, `MaxValue`, `MinValue`, `Range`, `ArithmeticMean`, `StandardError`, `ModuleStandardDeviation`, `ModuleVariance`, `ModulePopulationVariance`, `ModulePopulationS` `SkewnessModuleCoefficient`, `KurtosisModuleCoefficient`, `AllModuleStatistics`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
ModuleSum(modules)
```

ModuleVariance *Calculation of the Variance of the modules*

## Description

This function calculates the variance of a set of input modules.

## Usage

```
ModuleVariance(modules)
```

## Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

## Value

The variance of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Website http://fegtepinta.byethost11.com/

## See Also

`NumberOfElements`, `MaxValue`, `MinValue`, `Range`, `ModuleSum`, `ArithmeticMean`, `StandardError`, `ModuleStandardDeviation`, `ModulePopulationVariance`, `ModulePopulationSt` `SkewnessModuleCoefficient`, `KurtosisModuleCoefficient`, `AllModuleStatistics`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
ModuleVariance(modules)
```

NumberOfElements *Calculation of the Number of Elements of the modules*

### Description

This function calculates the Number of Elements of a set of modules

### Usage

```
NumberOfElements(modules)
```

### Arguments

| | |
|---|---|
| modules | Vector containing the values of the modules |

### Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

### Value

The number of elements of all input modules.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Website http://fegtepinta.byethost11.com/

### See Also

MaxValue, MinValue, Range, ModuleSum, ArithmeticMean, StandardError, ModuleStandardDevi ModuleVariance, ModulePopulationVariance, ModulePopulationStandardDeviation, SkewnessModuleCoefficient, KurtosisModuleCoefficient, AllModuleStatistics.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
NumberOfElements(modules)
```

---

`Range` *Calculation of the Range of the modules*

---

## Description

This function calculates the Range (Difference between maximum and minimum value of the module) of a set of modules

## Usage

```
Range(modules)
```

## Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the module |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

## Value

The range value of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Website http://fegtepinta.byethost11.com/

## See Also

`NumberOfElements`, `MaxValue`, `MinValue`, `ModuleSum`, `ArithmeticMean`, `StandardError`, `ModuleStandardDeviation`, `ModuleVariance`, `ModulePopulationVariance`, `ModulePopulationS` `SkewnessModuleCoefficient`, `KurtosisModuleCoefficient`, `AllModuleStatistics`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
Range(modules)
```

RaoTest *Rao Test. Formal test of uniformity*

## Description

This function performs the Rao test of uniformity.

## Usage

```
RaoTest(azimuths)
RaoTest(azimuths, Alpha = 0.01)
```

## Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |
| `Alpha` | Value used to obtain the Rao Value of the Rao Table. The values can be 0.001, 0.005, 0.01, 0.05, 0.1, 0.5, 0.9. The default is 0.01. |

## Details

For a uniform distribution, the space between points should be about `360°/n`. If the space deviates much from this value, the probability that the data belong to a uniform distribution is reduced.

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

## Value

Returns the probability value, and indicates whether or not to accept the hypothesis of uniformity.

## Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

## References

Bachelet E. (1981) Circular statistics in biology. London. London Academic Press.

Jammalamadaka S.R., Sengupta A. (2001) Topic in circular statistics. Singapore. World Scientific Publihing.

Mardia K.V. , Jupp, P.E. (2000) Directional statistics. Chichester. Wiley.

Russell G.S. , Levitin D.J. (1995) An expanded table of probability values for Rao´s spacing test. Communications in Statistics: Simulation and Computation, 24(4), 879-888.

Website `http://fegtepinta.byethost11.com/`

## See Also

`ValuationOfUniformity`, `RayleighTest`.

### Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
RaoTest(azimuths, Alpha = 0.01)
```

---

`RayleighTest` *Rayleigh Test. Formal test of uniformity*

---

### Description

This function performs the Rayleigh test of uniformity.

### Usage

```
RayleighTest(azimuths)
```

### Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

### Details

This test detects a single modal direction in a sample of azimuths when the mean azimuth is unspecified. The hypothesis of uniformity is rejected if the mean module is very large. This test assumes that a larger mean module implies a more concentration around the mean, and therefore less probability that the data is uniformly distributed.

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

### Value

Returns the value of the probability of accepting the hypothesis of uniformity.

### Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

### References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website http://fegtepinta.byethost11.com/

### See Also

`ValuationOfUniformity`, `RaoTest`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
RayleighTest(azimuths)
```

---

`SkewnessAzimuthCoefficient` *Calculation of the Skewness Coefficient of the azimuths*

---

## Description

This function calculates the Skewness Coefficient from a set of input azimuths.

## Usage

```
SkewnessAzimuthCoefficient(azimuths)
```

## Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

## Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

## Value

The value Skewness Coefficient of all input azimuths.

## Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

## References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website `http://fegtepinta.byethost11.com/`

## See Also

`MeanModule`, `MeanAzimuth`, `CircularVariance`, `CircularStandardDeviation`, `CircularDispersal`, `KurtosisAzimuthCoefficient`, `VonMisesParameter`, `AllAzimuthStatisti`

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
SkewnessAzimuthCoefficient(azimuths)
```

---

`SkewnessModuleCoefficient` *Calculation of the Skewness Coefficient of the modules*

---

## Description

This function calculates the skewness coefficient and indicates the symmetry of the distribution from a set of input modules.

## Usage

```
SkewnessModuleCoefficient(modules)
```

## Arguments

| | |
|---|---|
| `modules` | Vector containing the values of the modules |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

The normal distribution is symmetric if the skewness is 0.

## Value

The value skewnwess coefficient of all input modules

## Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

## References

Website `http://fegtepinta.byethost11.com/`

## See Also

`NumberOfElements`, `MaxValue`, `MinValue`, `Range`, `ModuleSum`, `ArithmeticMean`, `StandardError`, `ModuleStandardDeviation`, `ModuleVariance`, `ModulePopulationVariance`, `ModulePopulationStandardDeviation`, `KurtosisModuleCoefficient`, `AllModuleStatistics`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
SkewnessModuleCoefficient(modules)
```

StandardError *Calculation of the Standard Error of the modules*

## Description

This function calculates the standard error of the arithmetic mean of a set of input modules.

## Usage

```
StandardError(modules)
```

## Arguments

| | |
|---|---|
| modules | Vector containing the values of the modules |

## Details

One way to get a set of modules from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the LoadData function.

## Value

The standard error of all input modules.

## Author(s)

Juan Carlos Ruiz Cuetos <bilba_t@hotmail.com>, Maria Eugenia Polo Garcia <mepolo@unex.es>, Pablo Garcia Rodriguez <pablogr@unex.es>

## References

Website http://fegtepinta.byethost11.com/

## See Also

NumberOfElements, MaxValue, MinValue, Range, ModuleSum, ArithmeticMean, ModuleStandardDeviation, ModuleVariance, ModulePopulationVariance, ModulePopulationS
SkewnessModuleCoefficient, KurtosisModuleCoefficient, AllModuleStatistics.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
modules<-dat[,1]
StandardError(modules)
```

`ValuationOfUniformity` *Graphical assessment of uniformity*

## Description

This function generates a graph that allows you to see quickly if the data distribution can be considered uniform or if it departs from the uniformity.

## Usage

```
ValuationOfUniformity(azimuths)
```

## Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

## Details

The graphic is created by placing in increasing order n pairs of points from the calculation of the linear order statistics of the azimuths.

If the data fit to the uniform distribution, the points should lie along 45º line passing through the origin.

The arbitrary choice of the origin of the azimuths may induces a misunderstanding in the interpretation. We can solve this problem adding the unit to each element of the pair of values of the first 20 percent of points, and subtracting the unit to each element of the pair of values of the last 20 percent.

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

## Value

This function returns no value. A graph is displayed to show if the hypothesis of uniform distribution can be accepted or rejected.

## Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

## References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website `http://fegtepinta.byethost11.com/`

## See Also

`RayleighTest`, `RaoTest`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
ValuationOfUniformity(azimuths)
```

---

# VonMisesParameter *Calculation of Von Mises concentration parameter of theazimuths*

---

## Description

This function calculates the Von Mises concentration parameter a set of input azimuths.

## Usage

```
VonMisesParameter(azimuths)
```

## Arguments

| | |
|---|---|
| `azimuths` | Vector containing the values of the azimuths |

## Details

One way to get a set of azimuths from X and Y coordinates of the origin position and end position (coordinates X, Y of the vector), it is using the `LoadData` function.

The Von Mises concentration parameter measures the departure of the distribution from the uniform distribution. If this parameter tends to 0, the distribution converges to the uniform distribution, if tend to infinity, the distribution is concentrated around the mean azimuth.

## Value

The Von Mises concentration parameter of all input azimuths.

## Author(s)

Juan Carlos Ruiz Cuetos `<bilba_t@hotmail.com>`, Maria Eugenia Polo Garcia `<mepolo@unex.es>`, Pablo Garcia Rodriguez `<pablogr@unex.es>`

## References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website `http://fegtepinta.byethost11.com/`

## See Also

`MeanModule`, `MeanAzimuth`, `CircularVariance`, `CircularStandardDeviation`, `CircularDispersal`, `KurtosisAzimuthCoefficient`, `SkewnessAzimuthCoefficient`, `AllAzimuthStatistics`.

## Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStat")
dat<-LoadData(FileName, Type=1, Direction=2)
azimuths<-dat[,2]
VonMisesParameter(azimuths)
```

# Index