

Package: r6qualitytools (via r-universe)

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Description A comprehensive suite of statistical tools for Quality Management, designed around the Define, Measure, Analyze, Improve, and Control (DMAIC) cycle used in Six Sigma methodology. Based on the discontinued CRAN package 'qualitytools', this package refactors its original design by incorporating 'R6' object-oriented programming for increased flexibility and performance. It replaces traditional graphics with modern, interactive visualizations using 'ggplot2' and 'plotly'. Built on 'tidyverse' principles, it simplifies data manipulation and visualization, offering an intuitive approach to quality science.

License GPL (>= 3)

URL <https://github.com/Fabianenc/r6qualitytools>

BugReports <https://github.com/Fabianenc/r6qualitytools/issues>

Imports dplyr, EnvStats, ggplot2, graphics, grid, gridExtra, MASS, methods, patchwork, plotly, R6, RColorBrewer, Rsolnp, scales, stats, tibble, tidyr, utils

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| | |
|-------|--|
| adSim | <i>adSim: Bootstrap-based Anderson-Darling Test for Univariate</i> |
|-------|--|

Description

Performs the Anderson-Darling test for univariate distributions with an option for bootstrap-based p-value determination. It also allows p-value determination using tabled critical values.

Usage

```
adSim(x, distribution = "normal", b = 10000)
```

Arguments

| | |
|--------------|---|
| x | A numeric vector. |
| distribution | A character string specifying the distribution to test. Recognized distributions include <code>`cauchy`</code> , <code>`exponential`</code> , <code>`gumbel`</code> , <code>`gamma`</code> , <code>`log-normal`</code> , <code>`lognormal`</code> , <code>`logistic`</code> , <code>`normal`</code> , and <code>`weibull`</code> . |
| b | A numeric value indicating the number of bootstraps to perform. Allowed values range from 1000 to 1,000,000. If b is set to NA, the Anderson-Darling test will be applied without simulation. Note that higher values of b can significantly increase computation time, potentially taking hours depending on the distribution, sample size, and computer system. |

Details

The function first estimates the parameters for the tested distribution, typically using Maximum-Likelihood Estimation (MLE) via the `FitDistr` function. For normal and log-normal distributions, parameters are estimated by the mean and standard deviation. Cauchy distribution parameters are fitted by the sums of the weighted order statistic when using tabled critical values. The Anderson-Darling statistic is then calculated based on these estimated parameters.

Parametric bootstrapping generates the distribution of the Anderson-Darling test statistic, which is used to determine the p-value. This simulation-based Anderson-Darling distribution and its corresponding critical values for selected quantiles can be printed. If simulation is not performed, a p-value is obtained from tabled critical values, although no exact expressions exist except for the log-normal, normal, and exponential distributions.

Value

A list containing the following components:

`distribution` The distribution for which the Anderson-Darling test was applied.

`parameter_estimation` The estimated parameters for the distribution.

`Anderson_Darling` The value of the Anderson-Darling test statistic.

`p_value` The corresponding p-value, either simulated or from tabled values.

`critical_values` The critical values corresponding to the 0.75, 0.90, 0.95, 0.975, and 0.99 quantiles, either simulated or from tables.

`simAD` The bootstrap-based Anderson-Darling distribution.

Examples

```
x <- rnorm(25, 32, 2)
adSim(x)
adSim(x, "logistic", 2000)
adSim(x, "cauchy", NA)
adSim(x, "exponential", 2000)
adSim(x, "gumbel", 2000)
```

aliasTable

aliasTable: Display an alias table

Description

This function generates an alias table for a factorial design object.

Usage

```
aliasTable(fdo, degree, print = TRUE)
```

Arguments

| | |
|--------|--|
| fdo | An object of class <code>facDesign.c</code> . |
| degree | Numeric value specifying the degree of interaction i.e. <code>degree=3</code> means up to threeway interactions. |
| print | If TRUE, the alias table will be printed. By default print is set to TRUE. |

Value

The function `aliasTable` returns a matrix indicating the aliased effects.

See Also

`fracDesign`, `fracChoose`

Examples

```
# Create a fractional factorial design
dfrac <- fracDesign(k = 3, gen = "C = AB")
# Display the alias table for the fractional factorial design
aliasTable(dfrac)
```

as.data.frame_facDesign

as.data.frame_facDesign: Coerce to a data.frame

Description

Converts an object of class `facDesign.c` into a data frame.

Usage

```
as.data.frame_facDesign(dfac)
```

Arguments

dfac An object of class `facDesign.c` that you want to convert to a data frame.

Value

The function `as.data.frame_facDesign` returns a data frame.

Examples

```
fdo <- fracDesign(k = 2, replicates = 3, centerCube = 4)
as.data.frame_facDesign(fdo)
```

| | |
|----------|---------------------------|
| blocking | <i>blocking: Blocking</i> |
|----------|---------------------------|

Description

Blocks a given factorial or response surface design.

Usage

```
blocking(fdo, blocks, random.seed, useTable = "rsm", gen)
```

Arguments

| | |
|-------------|--|
| fdo | An object of class facDesign.c . |
| blocks | Numeric value giving the number of blocks. |
| random.seed | Numeric value to generate repeatable results for randomization within blocks. |
| useTable | Character indicating which table to use. The following options will be accepted: <ul style="list-style-type: none">• <code>`rms`</code>: table from reference• <code>`calc`</code>: table calculated by package |
| gen | Giving the generator that will be used. |

Value

The function `blocking` returns an object of class [facDesign.c](#) with blocking structure.

See Also

[facDesign](#).

Examples

```
# Example 1
#Create a 2^3 full factorial design
fdo <- facDesign(k = 3)
# Apply blocking to the design with 2 blocks
blocking(fdo, 2)

# Example 2
#Create a response surface design for 3 factors
fdo <- rsmDesign(k = 3)
# Apply blocking to the design with 3 blocks (1 block for star part and 2 blocks for the cube part)
blocking(fdo, 3)
```

cg *cg: Function to calculate and visualize the gage capability.*

Description

Function visualize the given values of measurement in a run chart and in a histogram. Furthermore the centralized Gage potential index Cg and the non-centralized Gage Capability index Cgk are calculated and displayed.

Usage

```
cg(
  x,
  target,
  tolerance,
  ref.interval,
  facCg,
  facCgk,
  n = 0.2,
  col,
  pch,
  xlim,
  ylim,
  conf.level = 0.95
)
```

Arguments

| | |
|--------------|--|
| x | A vector containing the measured values. |
| target | A numeric value giving the expected target value for the x-values. |
| tolerance | Vector of length 2 giving the lower and upper specification limits. |
| ref.interval | Numeric value giving the confidence interval on which the calculation is based. By default it is based on 6 sigma methodology. Regarding the normal distribution this relates to $\text{pnorm}(3) - \text{pnorm}(-3)$ which is exactly 99.73002 percent. If the calculation is based on another sigma value ref.interval needs to be adjusted. To give an example: If the sigma-level is given by 5.15 the ref.interval relates to $\text{pnorm}(5.15/2) - \text{pnorm}(-5.15/2)$ which is exactly 0.989976 percent. |
| facCg | Numeric value as a factor for the calculation of the gage potential index. The default value for facCg is 0.2. |
| facCgk | Numeric value as a factor for the calculation of the gage capability index. The default value for facCgk is 0.1. |
| n | Numeric value between 0 and 1 giving the percentage of the tolerance field (values between the upper and lower specification limits given by tolerance) where the values of x should be positioned. Limit lines will be drawn. Default value is 0.2. |

| | |
|------------|---|
| col | Character or numeric value specifying the color of the curve in the run chart. Default is <code>~black~</code> . |
| pch | Numeric or character specifying the plotting symbol. Default is 19 (filled circle). |
| xlim | Numeric vector of length 2 specifying the limits for the x-axis. Default is NULL which means the limits are set automatically. |
| ylim | Numeric vector of length 2 specifying the limits for the y-axis. Default is NULL which means the limits are set automatically. |
| conf.level | Confidence level for internal <code>t.test</code> checking the significance of the bias between <code>target</code> and mean of <code>x</code> . The default value is 0.95. The result of the <code>t.test</code> is shown in the histogram on the left side. |

Details

The calculation of the potential and actual gage capability are based on the following formula:

- $C_g = (\text{facCg} * \text{tolerance}[2] - \text{tolerance}[1]) / \text{ref.interval}$
- $C_{gk} = (\text{facCgk} * \text{abs}(\text{target} - \text{mean}(x)) / (\text{ref.interval} / 2)$

If the usage of the historical process variation is preferred the values for the tolerance tolerance must be adjusted manually. That means in case of the 6 sigma methodology for example, that `tolerance = 6 * sigma[process]`.

Value

The function `cg` returns a list of numeric values. The first element contains the calculated centralized gage potential index `Cg` and the second contains the non-centralized gage capability index `Cgk`.

See Also

[cg_RunChart](#), [cg_HistChart](#), [cg_ToleranceChart](#).

Examples

```
x <- c(9.991, 10.013, 10.001, 10.007, 10.010, 10.013, 10.008, 9.992,
      10.017, 10.005, 10.005, 10.002, 10.017, 10.005, 10.002, 9.996,
      10.011, 10.009, 10.006, 10.008, 10.003, 10.002, 10.006, 10.010, 10.013)

cg(x = x, target = 10.003, tolerance = c(9.903, 10.103))
```

cg_HistChart

cg_HistChart

Description

Function visualize the given values of measurement in a histogram

Usage

```
cg_HistChart(
  x,
  target,
  tolerance,
  ref.interval,
  facCg,
  facCgk,
  n = 0.2,
  col,
  xlim,
  ylim,
  main,
  conf.level = 0.95,
  cgOut = TRUE
)
```

Arguments

| | |
|--------------|--|
| x | A vector containing the measured values. |
| target | A numeric value giving the expected target value for the x-values. |
| tolerance | Vector of length 2 giving the lower and upper specification limits. |
| ref.interval | Numeric value giving the confidence interval on which the calculation is based. By default it is based on 6 sigma methodology. Regarding the normal distribution this relates to $\text{pnorm}(3) - \text{pnorm}(-3)$ which is exactly 99.73002 percent. If the calculation is based on another sigma value ref.interval needs to be adjusted. To give an example: If the sigma-level is given by 5.15 the ref.interval relates to $\text{pnorm}(5.15/2) - \text{pnorm}(-5.15/2)$ which is exactly 0.989976 percent. |
| facCg | Numeric value as a factor for the calculation of the gage potential index. The default Value for facCg is 0.2. |
| facCgk | Numeric value as a factor for the calculation of the gage capability index. The default value for facCgk is 0.1. |
| n | Numeric value between 0 and 1 giving the percentage of the tolerance field (values between the upper and lower specification limits given by tolerance) where the values of x should be positioned. Limit lines will be drawn. Default value is 0.2. |
| col | Character or numeric value specifying the color of the histogram. Default is `black`. |
| xlim | Numeric vector of length 2 specifying the limits for the x-axis. Default is NULL which means the limits are set automatically. |
| ylim | Numeric vector of length 2 specifying the limits for the y-axis. Default is NULL which means the limits are set automatically. |
| main | Character string specifying the title of the plot. Default is `Histogram of x - target`. |

| | |
|------------|---|
| conf.level | Confidence level for internal t.test checking the significance of the bias between target and mean of x. The default value is 0.95. |
| cgOut | Logical value deciding whether the Cg and Cgk values should be plotted in a legend. Default is TRUE. |

Details

The calculation of the potential and actual gage capability are based on the following formulae:

- $Cg = (\text{facCg} * \text{tolerance}[2] - \text{tolerance}[1]) / \text{ref.interval}$
- $Cgk = (\text{facCgk} * \text{abs}(\text{target} - \text{mean}(x)) / (\text{ref.interval} / 2)$

If the usage of the historical process variation is preferred the values for the tolerance tolerance must be adjusted manually. That means in case of the 6 sigma methodology for example, that $\text{tolerance} = 6 * \text{sigma}[\text{process}]$.

Value

The function `cg_HistChart` returns a list of numeric values. The first element contains the calculated centralized gage potential index Cg and the second contains the non-centralized gage capability index Cgk.

See Also

[cg_RunChart](#), [cg_ToleranceChart](#), [cg](#)

Examples

```
x <- c(9.991, 10.013, 10.001, 10.007, 10.010, 10.013, 10.008, 9.992,
      10.017, 10.005, 10.005, 10.002, 10.017, 10.005, 10.002, 9.996,
      10.011, 10.009, 10.006, 10.008, 10.003, 10.002, 10.006, 10.010, 10.013)

cg_HistChart(x = x, target = 10.003, tolerance = c(9.903, 10.103))
```

cg_RunChart

cg_RunChart

Description

Function visualize the given values of measurement in a Run Chart

Usage

```
cg_RunChart(
  x,
  target,
  tolerance,
  ref.interval,
  facCg,
  facCgk,
  n = 0.2,
  col = "black",
  pch = 19,
  xlim = NULL,
  ylim = NULL,
  main = "Run Chart",
  conf.level = 0.95,
  cgOut = TRUE
)
```

Arguments

| | |
|--------------|--|
| x | A vector containing the measured values. |
| target | A numeric value giving the expected target value for the x-values. |
| tolerance | Vector of length 2 giving the lower and upper specification limits. |
| ref.interval | Numeric value giving the confidence interval on which the calculation is based. By default it is based on 6 sigma methodology. Regarding the normal distribution this relates to $\text{pnorm}(3) - \text{pnorm}(-3)$ which is exactly 99.73002 percent. If the calculation is based on another sigma value ref.interval needs to be adjusted. To give an example: If the sigma-level is given by 5.15 the ref.interval relates to $\text{pnorm}(5.15/2) - \text{pnorm}(-5.15/2)$ which is exactly 0.989976 percent. |
| facCg | Numeric value as a factor for the calculation of the gage potential index. The default Value for facCg is 0.2. |
| facCgk | Numeric value as a factor for the calculation of the gage capability index. The default value for facCgk is 0.1. |
| n | Numeric value between 0 and 1 giving the percentage of the tolerance field (values between the upper and lower specification limits given by tolerance) where the values of x should be positioned. Limit lines will be drawn. Default value is 0.2. |
| col | Character or numeric value specifying the color of the curve in the run chart. Default is `black`. |
| pch | Numeric or character specifying the plotting symbol. Default is 19 (filled circle). |
| xlim | Numeric vector of length 2 specifying the limits for the x-axis. Default is NULL which means the limits are set automatically. |
| ylim | Numeric vector of length 2 specifying the limits for the y-axis. Default is NULL which means the limits are set automatically. |

| | |
|------------|--|
| main | Character string specifying the title of the plot. Default is `Run Chart`. |
| conf.level | Confidence level for internal t.test checking the significance of the bias between target and mean of x. The default value is 0.95. The result of the t.test is shown in the histogram on the left side. |
| cgOut | Logical value deciding whether the Cg and Cgk values should be plotted in a legend. Default is TRUE. |

Details

The calculation of the potential and actual gage capability are based on the following formulae:

- $Cg = (\text{facCg} * \text{tolerance}[2] - \text{tolerance}[1]) / \text{ref.interval}$
- $Cgk = (\text{facCgk} * \text{abs}(\text{target} - \text{mean}(x)) / (\text{ref.interval} / 2)$

If the usage of the historical process variation is preferred the values for the tolerance tolerance must be adjusted manually. That means in case of the 6 sigma methodology for example, that $\text{tolerance} = 6 * \text{sigma}[\text{process}]$.

Value

The function `cg_RunChart` returns a list of numeric values. The first element contains the calculated centralized gage potential index Cg and the second contains the non-centralized gage capability index Cgk.

See Also

[cg_HistChart](#), [cg_ToleranceChart](#), [cg](#)

Examples

```
x <- c(9.991, 10.013, 10.001, 10.007, 10.010, 10.013, 10.008, 9.992,
      10.017, 10.005, 10.005, 10.002, 10.017, 10.005, 10.002, 9.996,
      10.011, 10.009, 10.006, 10.008, 10.003, 10.002, 10.006, 10.010, 10.013)

cg_RunChart(x = x, target = 10.003, tolerance = c(9.903, 10.103))
```

cg_ToleranceChart *cg_ToleranceChart*

Description

Function visualize the given values of measurement in a Tolerance View.

Usage

```
cg_ToleranceChart(
  x,
  target,
  tolerance,
  ref.interval,
  facCg,
  facCgk,
  n = 0.2,
  col,
  pch,
  xlim,
  ylim,
  main,
  conf.level = 0.95,
  cgOut = TRUE
)
```

Arguments

| | |
|--------------|--|
| x | A vector containing the measured values. |
| target | A numeric value giving the expected target value for the x-values. |
| tolerance | Vector of length 2 giving the lower and upper specification limits. |
| ref.interval | Numeric value giving the confidence interval on which the calculation is based. By default it is based on 6 sigma methodology. Regarding the normal distribution this relates to $\text{pnorm}(3) - \text{pnorm}(-3)$ which is exactly 99.73002 percent. If the calculation is based on another sigma value <code>ref.interval</code> needs to be adjusted. To give an example: If the sigma-level is given by 5.15 the <code>ref.interval</code> relates to $\text{pnorm}(5.15/2) - \text{pnorm}(-5.15/2)$ which is exactly 0.989976 percent. |
| facCg | Numeric value as a factor for the calculation of the gage potential index. The default value for <code>facCg</code> is 0.2. |
| facCgk | Numeric value as a factor for the calculation of the gage capability index. The default value for <code>facCgk</code> is 0.1. |
| n | Numeric value between 0 and 1 giving the percentage of the tolerance field (values between the upper and lower specification limits given by <code>tolerance</code>) where the values of <code>x</code> should be positioned. Limit lines will be drawn. Default value is 0.2. |
| col | Character or numeric value specifying the color of the line and points in the tolerance view. Default is <code>`black`</code> . |
| pch | Numeric or character specifying the plotting symbol. Default is 19 (filled circle). |
| xlim | Numeric vector of length 2 specifying the limits for the x-axis. Default is NULL which means the limits are set automatically. |
| ylim | Numeric vector of length 2 specifying the limits for the y-axis. Default is NULL which means the limits are set automatically. |

| | |
|------------|---|
| main | Character string specifying the title of the plot. Default is <code>`Tolerance View`</code> . |
| conf.level | Confidence level for internal t.test checking the significance of the bias between target and mean of x. The default value is 0.95. |
| cgOut | Logical value deciding whether the Cg and Cgk values should be plotted in a legend. Default is TRUE. |

Details

The calculation of the potential and actual gage capability are based on the following formulae:

- $C_g = (\text{facCg} * \text{tolerance}[2] - \text{tolerance}[1]) / \text{ref.interval}$
- $C_{gk} = (\text{facCgk} * \text{abs}(\text{target} - \text{mean}(x)) / (\text{ref.interval} / 2))$

If the usage of the historical process variation is preferred the values for the tolerance tolerance must be adjusted manually. That means in case of the 6 sigma methodology for example, that $\text{tolerance} = 6 * \text{sigma}[\text{process}]$.

Value

The function `cg_ToleranceChart` returns a list of numeric values. The first element contains the calculated centralized gage potential index Cg and the second contains the non-centralized gage capability index Cgk.

See Also

[cg_RunChart](#), [cg_HistChart](#), [cg](#)

Examples

```
x <- c(9.991, 10.013, 10.001, 10.007, 10.010, 10.013, 10.008, 9.992,
      10.017, 10.005, 10.005, 10.002, 10.017, 10.005, 10.002, 9.996,
      10.011, 10.009, 10.006, 10.008, 10.003, 10.002, 10.006, 10.010, 10.013)

cg_ToleranceChart(x = x, target = 10.003, tolerance = c(9.903, 10.103))
```

code2real

code2real: Coding

Description

Function to calculate the real value of a coded value.

Usage

```
code2real(low, high, codedValue)
```

Arguments

| | |
|------------|---|
| low | Numeric value giving the lower boundary. |
| high | Numeric value giving the higher boundary. |
| codedValue | Numeric value giving the coded value that will be calculated. |

Value

The function return a real value of a coded value

Examples

```
code2real(160, 200, 0)
```

| | |
|-----------|--------------------------------------|
| confounds | <i>confounds: Confounded Effects</i> |
|-----------|--------------------------------------|

Description

Function to display confounded effects of a fractional factorial design in a human readable way.

Usage

```
confounds(x, depth = 2)
```

Arguments

| | |
|-------|---|
| x | An object of class <code>facDesign.c</code> . |
| depth | numeric value - up to depth-way confounded interactions are printed |

Value

The function returns a summary of the factors confounded.

Examples

```
vp.frac = fracDesign(k = 4, gen = "D=ABC")
confounds(vp.frac, depth=5)
```

`contourPlot`*contourPlot: Contour Plot*

Description

Creates a contour diagram for an object of class `facDesign.c`.

Usage

```
contourPlot(  
  x,  
  y,  
  z,  
  data = NULL,  
  xlim,  
  ylim,  
  main,  
  xlab,  
  ylab,  
  form = "fit",  
  col = 1,  
  steps,  
  fun,  
  plot = TRUE,  
  show.scale = TRUE  
)
```

Arguments

| | |
|-------------------|--|
| <code>x</code> | Name providing the Factor A for the plot. |
| <code>y</code> | Name providing the Factor B for the plot. |
| <code>z</code> | Name giving the Response variable. |
| <code>data</code> | Needs to be an object of class <code>facDesign.c</code> and contains the names of <code>x</code> , <code>y</code> , <code>z</code> . |
| <code>xlim</code> | Vector giving the range of the x-axis. |
| <code>ylim</code> | Vector giving the range of the y-axis. |
| <code>main</code> | Character string: title of the plot. |
| <code>xlab</code> | Character string: label for the x-axis. |
| <code>ylab</code> | Character string: label for the y-axis. |
| <code>form</code> | A character string or a formula with the syntax ' <code>y~ x+y + x*y</code> '. If form is a character it has to be one out of the following: <ul style="list-style-type: none">• <code>`quadratic`</code>• <code>`full`</code>• <code>`interaction`</code> |

| | |
|-------------------------|---|
| | <ul style="list-style-type: none"> • <code>`linear`</code> • <code>`fit`</code> |
| | <code>`fit`</code> takes the formula from the fit in the <code>facDesign.c</code> object <code>fdo</code> . Quadratic or higher orders should be given as <code>I(Variable^2)</code> . By default form is set as <code>`fit`</code> . |
| <code>col</code> | A predefined (1, 2, 3 or 4) or self defined <code>colorRampPalette</code> or color to be used (i.e. <code>`red`</code>). |
| <code>steps</code> | Number of grid points per factor. By default <code>steps = 25</code> . |
| <code>fun</code> | Function to be applied to <code>z</code> desirability. |
| <code>plot</code> | Logical value indicating whether to display the plot. Default is <code>TRUE</code> . |
| <code>show.scale</code> | Logical value indicating whether to display the color scale on the plot. Default is <code>TRUE</code> . |

Value

The function `contourPlot` returns an invisible list containing:

- `x` - locations of grid lines for `x` at which the values in `z` are measured.
- `y` - locations of grid lines for `y` at which the values in `z` are measured.
- `z` - a matrix containing the values of `z` to be plotted.
- `plot` - The generated plot.

See Also

[wirePlot](#), [paretoChart](#)

Examples

```
fdo = rsmDesign(k = 3, blocks = 2)
fdo$.response(data.frame(y = rnorm(fdo$nrow()))))

#I - display linear fit
contourPlot(A,B,y, data = fdo, form = "linear")
#II - display full fit (i.e. effect, interactions and quadratic effects
contourPlot(A,B,y, data = fdo, form = "full")
#III - display a fit specified before
fdo$set.fits(fdo$lm(y ~ B + I(A^2)))
contourPlot(A,B,y, data = fdo, form = "fit")
#IV - display a fit given directly
contourPlot(A,B,y, data = fdo, form = "y ~ A*B + I(A^2)")
#V - display a fit using a different colorRamp
contourPlot(A,B,y, data = fdo, form = "full", col = 2)
#VI - display a fit using a self defined colorRamp
myColour = colorRampPalette(c("green", "gray", "blue"))
contourPlot(A,B,y, data = fdo, form = "full", col = myColour)
```

`contourPlot3`*contourPlot3: Ternary plot*

Description

This function creates a ternary plot (contour plot) for mixture designs (i.e. object of class `mixDesign`).

Usage

```
contourPlot3(  
  x,  
  y,  
  z,  
  response,  
  data = NULL,  
  main,  
  xlab,  
  ylab,  
  zlab,  
  form = "linear",  
  col = 1,  
  col.text,  
  axes = TRUE,  
  steps,  
  plot = TRUE,  
  show.scale = TRUE  
)
```

Arguments

| | |
|-----------------------|---|
| <code>x</code> | Factor 1 of the <code>mixDesign</code> object. |
| <code>y</code> | Factor 2 of the <code>mixDesign</code> object. |
| <code>z</code> | Factor 3 of the <code>mixDesign</code> object. |
| <code>response</code> | the response of the <code>mixDesign</code> object. |
| <code>data</code> | The <code>mixDesign</code> object from which <code>x,y,z</code> and the response are taken. |
| <code>main</code> | Character string specifying the main title of the plot. |
| <code>xlab</code> | Character string specifying the label for the x-axis. |
| <code>ylab</code> | Character string specifying the label for the y-axis. |
| <code>zlab</code> | Character string specifying the label for the z-axis. |
| <code>form</code> | A character string or a formula with the syntax ' <code>y ~ A + B + C</code> '. If <code>form</code> is a character string, it has to be one of the following: <ul style="list-style-type: none">• '<code>linear</code>'• '<code>quadratic</code>' |

| | |
|------------|--|
| | How the form influences the output is described in the reference listed below. By default, form is set to 'linear'. |
| col | A predefined value (1, 2, 3, or 4) or a self-defined colorRampPalette specifying the colors to be used in the plot. |
| col.text | A character string specifying the color of the axis labels. The default value col.text is '1'. |
| axes | A logical value specifying whether the axes should be plotted. By default, axes is set to TRUE. |
| steps | A numeric value specifying the resolution of the plot, i.e., the number of rows for the square matrix, which also represents the number of grid points per factor. By default, steps is set to 25. |
| plot | Logical value indicating whether to display the plot. Default is TRUE. |
| show.scale | Logical value indicating whether to display the color scale on the plot. Default is TRUE. |

Value

The function contourPlot3 returns an invisible list containing:

- mat - A matrix containing the response values as NA's and numerics.
- plot - The generated plot.

See Also

[mixDesign.c](#), [mixDesign](#), [wirePlot3](#).

Examples

```
mdo = mixDesign(3,2, center = FALSE, axial = FALSE, randomize = FALSE,
               replicates = c(1,1,2,3))
mdo$names(c("polyethylene", "polystyrene", "polypropylene"))
mdo$units("percent")
elongation = c(11.0, 12.4, 15.0, 14.8, 16.1, 17.7, 16.4, 16.6, 8.8, 10.0, 10.0,
               9.7, 11.8, 16.8, 16.0)
mdo$response(elongation)
contourPlot3(A, B, C, elongation, data = mdo, form = "linear")
contourPlot3(A, B, C, elongation, data = mdo, form = "quadratic", col = 2)
contourPlot3(A, B, C, elongation, data = mdo,
             form = "elongation ~ I(A^2) - B:A + I(C^2)",
             col = 3, axes = FALSE)
contourPlot3(A, B, C, elongation, data = mdo,
             form = "quadratic",
             col = c("yellow", "white", "red"),
             axes = FALSE)
```

desirability *desirability: Desirability Function.*

Description

Creates desirability functions for use in the optimization of multiple responses.

Usage

```
desirability(
  response,
  low,
  high,
  target = "max",
  scale = c(1, 1),
  importance = 1
)
```

Arguments

| | |
|------------|---|
| response | Name of the response. |
| low | Lowest acceptable value for the response. |
| high | Highest acceptable value for the response. |
| target | Desired target value of the response. target can be `max`, `min`, or any specific numeric value. |
| scale | Numeric value giving the scaling factors for one and two-sided transformations. Default is c(1, 1). |
| importance | A value ranging from 0.1 to 10, used to calculate a weighted importance, i.e., with importances 1, 2, and 4, $D = [(d1)^1, (d2)^2, (d3)^4]^{(1/7)}$. Default is '1'. |

Details

For a product to be developed, different values of responses are desired, leading to multiple response optimization. Minimization, maximization, as well as a specific target value, are defined using desirability functions. A desirability function transforms the values of a response into [0,1], where 0 stands for a non-acceptable value of the response and 1 for values where higher/lower (depending on the direction of the optimization) values of the response have little merit. This function builds upon the desirability functions specified by Harrington (1965) and the modifications by Derringer and Suich (1980) and Derringer (1994). Castillo, Montgomery, and McCarville (1996) further extended these functions, but these extensions are not implemented in this version.

Value

This function returns a [desirability.c](#) object.

See Also[overall](#), [optimum](#)**Examples**

```
# Example 1: Maximization of a response
# Define a desirability for response y where higher values of y are better
# as long as the response is smaller than high
d = desirability(y, low = 6, high = 18, target = "max")
# Show and plot the desirability function
d
plot(d)

# Example 2: Minimization of a response including a scaling factor
# Define a desirability for response y where lower values of y are better
# as long as the response is higher than low
d = desirability(y, low = 6, high = 18, scale = c(2), target = "min")
# Show and plot the desirability function
d
plot(d)

# Example 3: Specific target of a response is best including a scaling factor
# Define a desirability for response y where desired value is at 8 and
# values lower than 6 as well as values higher than 18 are not acceptable
d = desirability(y, low = 6, high = 18, scale = c(0.5, 2), target = 12)
# Show and plot the desirability function
d
plot(d)

# Example 4:
y1 <- c(102, 120, 117, 198, 103, 132, 132, 139, 102, 154, 96, 163, 116, 153,
        133, 133, 140, 142, 145, 142)
y2 <- c(470, 410, 570, 240, 640, 270, 410, 380, 590, 260, 520, 380, 520, 290,
        380, 380, 430, 430, 390, 390)
d1 <- desirability(y1, 120, 170, scale = c(1, 1), target = "max")
d3 <- desirability(y2, 400, 600, target = 500)
d1
plot(d1)
d3
plot(d3)
```

`desirability.c`*desirability-class: Class 'desirability'*

Description

A class representing the desirability metrics for responses in a design.

Public fields

response A numeric vector specifying the responses for which desirability is calculated.
low A numeric vector representing the lower bounds of the desirable range for each response.
high A numeric vector representing the upper bounds of the desirable range for each response.
target A numeric vector or character string indicating the target values or goals for each response.
scale A numeric vector specifying the scaling factors used in the desirability calculation.
importance A numeric vector indicating the importance of each response in the desirability calculation.

Methods**Public methods:**

- `desirability.c$new()`
- `desirability.c$print()`
- `desirability.c$plot()`
- `desirability.c$clone()`

Method `new()`: Initializes a new `desirability.c` object with specified parameters.

Usage:

```
desirability.c$new(  
  response = NULL,  
  low = NULL,  
  high = NULL,  
  target = NULL,  
  scale = NULL,  
  importance = NULL  
)
```

Arguments:

response A numeric or character vector specifying the responses for which desirability is calculated.
low A numeric vector representing the lower bounds of the desirable range for each response.
high A numeric vector representing the upper bounds of the desirable range for each response.
target A numeric vector or character string indicating the target values or goals for each response.
scale A numeric vector specifying the scaling factors used in the desirability calculation.
importance A numeric vector indicating the importance of each response in the desirability calculation.

Method `print()`: Prints the details of a `desirability.c` object.

Usage:

```
desirability.c$print()
```

Method `plot()`: Plots the desirability functions based on the specified parameters.

Usage:

```
desirability.c$plot(scale, main, xlab, ylab, line.width, col, numPoints = 500)
```

Arguments:

scale A numeric vector specifying the scaling factors used in the plot.

main A character string specifying the main title of the plot.

xlab A character string specifying the label for the x-axis.

ylab A character string specifying the label for the y-axis.

line.width A numeric value specifying the width of the plot lines.

col A vector of colors for the plot lines.

numPoints An integer specifying the number of points to plot (default is 500).

Method clone(): The objects of this class are cloneable with this method.

Usage:

```
desirability.c$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

See Also

[desirability](#), [overall](#), [optimum](#)

desOpt

desOpt-class: Class 'desOpt'

Description

The desOpt class represents an object that stores optimization results for factorial design experiments. It includes coded and real factors, responses, desirabilities, overall desirability, and the design object.

Public fields

facCoded A list containing the coded values for the factors in the design.

facReal A list containing the real (actual) values for the factors in the design.

responses A list of response variables obtained from the design.

desirabilities A list of desirability scores for each response variable.

overall Numeric value representing the overall desirability score.

all A data frame containing all the relevant data from the design and optimization process.

fdo The factorial design object used in the optimization process.

Methods**Public methods:**

- [desOpt\\$as.data.frame\(\)](#)
- [desOpt\\$print\(\)](#)
- [desOpt\\$clone\(\)](#)

Method `as.data.frame()`: Convert the object to a data frame.

Usage:

```
desOpt$as.data.frame()
```

Method `print()`: Print a summary of the object.

Usage:

```
desOpt$print()
```

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
desOpt$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

See Also

[optimum](#), [facDesign](#), [desirability](#)

dgamma3

dgamma3: The gamma Distribution (3 Parameter)

Description

Density function, distribution function, and quantile function for the Gamma distribution.

Usage

```
dgamma3(x, shape, scale, threshold)
```

Arguments

| | |
|------------------------|--|
| <code>x</code> | A numeric vector of quantiles. |
| <code>shape</code> | The shape parameter, default is 1. |
| <code>scale</code> | The scale parameter, default is 1. |
| <code>threshold</code> | The threshold parameter, default is 0. |

Details

The Gamma distribution with scale parameter α , shape parameter c , and threshold parameter ζ has a density given by:

$$f(x) = \frac{c}{\alpha} \left(\frac{x - \zeta}{\alpha} \right)^{c-1} \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

The cumulative distribution function is given by:

$$F(x) = 1 - \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

Value

`dgamma3` gives the density, `pgamma3` gives the distribution function, and `qgamma3` gives the quantile function.

Examples

```
dgamma3(x = 1, scale = 1, shape = 5, threshold = 0)
temp <- pgamma3(q = 1, scale = 1, shape = 5, threshold = 0)
temp
qgamma3(p = temp, scale = 1, shape = 5, threshold = 0)
```

Distr

Distr-class: Class 'Distr'

Description

R6 Class for Distribution Objects

Public fields

`x` Numeric vector of data values.

`name` Character string representing the name of the distribution.

`parameters` List of parameters for the distribution.

`sd` Numeric value representing the standard deviation of the distribution.

`n` Numeric value representing the sample size.

`loglik` Numeric value representing the log-likelihood.

Methods

Public methods:

- [Distr\\$new\(\)](#)
- [Distr\\$plot\(\)](#)
- [Distr\\$clone\(\)](#)

Method new(): Initialize the fields of the 'Distribution' object

Usage:

```
Distr$new(x, name, parameters, sd, n, loglik)
```

Arguments:

x Numeric vector of data values.

name Character string representing the name of the distribution.

parameters List of parameters for the distribution.

sd Numeric value representing the standard deviation of the distribution.

n Numeric value representing the sample size.

loglik Numeric value representing the log-likelihood.

Method plot(): Plot the distribution with histogram and fitted density curve.

Usage:

```
Distr$plot(
  main = NULL,
  xlab = NULL,
  xlim = NULL,
  xlim.t = TRUE,
  ylab = NULL,
  line.col = "red",
  fill.col = "lightblue",
  border.col = "black",
  box = TRUE,
  line.width = 1
)
```

Arguments:

main Character string for the main title of the plot. Defaults to the name of the distribution.

xlab Character string for the x-axis label. Defaults to "x".

xlim Numeric vector specifying the x-axis limits.

xlim.t Logical value specifying to change the xlim default.

ylab Character string for the y-axis label. Defaults to "Density".

line.col Character string for the color of the plot line. Default is "red".

fill.col Character string for the color of the fill histogram plot line. Default is "lightblue".

border.col Character string for the color of the border of the fill histogram plot line. Default is "black".

box Logical value indicating whether to draw a box with the parameters in the plot. Default is TRUE.

line.width Numeric value specifying the width of the plot line. Default is 1.

Method clone(): The objects of this class are cloneable with this method.

Usage:

```
Distr$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

See Also

[distribution](#), [FitDistr](#), [DistrCollection](#)

Examples

```
# Normal
set.seed(123)
data1 <- rnorm(100, mean = 5, sd = 2)
parameters1 <- list(mean = 5, sd = 2)
distr1 <- Distr$new(x = data1, name = "normal", parameters = parameters1,
                  sd = 2, n = 100, loglik = -120)
distr1$plot()

# Log-normal
data2 <- rlnorm(100, meanlog = 1, sdlog = 0.5)
parameters2 <- list(meanlog = 1, sdlog = 0.5)
distr2 <- Distr$new(x = data2, name = "log-normal", parameters = parameters2,
                  sd = 0.5, n = 100, loglik = -150)
distr2$plot()

# Geometric
data3 <- rgeom(100, prob = 0.3)
parameters3 <- list(prob = 0.3)
distr3 <- Distr$new(x = data3, name = "geometric", parameters = parameters3,
                  sd = sqrt((1 - 0.3) / (0.3^2)), n = 100, loglik = -80)
distr3$plot()

# Exponential
data4 <- rexp(100, rate = 0.2)
parameters4 <- list(rate = 0.2)
distr4 <- Distr$new(x = data4, name = "exponential", parameters = parameters4,
                  sd = 1 / 0.2, n = 100, loglik = -110)
distr4$plot()

# Poisson
data5 <- rpois(100, lambda = 3)
parameters5 <- list(lambda = 3)
distr5 <- Distr$new(x = data5, name = "poisson", parameters = parameters5,
                  sd = sqrt(3), n = 100, loglik = -150)
distr5$plot()

# Chi-square
```

```

data6 <- rchisq(100, df = 5)
parameters6 <- list(df = 5)
distr6 <- Distr$new(x = data6, name = "chi-squared", parameters = parameters6,
                  sd = sqrt(2 * 5), n = 100, loglik = -130)
distr6$plot()

# Logistic
data7 <- rlogis(100, location = 0, scale = 1)
parameters7 <- list(location = 0, scale = 1)
distr7 <- Distr$new(x = data7, name = "logistic", parameters = parameters7,
                  sd = 1 * sqrt(pi^2 / 3), n = 100, loglik = -140)
distr7$plot()

# Gamma
data8 <- rgamma(100, shape = 2, rate = 0.5)
parameters8 <- list(shape = 2, rate = 0.5)
distr8 <- Distr$new(x = data8, name = "gamma", parameters = parameters8,
                  sd = sqrt(2 / (0.5^2)), n = 100, loglik = -120)
distr8$plot()

# f
data9 <- rf(100, df1 = 5, df2 = 10)
parameters9 <- list(df1 = 5, df2 = 10)
df1 <- 5
df2 <- 10
distr9 <- Distr$new(x = data9, name = "f", parameters = parameters9,
                  sd = sqrt(((df2^2 * (df1 + df2 - 2)) /
                          (df1 * (df2 - 2)^2 * (df2 - 4)))),
                  n = 100, loglik = -150)
distr9$plot()

# t
data10 <- rt(100, df = 10)
parameters10 <- list(df = 10)
distr10 <- Distr$new(x = data10, name = "t", parameters = parameters10,
                  sd = sqrt(10 / (10 - 2)), n = 100, loglik = -120)
distr10$plot()

# negative binomial
data11 <- rnbinom(100, size = 5, prob = 0.3)
parameters11 <- list(size = 5, prob = 0.3)
distr11 <- Distr$new(x = data11, name = "negative binomial",
                  parameters = parameters11,
                  sd = sqrt(5 * (1 - 0.3) / (0.3^2)),
                  n = 100, loglik = -130)
distr11$plot()

```

Description

R6 Class for Managing a Collection of Distribution Objects

Public fields

distr List of [Distr](#) objects.

Methods**Public methods:**

- [DistrCollection\\$new\(\)](#)
- [DistrCollection\\$add\(\)](#)
- [DistrCollection\\$get\(\)](#)
- [DistrCollection\\$print\(\)](#)
- [DistrCollection\\$summary\(\)](#)
- [DistrCollection\\$plot\(\)](#)
- [DistrCollection\\$clone\(\)](#)

Method `new()`: Initialize the fields of the `DistrCollection` object.

Usage:

```
DistrCollection$new()
```

Method `add()`: Add a `Distr` object to the collection.

Usage:

```
DistrCollection$add(distr)
```

Arguments:

distr A `Distr` object to add to the collection.

Method `get()`: Get a `Distr` object from the collection by its index.

Usage:

```
DistrCollection$get(i)
```

Arguments:

i Integer index of the `Distr` object to retrieve.

Returns: A `Distr` object.

Method `print()`: Print the summary of all distributions in the collection.

Usage:

```
DistrCollection$print()
```

Method `summary()`: Summarize the goodness of fit for all distributions in the collection.

Usage:

```
DistrCollection$summary()
```

Returns: A data frame with distribution names, Anderson-Darling test statistics, and p-values.

Method `plot()`: Plot all distributions in the collection.

Usage:

```
DistrCollection$plot(
  xlab = NULL,
  ylab = NULL,
  xlim = NULL,
  ylim = NULL,
  line.col = "red",
  fill.col = "lightblue",
  border.col = "black",
  line.width = 1,
  box = TRUE
)
```

Arguments:

`xlab` Character string for the x-axis label.

`ylab` Character string for the y-axis label.

`xlim` Numeric vector specifying the x-axis limits.

`ylim` Numeric vector specifying the y-axis limits.

`line.col` Character string for the color of the plot line. Default is "red".

`fill.col` Character string for the color of the histogram fill. Default is "lightblue".

`border.col` Character string for the color of the histogram border. Default is "black".

`line.width` Numeric value specifying the width of the plot line. Default is 1.

`box` Logical value indicating whether to draw a box with the parameters in the plot. Default is TRUE.

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
DistrCollection$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

See Also

[Distr](#), [distribution](#), [FitDistr](#)

Examples

```
set.seed(123)
data1 <- rnorm(100, mean = 5, sd = 2)
parameters1 <- list(mean = 5, sd = 2)
distr1 <- Distr$new(x = data1, name = "normal",
  parameters = parameters1, sd = 2,
  n = 100, loglik = -120)

data2 <- rpois(100, lambda = 3)
parameters2 <- list(lambda = 3)
distr2 <- Distr$new(x = data2, name = "poisson",
```

```

        parameters = parameters2, sd = sqrt(3),
        n = 100, loglik = -150)
collection <- DistrCollection$new()
collection$add(distr1)
collection$add(distr2)
collection$summary()
collection$plot()

```

distribution

distribution: Distribution

Description

Calculates the most likely parameters for a given distribution.

Usage

```
distribution(x = NULL, distrib = "weibull", ...)
```

Arguments

| | |
|---------|--|
| x | Vector of distributed values from which the parameter should be determined. |
| distrib | Character string specifying the distribution of x. The function <code>distribution</code> will accept the following character strings for distribution: <ul style="list-style-type: none"> • <code>`normal`</code> • <code>`chi-squared`</code> • <code>`exponential`</code> • <code>`logistic`</code> • <code>`gamma`</code> • <code>`weibull`</code> • <code>`cauchy`</code> • <code>`beta`</code> • <code>`f`</code> • <code>`t`</code> • <code>`geometric`</code> • <code>`poisson`</code> • <code>`negative binomial`</code> • <code>`log-normal`</code> By default, <code>distribution</code> is set to <code>`weibull`</code> . |
| ... | Additional arguments to be passed to the fitting function. |

Value

`distribution()` returns an object of class `DistrCollection`.

See Also

[Distr](#), [DistrCollection](#)

Examples

```
data1 <- rnorm(100, mean = 5, sd = 2)
distribution(data1, distrib = "normal")
```

dlnorm3

dlnorm3: The Lognormal Distribution (3 Parameter)

Description

Density function, distribution function, and quantile function for the Lognormal distribution.

Usage

```
dlnorm3(x, meanlog, sdlog, threshold)
```

Arguments

| | |
|----------------|---|
| x | A numeric vector of quantiles. |
| meanlog, sdlog | The mean and standard deviation of the distribution on the log scale with default values of 0 and 1 respectively. |
| threshold | The threshold parameter, default is 0. |

Details

The Lognormal distribution with meanlog parameter zeta, sdlog parameter sigma, and threshold parameter theta has a density given by:

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma(x-\theta)} \exp\left(-\frac{(\log(x-\theta) - \zeta)^2}{2\sigma^2}\right)$$

The cumulative distribution function is given by:

$$F(x) = \Phi\left(\frac{\log(x-\theta) - \zeta}{\sigma}\right)$$

where Φ is the cumulative distribution function of the standard normal distribution.

Value

dlnorm3 gives the density, plnorm3 gives the distribution function, and qlnorm3 gives the quantile function.

Examples

```
dlnorm3(x = 2, meanlog = 0, sdlog = 1/8, threshold = 1)
temp <- plnorm3(q = 2, meanlog = 0, sdlog = 1/8, threshold = 1)
temp
qlnorm3(p = temp, meanlog = 0, sdlog = 1/8, threshold = 1)
```

doeFactor

*doeFactor-class: Class 'doeFactor'***Description**

An R6 class representing a factor in a design of experiments (DOE).

Public fields

`low` Numeric value specifying the lower bound of the factor. Default is `'-1'`.

`high` Numeric value specifying the upper bound of the factor. Default is `'1'`.

`name` Character string specifying the name of the factor. Default is an empty string `''`.

`unit` Character string specifying the unit of measurement for the factor. Default is an empty string `''`.

`type` Character string specifying the type of the factor. Can be either `'numeric'` or `'categorical'`. Default is `'numeric'`.

Methods**Public methods:**

- `doeFactor$attributes()`
- `doeFactor$.low()`
- `doeFactor$.high()`
- `doeFactor$.type()`
- `doeFactor$.unit()`
- `doeFactor$names()`
- `doeFactor$print()`
- `doeFactor$clone()`

Method `attributes()`: Get the attributes of the factor.

Usage:

```
doeFactor$attributes()
```

Method `.low()`: Get and set the lower bound for the factor.

Usage:

```
doeFactor$.low(value)
```

Arguments:

value Numeric value to set as the lower bound. If missing, the current lower bound is returned.

Method `.high()`: Get and set the upper bound for the factor.

Usage:

```
doeFactor$.high(value)
```

Arguments:

value Numeric value to set as the upper bound. If missing, the current upper bound is returned.

Method `.type()`: Get and set the type of the factor.

Usage:

```
doeFactor$.type(value)
```

Arguments:

value Character string specifying the type of the factor. Can be "numeric" or "categorical".
If missing, the current type is returned.

Method `.unit()`: Get and set the unit of measurement for the factor.

Usage:

```
doeFactor$.unit(value)
```

Arguments:

value Character string specifying the unit of measurement. If missing, the current unit is returned.

Method `names()`: Get and set the name of the factor.

Usage:

```
doeFactor$names(value)
```

Arguments:

value Character string specifying the name of the factor. If missing, the current name is returned.

Method `print()`: Print the characteristics of the factors.

Usage:

```
doeFactor$print()
```

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
doeFactor$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

See Also

[taguchiFactor](#)

`dotPlot`*dotPlot: Function to create a dot plot*

Description

Creates a dot plot. For data in groups, the dot plot can be displayed stacked or in separate regions.

Usage

```
dotPlot(  
  x,  
  group,  
  xlim,  
  ylim,  
  col,  
  xlab,  
  ylab,  
  pch,  
  cex,  
  breaks,  
  stacked = TRUE,  
  main,  
  showPlot = TRUE  
)
```

Arguments

| | |
|---------------------|--|
| <code>x</code> | A numeric vector containing the values to be plotted. |
| <code>group</code> | (Optional) A vector for grouping the values. This determines the grouping of the data points in the dot plot. |
| <code>xlim</code> | A numeric vector of length 2 specifying the limits of the x-axis (lower and upper limits). |
| <code>ylim</code> | A numeric vector of length 2 specifying the limits of the y-axis (lower and upper limits). |
| <code>col</code> | A vector containing numeric values or strings specifying the colors for the different groups in the dot plot. |
| <code>xlab</code> | A title for the x-axis. |
| <code>ylab</code> | A title for the y-axis. |
| <code>pch</code> | A vector of integers specifying the symbols or a single character to be used for plotting points for the different groups in the dot plot. |
| <code>cex</code> | The amount by which points and symbols should be magnified relative to the default. |
| <code>breaks</code> | A numeric vector specifying the breakpoints for binning the values in <code>x</code> . |

| | |
|----------|--|
| stacked | A logical value indicating whether the groups should be plotted in a stacked dot plot (default is TRUE). |
| main | A title for the plot. |
| showPlot | A logical value indicating whether to display the plot. Default is TRUE. |

Details

Values in `x` are assigned to the bins defined by `breaks`. The binning is performed using `hist`.

Value

A list containing:

- An invisible matrix containing NAs and numeric values representing values in a bin. The number of bins is given by the number of columns of the matrix.
- The graphic.

Examples

```
# Create some data and grouping
set.seed(1)
x <- rnorm(28)
g <- rep(1:2, 14)

# Dot plot with groups and no stacking
dotPlot(x, group = g, stacked = FALSE, pch = c(19, 20), main = "Non stacked dot plot")

# Dot plot with groups and stacking
dotPlot(x, group = g, stacked = TRUE, pch = c(19, 20), main = "Stacked dot plot")
```

dweibull3

dweibull3: The Weibull Distribution (3 Parameter)

Description

Density function, distribution function, and quantile function for the Weibull distribution with a threshold parameter.

Usage

```
dweibull3(x, shape, scale, threshold)
```

Arguments

| | |
|------------------------|--|
| <code>x</code> | A numeric vector of quantiles. |
| <code>shape</code> | The shape parameter of the Weibull distribution. Default is 1. |
| <code>scale</code> | The scale parameter of the Weibull distribution. Default is 1. |
| <code>threshold</code> | The threshold (or location) parameter of the Weibull distribution. Default is 0. |

Details

The Weibull distribution with the scale parameter alpha, shape parameter c, and threshold parameter zeta has a density function given by:

$$f(x) = \frac{c}{\alpha} \left(\frac{x - \zeta}{\alpha} \right)^{c-1} \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

The cumulative distribution function is given by:

$$F(x) = 1 - \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

Value

dweibull13 returns the density, pweibull13 returns the distribution function, and qweibull13 returns the quantile function for the Weibull distribution with a threshold.

Examples

```
dweibull13(x = 1, scale = 1, shape = 5, threshold = 0)
temp <- pweibull13(q = 1, scale = 1, shape = 5, threshold = 0)
temp
qweibull13(p = temp, scale = 1, shape = 5, threshold = 0)
```

 facDesign

facDesign

Description

Generates a 2^k full factorial design.

Usage

```
facDesign(
  k = 3,
  p = 0,
  replicates = 1,
  blocks = 1,
  centerCube = 0,
  random.seed = 1234
)
```

Arguments

| | |
|-------------|--|
| k | Numeric value giving the number of factors. By default k is set to '3'. |
| p | Numeric integer between '0' and '7'. p is giving the number of additional factors in the response surface design by aliasing effects. For further information see fracDesign and fracChoose. By default p is set to '0'. |
| replicates | Numeric value giving the number of replicates per factor combination. By default replicates is set to '1'. |
| blocks | Numeric value giving the number of blocks. By default blocks is set to '1'. Blocking is only performed for k greater 2. |
| centerCube | Numeric value giving the number of centerpoints within the 2^k design. By default centerCube is set to '0'. |
| random.seed | Numeric value for setting the random seed for reproducibility. |

Value

The function facDesign returns an object of class [facDesign.c](#).

See Also

[fracDesign](#), [fracChoose](#), [rsmDesign](#), [pbDesign](#), [taguchiDesign](#)

Examples

```
# Example 1
vp.full <- facDesign(k = 3)
vp.full$response(rnorm(2^3))
vp.full$summary()

# Example 2
vp.rep <- facDesign(k = 2, replicates = 3, centerCube = 4)
vp.rep$names(c("Name 1", "Name 2"))
vp.rep$unit(c("min", "F"))
vp.rep$lows(c(20, 40, 60))
vp.rep$highs(c(40, 60, 80))
vp.rep$summary()

# Example 3
dfac <- facDesign(k = 3, centerCube = 4)
dfac$names(c('Factor 1', 'Factor 2', 'Factor 3'))
dfac$names()
dfac$lows(c(80, 120, 1))
dfac$lows()
dfac$highs(c(120, 140, 2))
dfac$highs()
dfac$summary()
```

`facDesign.c`*facDesign-class: Class 'facDesign'*

Description

The `facDesign.c` class is used to represent factorial designs, including their factors, responses, blocks, and design matrices. This class supports various experimental designs and allows for the storage and manipulation of data related to the design and analysis of factorial experiments.

Public fields

`name` Character string representing the name of the factorial design.

`factors` List of factors involved in the factorial design, including their levels and settings.

`cube` Data frame containing the design matrix for the cube portion of the factorial design.

`star` Data frame containing the design matrix for the star portion of the factorial design.

`centerCube` Data frame containing the center points within the cube portion of the factorial design.

`centerStar` Data frame containing the center points within the star portion of the factorial design.

`generator` List of generators used to create the fractional factorial design.

`response` Data frame containing the responses or outcomes measured in the design.

`block` Data frame specifying the block structures if the design is blocked.

`blockGen` Data frame specifying the block generators for the design.

`runOrder` Data frame specifying the order in which runs are performed.

`standardOrder` Data frame specifying the standard order of the runs.

`desiredVal` List of desired values or targets for the response variables.

`desirability` List of desirability scores or metrics based on the desired values.

`fits` Data frame containing the fitted model parameters and diagnostics for the responses in the design.

Methods

Public methods:

- `facDesign.c$nrow()`
- `facDesign.c$ncol()`
- `facDesign.c$print()`
- `facDesign.c$.clear()`
- `facDesign.c$names()`
- `facDesign.c$as.data.frame()`
- `facDesign.c$get()`
- `facDesign.c$lows()`
- `facDesign.c$highs()`
- `facDesign.c$.nfp()`

- `facDesign.c$identity()`
- `facDesign.c$summary()`
- `facDesign.c$.response()`
- `facDesign.c$effectPlot()`
- `facDesign.c$lm()`
- `facDesign.c$desires()`
- `facDesign.c$set.fits()`
- `facDesign.c$types()`
- `facDesign.c$unit()`
- `facDesign.c$.star()`
- `facDesign.c$.blockGen()`
- `facDesign.c$.block()`
- `facDesign.c$.centerCube()`
- `facDesign.c$.centerStar()`
- `facDesign.c$.generators()`
- `facDesign.c$clone()`

Method `nrow()`: Get the number of rows Design.

Usage:

```
facDesign.c$nrow()
```

Method `ncol()`: Get the number of columns Design.

Usage:

```
facDesign.c$ncol()
```

Method `print()`: Prints a formatted representation of the factorial design object, including design matrices and responses.

Usage:

```
facDesign.c$print()
```

Method `.clear()`: Clears the factorial design object.

Usage:

```
facDesign.c$.clear()
```

Method `names()`: Get or set the names of the factors in the factorial design.

Usage:

```
facDesign.c$names(value)
```

Arguments:

value Character vector with new names for the factors. If missing, retrieves the current names.

Method `as.data.frame()`: Converts the factorial design object to a data frame.

Usage:

```
facDesign.c$as.data.frame()
```


Method `get()`: Retrieves elements from the factorial design object.

Usage:

```
facDesign.c$get(i, j)
```

Arguments:

i Row index.

j Column index.

Method `lows()`: Get or set the lower bounds of the factors in the factorial design.

Usage:

```
facDesign.c$lows(value)
```

Arguments:

value Numeric vector with new lower bounds. If missing, retrieves the current lower bounds.

Method `highs()`: Get or set the upper bounds of the factors in the factorial design.

Usage:

```
facDesign.c$highs(value)
```

Arguments:

value Numeric vector with new upper bounds. If missing, retrieves the current upper bounds.

Method `.nfp()`: Prints a summary of the factors attributes including their low, high, name, unit, and type.

Usage:

```
facDesign.c$.nfp()
```

Method `identity()`: Returns the factorial design object itself, used to verify or return the object.

Usage:

```
facDesign.c$identity()
```

Method `summary()`: Summarizes the factorial design object.

Usage:

```
facDesign.c$summary()
```

Method `.response()`: Get or set the response data in the factorial design object.

Usage:

```
facDesign.c$.response(value)
```

Arguments:

value Data frame or numeric vector with new responses. If missing, retrieves the current responses.

Method `effectPlot()`: Plots the effects of factors on the response variables.

Usage:

```
facDesign.c$effectPlot(  
  factors,  
  fun = mean,  
  response = NULL,  
  lty,  
  xlab,  
  ylab,  
  main,  
  ylim  
)
```

Arguments:

factors Factors to be plotted.

fun Function applied to the response variables (e.g., mean).

response Optional; specifies which response variables to plot.

lty Line type for plotting.

xlab Label for the x-axis.

ylab Label for the y-axis.

main Main title for the plot.

ylim Limits for the y-axis.

Method `lm()`: Fits a linear model to the response data in the factorial design object.

Usage:

```
facDesign.c$lm(formula)
```

Arguments:

formula Formula specifying the model to be fitted.

Method `desires()`: Get or set the desirability values for the response variables.

Usage:

```
facDesign.c$desires(value)
```

Arguments:

value List of new desirability values. If missing, retrieves the current desirability values.

Method `set.fits()`: Set the fits for the response variables in the factorial design object.

Usage:

```
facDesign.c$set.fits(value)
```

Arguments:

value New fits.

Method `types()`: Get or set the types of designs used in the factorial design object.

Usage:

```
facDesign.c$types(value)
```

Arguments:

value New design types. If missing, retrieves the current types.

Method `unit()`: Get or set the units for the factors in the factorial design object.

Usage:

```
facDesign.c$unit(value)
```

Arguments:

value New units. If missing, retrieves the current units.

Method `.star()`: Get or set the star points in the factorial design object.

Usage:

```
facDesign.c$.star(value)
```

Arguments:

value New star points. If missing, retrieves the current star points.

Method `.blockGen()`: Get or set the block generators in the factorial design object.

Usage:

```
facDesign.c$.blockGen(value)
```

Arguments:

value New block generators. If missing, retrieves the current block generators.

Method `.block()`: Get or set the blocks in the factorial design object.

Usage:

```
facDesign.c$.block(value)
```

Arguments:

value New blocks. If missing, retrieves the current blocks.

Method `.centerCube()`: Get or set the center points in the cube portion of the factorial design.

Usage:

```
facDesign.c$.centerCube(value)
```

Arguments:

value New center points for the cube. If missing, retrieves the current center points.

Method `.centerStar()`: Get or set the center points in the star portion of the factorial design.

Usage:

```
facDesign.c$.centerStar(value)
```

Arguments:

value New center points for the star. If missing, retrieves the current center points.

Method `.generators()`: Get or set the generators for the factorial design.

Usage:

```
facDesign.c$.generators(value)
```

Arguments:

value New generators. If missing, retrieves the current generators.

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
facDesign.c$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

See Also

[mixDesign.c](#), [taguchiDesign.c](#).

 FitDistr

FitDistr: Maximum-likelihood Fitting of Univariate Distributions

Description

Maximum-likelihood fitting of univariate distributions, allowing parameters to be held fixed if desired.

Usage

```
FitDistr(x, densfun, start, ...)
```

Arguments

| | |
|---------|--|
| x | A numeric vector of length at least one containing only finite values. Either a character string or a function returning a density evaluated at its first argument. |
| densfun | character string specifying the density function to be used for fitting the distribution. Distributions "beta", "cauchy", "chi-squared", "exponential", "gamma", "geometric", "log-normal", "lognormal", "logistic", "negative binomial", "normal", "Poisson", "t" and "weibull" are recognised, case being ignored. |
| start | A named list giving the parameters to be optimized with initial values. This can be omitted for some of the named distributions and must be for others (see Details). |
| ... | Additional parameters, either for 'densfun' or for 'optim'. In particular, it can be used to specify bounds via 'lower' or 'upper' or both. If arguments of 'densfun' (or the density function corresponding to a character-string specification) are included they will be held fixed. |

Details

For the Normal, log-Normal, geometric, exponential and Poisson distributions the closed-form MLEs (and exact standard errors) are used, and 'start' should not be supplied.

For all other distributions, direct optimization of the log-likelihood is performed using 'optim'. The estimated standard errors are taken from the observed information matrix, calculated by a numerical approximation. For one-dimensional problems the Nelder-Mead method is used and for multi-dimensional problems the BFGS method, unless arguments named 'lower' or 'upper' are supplied (when 'L-BFGS-B' is used) or 'method' is supplied explicitly.

For the "t" named distribution the density is taken to be the location-scale family with location 'm' and scale 's'.

For the following named distributions, reasonable starting values will be computed if 'start' is omitted or only partially specified: "cauchy", "gamma", "logistic", "negative binomial" (parametrized

by mu and size), "t" and "weibull". Note that these starting values may not be good enough if the fit is poor: in particular they are not resistant to outliers unless the fitted distribution is long-tailed.

There are 'print', 'coef', 'vcov' and 'logLik' methods for class "FitDistr".

Value

The function 'FitDistr' returns an object of class 'fitdistr', which is a list containing:

| | |
|----------|--|
| estimate | a named vector of parameter estimates. |
| sd | a named vector of the estimated standard errors for the parameters. |
| vcov | the estimated variance-covariance matrix of the parameter estimates. |
| loglik | the log-likelihood of the fitted model. |
| n | length vector. |

See Also

[distribution](#), [Distr](#), [DistrCollection](#).

Examples

```
set.seed(123)
x = rgamma(100, shape = 5, rate = 0.1)
FitDistr(x, "gamma")

# Now do this directly with more control.
FitDistr(x, dgamma, list(shape = 1, rate = 0.1), lower = 0.001)

set.seed(123)
x2 = rt(250, df = 9)
FitDistr(x2, "t", df = 9)

# Allow df to vary: not a very good idea!
FitDistr(x2, "t")

# Now do fixed-df fit directly with more control.
mydt = function(x, m, s, df) dt((x-m)/s, df)/s
FitDistr(x2, mydt, list(m = 0, s = 1), df = 9, lower = c(-Inf, 0))

set.seed(123)
x3 = rweibull(100, shape = 4, scale = 100)
FitDistr(x3, "weibull")
```

| | |
|------------|---|
| fracChoose | <i>fracChoose: Choosing a fractional or full factorial design from a table.</i> |
|------------|---|

Description

Designs displayed are the classic minimum aberration designs. Choosing a design is done by clicking with the mouse into the appropriate field.

Usage

```
fracChoose()
```

Value

fracChoose returns an object of class [facDesign.c](#).

See Also

[fracDesign](#), [facDesign](#), [rsmChoose](#), [rsmDesign](#)

Examples

```
fracChoose()
```

| | |
|------------|-------------------|
| fracDesign | <i>fracDesign</i> |
|------------|-------------------|

Description

Generates a 2^k -p fractional factorial design.

Usage

```
fracDesign(  
  k = 3,  
  p = 0,  
  gen = NULL,  
  replicates = 1,  
  blocks = 1,  
  centerCube = 0,  
  random.seed = 1234  
)
```

Arguments

| | |
|-------------|--|
| k | Numeric value giving the number of factors. By default k is set to '3'. |
| p | Numeric integer between '0' and '7'. p is giving the number of additional factors in the response surface design by aliasing effects. A 2^{k-p} factorial design will be generated and the generators of the standard designs available in fracChoose() will be used. By default p is set to '0'. Any other value will cause the function to omit the argument gen given by the user and replace it by the one out of the table of standard designs (see: fracChoose). Replicates and blocks can be set anyway! |
| gen | One or more defining relations for a fractional factorial design, for example: `C=AB`. By default gen is set to NULL. |
| replicates | Numeric value giving the number of replicates per factor combination. By default replicates is set to '1'. |
| blocks | Numeric value giving the number of blocks. By default blocks is set to '1'. |
| centerCube | Numeric value giving the number of center points within the 2^k design. By default centerCube is set to '0'. |
| random.seed | Seed for randomization of the design |

Value

The function fracDesign returns an object of class [facDesign.c](#).

See Also

[facDesign](#), [fracChoose](#), [rsmDesign](#), [pbDesign](#), [taguchiDesign](#)

Examples

```
#Example 1
#Returns a 2^4-1 fractional factorial design. Factor D will be aliased with
vp.frac = fracDesign(k = 4, gen = "D=ABC")
#the three-way-interaction ABC (i.e. I = ABCD)
vp.frac$response(rnorm(2^(4-1)))
# summary of the fractional factorial design
vp.frac$summary()

#Example 2
#Returns a full factorial design with 3 replications per factor combination and 4 center points
vp.rep = fracDesign(k = 3, replicates = 3, centerCube = 4)
#Summary of the replicated fractional factorial design
vp.rep$summary()
```

| | |
|---------|--|
| gageLin | <i>gageLin: Function to visualize and calculate the linearity of a gage.</i> |
|---------|--|

Description

Function visualize the linearity of a gage by plotting the single and mean bias in one plot and intercalate them with a straight line. Furthermore the function deliver some characteristic values of linearity studies according to MSA (Measurement System Analysis).

Usage

```
gageLin(
  object,
  conf.level = 0.95,
  ylim,
  col,
  pch,
  lty = c(1, 2),
  stats = TRUE,
  plot = TRUE
)
```

Arguments

| | |
|------------|---|
| object | An object of class <code>MSALinearity</code> containing the data and model for the linearity analysis. To create such an object see <code>gageLinDesign</code> . |
| conf.level | A numeric value between '0' and '1', giving the confidence interval for the analysis. Default value: '0.95'. |
| ylim | A numeric vector of length 2 specifying the y-axis limits for the plot. If not specified, the limits are set automatically based on the data. |
| col | A vector with four numeric entries. The first gives the color of the single points, the second gives the color of the points for the mean bias, the third gives the color for the straight interpolation line and the fourth gives the color for the lines representing the confidence interval. If one of the values is missing or negative the points or lines are not plotted. col is by default 'c(1,2,1,4)'. |
| pch | A vector with two numeric or single character entries giving the symbols for the single points (1st entry) and the mean bias (2nd entry). The default vector is 'c(20,18)'. |
| lty | a vector with two entries giving the line-style for the interpolating line and the confidence interval lines. For detailed information to the entries please see par. The default value for lty is 'c(1,2)'. |
| stats | Logical value. If 'TRUE' (default) the function returns all calculated information. |
| plot | Logical value indicating whether to generate a plot of the linearity analysis. Default is TRUE. |

Value

The function returns an object of class `MSALinearity` which can be used with e.g. `plot` or `summary`.

See Also

[cg](#), [gageRR](#), [gageLinDesign](#), [MSALinearity](#).

Examples

```
# Results of single runs
A=c(2.7,2.5,2.4,2.5,2.7,2.3,2.5,2.5,2.4,2.4,2.6,2.4)
B=c(5.1,3.9,4.2,5,3.8,3.9,3.9,3.9,3.9,4,4.1,3.8)
C=c(5.8,5.7,5.9,5.9,6,6.1,6,6.1,6.4,6.3,6,6.1)
D=c(7.6,7.7,7.8,7.7,7.8,7.8,7.8,7.7,7.8,7.5,7.6,7.7)
E=c(9.1,9.3,9.5,9.3,9.4,9.5,9.5,9.5,9.6,9.2,9.3,9.4)

# create Design
test=gageLinDesign(ref=c(2,4,6,8,10),n=12)
# create data.frame for results
results=data.frame(rbind(A,B,C,D,E))
# enter results in Design
test$response(results)
test$summary()

# no plot and no return
MSALin=gageLin(test,stats=FALSE,plot=FALSE)

# plot only
plot(MSALin)
MSALin$plot()

# summary
MSALin$summary()
```

gageLinDesign

gageLinDesign: Function to create a object of class MSALinearity.

Description

Function generates an object that can be used with the function `gageLin`.

Usage

```
gageLinDesign(ref, n = 5)
```

Arguments

`ref` A vector and contains the reference values for each group.
`n` A single value and gives the amount of runs.Default value: '5'..

Value

The function returns an object of class `MSALinearity`.

See Also

[MSALinearity](#), [gageLin](#).

Examples

```
# results of run A-E
A=c(2.7,2.5,2.4,2.5,2.7,2.3,2.5,2.5,2.4,2.4,2.6,2.4)
B=c(5.1,3.9,4.2,5,3.8,3.9,3.9,3.9,3.9,4,4.1,3.8)
C=c(5.8,5.7,5.9,5.9,6,6.1,6,6.1,6.4,6.3,6,6.1)
D=c(7.6,7.7,7.8,7.7,7.8,7.8,7.8,7.7,7.8,7.5,7.6,7.7)
E=c(9.1,9.3,9.5,9.3,9.4,9.5,9.5,9.5,9.6,9.2,9.3,9.4)

# create Design
test=gageLinDesign(ref=c(2,4,6,8,10),n=12)
# create data.frame for results
results=data.frame(rbind(A,B,C,D,E))
# enter results in Design
test$response(results)
```

gageRR

gageRR: Gage R&R - Gage Repeatability and Reproducibility

Description

Performs a Gage R&R analysis for an object of class [gageRR.c](#).

Usage

```
gageRR(  
  gdo,  
  method = "crossed",  
  sigma = 6,  
  alpha = 0.25,  
  tolerance = NULL,  
  dig = 3,  
  print = TRUE  
)
```

Arguments

`gdo` Needs to be an object of class `gageRR.c`.

| | |
|-----------|--|
| method | Character string specifying the Gage R&R method. `crossed` which is the typical design for performing a Measurement Systems Analysis using Gage Repeatability and Reproducibility or `nested` which is used for destructive testing (i.e. the same part cannot be measured twice). Operators measure each a different sample of parts under the premise that the parts of each batch are alike. By default method is set to `crossed`. |
| sigma | Numeric value giving the number of sigmas. For sigma=6 this relates to 99.73 percent representing the full spread of a normal distribution function (i.e. $\text{pnorm}(3) - \text{pnorm}(-3)$). Another popular setting sigma=5.15 relates to 99 percent (i.e. $\text{pnorm}(2.575) - \text{pnorm}(-2.575)$). By default sigma is set to '6'. |
| alpha | Alpha value for discarding the interaction Operator:Part and fitting a non-interaction model. By default alpha is set to '0.25'. |
| tolerance | Mumeric value giving the tolerance for the measured parts. This is required to calculate the Process to Tolerance Ratio. By default tolerance is set to NULL. |
| dig | numeric value giving the number of significant digits for format. By default dig is set to '3'. |
| print | Print the summary of the perform of the Gage. |

Value

The function gageRR returns an object of class gageRR.c and shows typical Gage Repeatability and Reproducibility Output including Process to Tolerance Ratios and the number of distinctive categories (i.e. ndc) the measurement system is able to discriminate with the tested setting.

See Also

[gageRR.c](#), [gageRRDesign](#), [gageLin](#), [cg](#).

Examples

```
# Create de gageRR Design
design <- gageRRDesign(Operators = 3, Parts = 10, Measurements = 3,
                     method = "crossed", sigma = 6, randomize = TRUE)
design$response(rnorm(nrow(design$X), mean = 10, sd = 2))

# Results of de Design
result <- gageRR(gdo = design, method = "crossed", sigma = 6, alpha = 0.25)
class(result)
result$plot()
```

gageRR.c

gageRR-class: Class 'gageRR'

Description

R6 Class for Gage R&R (Repeatability and Reproducibility) Analysis

Public fields

- X Data frame containing the measurement data.
- ANOVA List containing the results of the Analysis of Variance (ANOVA) for the gage study.
- RedANOVA List containing the results of the reduced ANOVA.
- method Character string specifying the method used for the analysis (e.g., ``crossed``, ``nested``).
- Estimates List of estimates including variance components, repeatability, and reproducibility.
- Varcomp List of variance components.
- Sigma Numeric value representing the standard deviation of the measurement system.
- GageName Character string representing the name of the gage.
- GageTolerance Numeric value indicating the tolerance of the gage.
- DateOfStudy Character string representing the date of the gage R&R study.
- PersonResponsible Character string indicating the person responsible for the study.
- Comments Character string for additional comments or notes about the study.
- b Factor levels for operator.
- a Factor levels for part.
- y Numeric vector or matrix containing the measurement responses.
- facNames Character vector specifying the names of the factors (e.g., ``Operator``, ``Part``).
- numO Integer representing the number of operators.
- numP Integer representing the number of parts.
- numM Integer representing the number of measurements per part-operator combination.

Methods**Public methods:**

- `gageRR.c$new()`
- `gageRR.c$print()`
- `gageRR.c$subset()`
- `gageRR.c$summary()`
- `gageRR.c$get.response()`
- `gageRR.c$response()`
- `gageRR.c$names()`
- `gageRR.c$as.data.frame()`
- `gageRR.c$get.tolerance()`
- `gageRR.c$set.tolerance()`
- `gageRR.c$get.sigma()`
- `gageRR.c$set.sigma()`
- `gageRR.c$plot()`
- `gageRR.c$errorPlot()`
- `gageRR.c$whiskersPlot()`
- `gageRR.c$averagePlot()`

- `gageRR.c$compPlot()`
- `gageRR.c$clone()`

Method `new()`: Initialize the fields of the gageRR object

Usage:

```
gageRR.c$new(
  X,
  ANOVA = NULL,
  RedANOVA = NULL,
  method = NULL,
  Estimates = NULL,
  Varcomp = NULL,
  Sigma = NULL,
  GageName = NULL,
  GageTolerance = NULL,
  DateOfStudy = NULL,
  PersonResponsible = NULL,
  Comments = NULL,
  b = NULL,
  a = NULL,
  y = NULL,
  facNames = NULL,
  numO = NULL,
  numP = NULL,
  numM = NULL
)
```

Arguments:

`X` Data frame containing the measurement data.

`ANOVA` List containing the results of the Analysis of Variance (ANOVA) for the gage study.

`RedANOVA` List containing the results of the reduced ANOVA.

`method` Character string specifying the method used for the analysis (e.g., "crossed", "nested").

`Estimates` List of estimates including variance components, repeatability, and reproducibility.

`Varcomp` List of variance components.

`Sigma` Numeric value representing the standard deviation of the measurement system.

`GageName` Character string representing the name of the gage.

`GageTolerance` Numeric value indicating the tolerance of the gage.

`DateOfStudy` Character string representing the date of the gage R&R study.

`PersonResponsible` Character string indicating the person responsible for the study.

`Comments` Character string for additional comments or notes about the study.

`b` Factor levels for operator.

`a` Factor levels for part.

`y` Numeric vector or matrix containing the measurement responses.

`facNames` Character vector specifying the names of the factors (e.g., "Operator", "Part").

`numO` Integer representing the number of operators.

`numP` Integer representing the number of parts.

numM Integer representing the number of measurements per part-operator combination.

Method print(): Return the data frame containing the measurement data (X)

Usage:

```
gageRR.c$print()
```

Method subset(): Return a subset of the data frame that containing the measurement data (X)

Usage:

```
gageRR.c$subset(i, j)
```

Arguments:

i The i-position of the row of X.

j The j-position of the column of X.

Method summary(): Summarize the information of the fields of the gageRR object.

Usage:

```
gageRR.c$summary()
```

Method get.response(): Get or get the response for a gageRRDesign object.

Usage:

```
gageRR.c$get.response()
```

Method response(): Set the response for a gageRRDesign object.

Usage:

```
gageRR.c$response(value)
```

Arguments:

value New response vector.

Method names(): Methods for function names in Package base.

Usage:

```
gageRR.c$names()
```

Method as.data.frame(): Methods for function as.data.frame in Package base.

Usage:

```
gageRR.c$as.data.frame()
```

Method get.tolerance(): Get the tolerance for an object of class gageRR.

Usage:

```
gageRR.c$get.tolerance()
```

Method set.tolerance(): Set the tolerance for an object of class gageRR.

Usage:

```
gageRR.c$set.tolerance(value)
```

Arguments:

value A data.frame or vector for the new value of tolerance.

Method `get.sigma()`: Get the sigma for an object of class `gageRR`.

Usage:

```
gageRR.c$get.sigma()
```

Method `set.sigma()`: Set the sigma for an object of class `gageRR`.

Usage:

```
gageRR.c$set.sigma(value)
```

Arguments:

value Valor of sigma

Method `plot()`: This function creates a customized plot using the data from the `gageRR.c` object.

Usage:

```
gageRR.c$plot(main = NULL, xlab = NULL, ylab = NULL, col, lwd, fun = mean)
```

Arguments:

main Character string specifying the title of the plot.

xlab A character string for the x-axis label.

ylab A character string for the y-axis label.

col A character string or vector specifying the color(s) to be used for the plot elements.

lwd A numeric value specifying the line width of plot elements

fun Function to use for the calculation of the interactions (e.g., mean, median). Default is mean.

Examples:

```
# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$plot()
```

Method `errorPlot()`: The data from an object of class `gageRR` can be analyzed by running 'Error Charts' of the individual deviations from the accepted reference values. These 'Error Charts' are provided by the function `errorPlot`.

Usage:

```
gageRR.c$errorPlot(main, xlab, ylab, col, pch, ylim, legend = TRUE)
```

Arguments:

`main` a main title for the plot.
`xlab` A character string for the x-axis label.
`ylab` A character string for the y-axis label.
`col` Plotting color.
`pch` An integer specifying a symbol or a single character to be used as the default in plotting points.
`ylim` The y limits of the plot.
`legend` A logical value specifying whether a legend is plotted automatically. By default legend is set to 'TRUE'.

Examples:

```
# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$errorPlot()
```

Method `whiskersPlot()`: In a Whiskers Chart, the high and low data values and the average (median) by part-by-operator are plotted to provide insight into the consistency between operators, to indicate outliers and to discover part-operator interactions. The Whiskers Chart reminds of boxplots for every part and every operator.

Usage:

```
gageRR.c$whiskersPlot(main, xlab, ylab, col, ylim, legend = TRUE)
```

Arguments:

`main` a main title for the plot.
`xlab` A character string for the x-axis label.
`ylab` A character string for the y-axis label.
`col` Plotting color.
`ylim` The y limits of the plot.
`legend` A logical value specifying whether a legend is plotted automatically. By default legend is set to 'TRUE'.

Examples:


```

# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$whiskersPlot()

```

Method `averagePlot()`: `averagePlot` creates all x-y plots of averages by size out of an object of class `gageRR`. Therefore the averages of the multiple readings by each operator on each part are plotted with the reference value or overall part averages as the index.

Usage:

```
gageRR.c$averagePlot(main, xlab, ylab, col, single = FALSE)
```

Arguments:

`main` a main title for the plot.

`xlab` A character string for the x-axis label.

`ylab` A character string for the y-axis label.

`col` Plotting color.

`single` A logical value.If 'TRUE' a new graphic device will be opened for each plot. By default `single` is set to 'FALSE'.

Examples:

```

# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

```

```
gdo$averagePlot()
```

Method compPlot(): compPlot creates comparison x-y plots of an object of class gageRR. The averages of the multiple readings by each operator on each part are plotted against each other with the operators as indices. This plot compares the values obtained by one operator to those of another.

Usage:

```
gageRR.c$compPlot(main, xlab, ylab, col, cex.lab, fun = NULL)
```

Arguments:

main a main title for the plot.

xlab A character string for the x-axis label.

ylab A character string for the y-axis label.

col Plotting color.

cex.lab The magnification to be used for x and y labels relative to the current setting of cex.

fun Optional function that will be applied to the multiple readings of each part. fun should be an object of class function like mean, median, sum, etc. By default, fun is set to 'NULL' and all readings will be plotted.

Examples:

```
# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$compPlot()
```

Method clone(): The objects of this class are cloneable with this method.

Usage:

```
gageRR.c$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

Examples

```
#create gageRR-object
gdo <- gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
```

```

#vector of responses
y <- c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

#appropriate responses
gdo$response(y)
# perform and gageRR
gdo <- gageRR(gdo)

# Using the plots
gdo$plot()

## -----
## Method `gageRR.c$plot`
## -----

# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$plot()

## -----
## Method `gageRR.c$errorPlot`
## -----

# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

```

```

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$errorPlot()

## -----
## Method `gageRR.c$whiskersPlot`
## -----

# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$whiskersPlot()

## -----
## Method `gageRR.c$averagePlot`
## -----

# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$averagePlot()

## -----

```

```
## Method `gageRR.c$compPlot`
## -----

# Create gageRR-object
gdo = gageRRDesign(Operators = 3, Parts = 10, Measurements = 3, randomize = FALSE)
# Vector of responses
y = c(0.29,0.08, 0.04,-0.56,-0.47,-1.38,1.34,1.19,0.88,0.47,0.01,0.14,-0.80,
      -0.56,-1.46, 0.02,-0.20,-0.29,0.59,0.47,0.02,-0.31,-0.63,-0.46,2.26,
      1.80,1.77,-1.36,-1.68,-1.49,0.41,0.25,-0.11,-0.68,-1.22,-1.13,1.17,0.94,
      1.09,0.50,1.03,0.20,-0.92,-1.20,-1.07,-0.11, 0.22,-0.67,0.75,0.55,0.01,
      -0.20, 0.08,-0.56,1.99,2.12,1.45,-1.25,-1.62,-1.77,0.64,0.07,-0.15,-0.58,
      -0.68,-0.96,1.27,1.34,0.67,0.64,0.20,0.11,-0.84,-1.28,-1.45,-0.21,0.06,
      -0.49,0.66,0.83,0.21,-0.17,-0.34,-0.49,2.01,2.19,1.87,-1.31,-1.50,-2.16)

# Appropriate responses
gdo$response(y)
# Perform and gageRR
gdo <- gageRR(gdo)

gdo$compPlot()
```

gageRRDesign

gageRRDesign: Gage R&R - Gage Repeatability and Reproducibility

Description

Function to Creates a Gage R&R design.

Usage

```
gageRRDesign(
  Operators = 3,
  Parts = 10,
  Measurements = 3,
  method = "crossed",
  sigma = 6,
  randomize = TRUE
)
```

Arguments

| | |
|--------------|---|
| Operators | Numeric value giving a number or a character vector defining the Operators. By default Operators is set to '3'. |
| Parts | A number or character vector defining the Parts. By default parts is set to '10'. |
| Measurements | A number defining the measurements per part. By default Measurements is set to '3'. |

| | |
|-----------|--|
| method | Character string specifying the Gage R&R method. <code>`crossed`</code> which is the typical design for performing a Measurement Systems Analysis using Gage Repeatability and Reproducibility or <code>`nested`</code> which is used for destructive testing (i.e. the same part cannot be measured twice). Operators measure each a different sample of parts under the premise that the parts of each batch are alike. By default method is set to <code>`crossed`</code> . |
| sigma | For <code>sigma=6</code> this relates to 99.73 percent representing the full spread of a normal distribution function (i.e. <code>pnorm(3) - pnorm(-3)</code>). Another popular setting <code>sigma=5.15</code> relates to 99 percent (i.e. <code>pnorm(2.575) - pnorm(-2.575)</code>). By default sigma is set to <code>'6'</code> . |
| randomize | Logical value. TRUE (default) randomizes the gageRR design. |

Value

The function `gageRRDesign` returns an object of class `gageRR`.

See Also

[gageRR.c](#), [gageRR](#).

Examples

```
design <- gageRRDesign(Operators = 3, Parts = 10, Measurements = 3,
                     method = "crossed", sigma = 6, randomize = TRUE)
```

| | |
|-----------------|------------------------|
| interactionPlot | <i>interactionPlot</i> |
|-----------------|------------------------|

Description

Creates an interaction plot for the factors in a factorial design to visualize the interaction effects between them.

Usage

```
interactionPlot(dfac, response = NULL, fun = mean, main, col = 1:2)
```

Arguments

| | |
|----------|--|
| dfac | An object of class facDesign.c , representing a factorial design. |
| response | Response variable. If the response data frame of <code>fdo</code> consists of more than one responses, this variable can be used to choose just one column of the response data frame. <code>response</code> Needs to be an object of class character with length of <code>'1'</code> . It needs to be the same character as the name of the response in the response data frame that should be plotted. |
| fun | Function to use for the calculation of the interactions (e.g., mean, median). Default is mean. |

main Character string: title of the plot.

col Vector of colors for the plot. Single colors can be given as character strings or numeric values. Default is 1:2.

Details

`interactionPlot()` displays interactions for an object of class `facDesign` (i.e. 2^k full or 2^k -p fractional factorial design). Parts of the original `interactionPlot` were integrated.

Value

Return an interaction plot for the factors in a factorial design.

See Also

[fracDesign](#), [facDesign](#)

Examples

```
# Example 1
# Create the facDesign object
dfac <- facDesign(k = 3, centerCube = 4)
dfac$names(c('Factor 1', 'Factor 2', 'Factor 3'))

# Assign performance to the factorial design
rend <- c(simProc(120,140,1), simProc(80,140,1), simProc(120,140,2),
          simProc(120,120,1), simProc(90,130,1.5), simProc(90,130,1.5),
          simProc(80,120,2), simProc(90,130,1.5), simProc(90,130,1.5),
          simProc(120,120,2), simProc(80,140,2), simProc(80,120,1))
dfac$.response(rend)

# Create an interaction plot
interactionPlot(dfac, fun = mean, col = c("purple", "red"))

# Example 2
vp <- fracDesign(k=3, replicates = 2)
y <- 4*vp$get(j=1) -7*vp$get(j=2) + 2*vp$get(j=2)*vp$get(j=1) +
     0.2*vp$get(j=3) + rnorm(16)
vp$.response(y)

interactionPlot(vp)
```

Description

Function to generate simplex lattice and simplex centroid mixture designs with optional center points and axial points.

Usage

```

mixDesign(
  p,
  n = 3,
  type = "lattice",
  center = TRUE,
  axial = FALSE,
  delta,
  replicates = 1,
  lower,
  total = 1,
  randomize,
  seed = 1234
)

```

Arguments

| | |
|------------|--|
| p | Numerical value giving the amount of factors. |
| n | Numerical value specifying the degree (ignored if type = 'centroid'). |
| type | Character string giving the type of design. type can be 'lattice' or 'centroid' (referencing to the first source under the section references). By default type is set to 'lattice'. |
| center | Logical value specifying whether (optional) center points will be added. By default 'center' is set to 'TRUE'. |
| axial | Logical value specifying whether (optional) axial points will be added. By default 'axial' is set to 'FALSE'. |
| delta | Numerical value giving the delta (see references) for axial runs. No default setting. |
| replicates | Vector with the number of replicates for the different design points i.e. c(center = 1, axial = 1, pureBlend = 1, BinaryBlend = 1, p-3 blend, p-2 blend, p-1 blend). By default 'replicates' is set to '1'. |
| lower | Numeric vector of lower-bound constraints on the component proportions (i.e. must be given in percent). |
| total | Numeric vector with <ul style="list-style-type: none"> • [1] the percentage of the mixture made up by the q - components (e.g. q = 3 and $x_1 + x_2 + x_3 = 0.8$, total = 0.8 with 0.2 for the other factors being held constant) • [2] overall total in corresponding units (e.g. 200ml for the overall mixture) |
| randomize | Logical value. If 'TRUE' the RunOrder of the mixture design will be randomized (default). |
| seed | Nmerical value giving the input for set.seed. |

Value

The function `mixDesig()` returns an object of class `mixDesig()`.

Note

In this version the creation of (augmented) lattice, centroid mixture designs is fully supported. Getters and Setter methods for the mixDesign object exist just as for objects of class facDesign (i.e. factorial designs).

The creation of constrained component proportions is partially supported but don't rely on it. Visualization (i.e. ternary plots) for some of these designs can be done with the help of the wirePlot3 and contourPlot3 function.

See Also

[mixDesign.c](#), [facDesign.c](#), [facDesign](#), [fracDesign](#), [rsmDesign](#), [wirePlot3](#), [contourPlot3](#).

Examples

```
# Example usage of mixDesign
mdo <- mixDesign(3, 2, center = FALSE, axial = FALSE, randomize = FALSE, replicates = c(1, 1, 2, 3))

mdo$names(c("polyethylene", "polystyrene", "polypropylene"))
elongation <- c(11.0, 12.4, 15.0, 14.8, 16.1, 17.7,
               16.4, 16.6, 8.8, 10.0, 10.0, 9.7,
               11.8, 16.8, 16.0)
mdo$.response(elongation)

mdo$units()
mdo$summary()
```

mixDesign.c

mixDesign-class: Class 'mixDesign'

Description

mixDesign class for simplex lattice and simplex centroid mixture designs with optional center points and augmented points.

Public fields

name Character string representing the name of the design.

factors List of factors involved in the mixture design, including their levels and settings.

total Numeric value representing the total number of runs in the design.

lower Numeric vector representing the lower bounds of the factors in the design.

design Data frame containing the design matrix for the mixture design.

designType Character string specifying the type of design (e.g., "simplex-lattice", "simplex-centroid").

pseudo Data frame containing pseudo-experimental runs if applicable.

response Data frame containing the responses or outcomes measured in the design.

Type Data frame specifying the type of design used (e.g., "factorial", "response surface").

block Data frame specifying block structures if the design is blocked.
 runOrder Data frame specifying the order in which runs are performed.
 standardOrder Data frame specifying the standard order of the runs.
 desireVal List of desired values or targets for the response variables.
 desirability List of desirability scores or metrics based on the desired values.
 fits Data frame containing the fitted model parameters and diagnostics.

Methods

Public methods:

- `mixDesign.c$.factors()`
- `mixDesign.c$names()`
- `mixDesign.c$as.data.frame()`
- `mixDesign.c$print()`
- `mixDesign.c$.response()`
- `mixDesign.c$.nfp()`
- `mixDesign.c$summary()`
- `mixDesign.c$units()`
- `mixDesign.c$lows()`
- `mixDesign.c$highs()`
- `mixDesign.c$clone()`

Method `.factors()`: Get and set the factors in an object of class `mixDesign`

Usage:

`mixDesign.c$.factors(value)`

Arguments:

value New factors, If missing value get the factors.

Method `names()`: Get and set the names in an object of class `mixDesign`.

Usage:

`mixDesign.c$names(value)`

Arguments:

value New names, If missing value get the names.

Method `as.data.frame()`: Methods for function `as.data.frame` in Package base.

Usage:

`mixDesign.c$as.data.frame()`

Method `print()`: Methods for function `print` in Package base.

Usage:

`mixDesign.c$print()`

Method `.response()`: Get and set the the response in an object of class `mixDesign`.

Usage:

```
mixDesign.c$.response(value)
```

Arguments:

value New response, If missing value get the response.

Method .nfp(): Prints a summary of the factors attributes including their low, high, name, unit, and type.

Usage:

```
mixDesign.c$.nfp()
```

Method summary(): Methods for function summary in Package base.

Usage:

```
mixDesign.c$summary()
```

Method units(): Get and set the units for the factors in an object of class mixDesign.

Usage:

```
mixDesign.c$units(value)
```

Arguments:

value New units, If missing value get the units.

Method lows(): Get and set the lows for the factors in an object of class mixDesign.

Usage:

```
mixDesign.c$lows(value)
```

Arguments:

value New lows, If missing value get the lows.

Method highs(): Get and set the highs for the factors in an object of class mixDesign.

Usage:

```
mixDesign.c$highs(value)
```

Arguments:

value New highs, If missing value get the highs.

Method clone(): The objects of this class are cloneable with this method.

Usage:

```
mixDesign.c$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

See Also

[mixDesign](#), [contourPlot3](#), [wirePlot3](#)

MSALinearity

*MSALinearity-class: Class 'MSALinearity'***Description**

R6 class for performing Measurement System Analysis (MSA) Linearity studies.

Public fields

X A data frame containing the independent variable(s) used in the linearity study.

Y A data frame containing the dependent variable(s) or responses measured in the linearity study.

model The linear model object resulting from the linearity analysis.

conf.level A numeric value specifying the confidence level for the linearity analysis. This should be between 0 and 1 (e.g., 0.95 for a 95% confidence level).

Linearity A list or data frame containing the results of the linearity study, including the linearity value and associated statistics.

GageName A character string specifying the name of the gage or measurement system under analysis.

GageTolerance A numeric value specifying the tolerance of the gage or measurement system.

DateOfStudy A character string or Date object indicating the date when the linearity study was conducted.

PersonResponsible A character string specifying the name of the person responsible for the linearity study.

Comments A character string for additional comments or notes about the linearity study.

facNames A character vector specifying the names of the factors involved in the study, if any.

Methods**Public methods:**

- `MSALinearity$response()`
- `MSALinearity$summary()`
- `MSALinearity$plot()`
- `MSALinearity$print()`
- `MSALinearity$as.data.frame()`
- `MSALinearity$clone()`

Method `response()`: Get and set the the response in an object of class `MSALinearity`.

Usage:

`MSALinearity$response(value)`

Arguments:

value New response, If missing value get the response.

Method `summary()`: Methods for function `summary` in Package base.

Usage:

```
MSALinearity$summary()
```

Method `plot()`: Plots the measurement system, including individual biases, mean bias, and a regression line with confidence intervals.

Usage:

```
MSALinearity$plot(ylim, col, pch, lty = c(1, 2))
```

Arguments:

`ylim` A numeric vector specifying the limits for the y-axis. If not provided, the limits are automatically calculated based on data.

`col` A vector specifying the colors to be used for different plot elements.

`pch` A numeric vector specifying the plotting characters (symbols) for individual data points and mean bias points.

`lty` A numeric vector specifying the line types for the regression line and its confidence intervals. The default is `c(1, 2)`.

Method `print()`: Methods for function `print` in Package base.

Usage:

```
MSALinearity$print()
```

Method `as.data.frame()`: Return a data frame with the information of the object `MSALinearity`.

Usage:

```
MSALinearity$as.data.frame()
```

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
MSALinearity$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

Description

Creates a plot for visualizing the relationships between a response variable and multiple factors.

Usage

```
mvPlot(
  response,
  fac1,
  fac2,
  fac3,
  fac4,
  sort = TRUE,
  col,
  pch,
  labels = FALSE,
  quantile = TRUE,
  FUN = NA
)
```

Arguments

| | |
|----------|---|
| response | The values of the response in a vector.response must be declared. |
| fac1 | Vector providing factor 1 as shown in the example.fac1 must be declared. |
| fac2 | Vector providing factor 1 as shown in the example.fac2 must be declared. |
| fac3 | Optional vector providing factor 3 as shown in the example. |
| fac4 | Optional vector providing factor 4 as shown in the example. |
| sort | Logical value indicating whether the sequence of the factors given by fac1 - fac4 should be reordered to minimize the space needed to visualize the Multi-Vari-Chart. By default sort is set to 'TRUE'. |
| col | Graphical parameter. Vector containing numerical values or character strings giving the colors for the different factors. By default col starts with the value '3' and is continued as needed. |
| pch | Graphical parameter. Vector containing numerical values or single characters giving plotting points for the different factors. See points for possible values and their interpretation. Note that only integers and single-character strings can be set as a graphics parameter (and not NA nor NULL). By default pch starts with the value '1' and is continued as needed. |
| labels | Logical value indicating whether the single points should be labels with the row-number of the data.frame invisibly returned by the function mvPlot. By default labels is set to 'FALSE'. |
| quantile | A logical value indicating whether the quantiles (0.00135, 0.5 & 0.99865) should be visualized for the single groups. By default quantile is set to 'TRUE'. |
| FUN | An optional function to be used for calculation of response for unique settings of the factors e.g. the mean. By default FUN is set to 'NA' and therefore omitted. |

Value

mvPlot returns an invisible list containing: a data.frame in which all plotted points are listed and the final plot. The option labels can be used to plot the row-numbers at the single points and to ease the identification.

Examples

```
#Example I
examp1 = expand.grid(c("Engine1", "Engine2", "Engine3"), c(10, 20, 30, 40))
examp1 = as.data.frame(rbind(examp1, examp1, examp1))
examp1 = cbind(examp1, rnorm(36, 1, 0.02))
names(examp1) = c("factor1", "factor2", "response")
mvPlot(response = examp1[,3], fac1 = examp1[,2], fac2 = examp1[,1], sort=FALSE, FUN=mean)
```

normalPlot

normalPlot: Normal plot

Description

Creates a normal probability plot for the effects in a [facDesign.c](#) object.

Usage

```
normalPlot(
  dfac,
  response = NULL,
  main,
  ylim,
  xlim,
  xlab,
  ylab,
  pch,
  col,
  border = "red"
)
```

Arguments

| | |
|----------|--|
| dfac | An object of class facDesign.c . |
| response | Response variable. If the response data frame of fdo consists of more than one responses, this variable can be used to choose just one column of the response data frame. response needs to be an object of class character with length of '1'. It needs to be the same character as the name of the response in the response data frame that should be plotted. By default response is set to NULL. |
| main | Character string specifying the main title of the plot. |
| ylim | Graphical parameter. The y limits of the plot. |
| xlim | Graphical parameter. The x limits (x1, x2) of the plot. Note that x1 > x2 is allowed and leads to a 'reversed axis'. |
| xlab | Character string specifying the label for the x-axis. |
| ylab | Character string specifying the label for the y-axis. |

| | |
|--------|--|
| pch | Graphical parameter. Vector containing numerical values or single characters giving plotting points for the different factors. Accepts values from 0 to 25, each corresponding to a specific shape in ggplot2 (e.g., 0: square, 1: circle, 2: triangle point up, 3: plus, 4: cross). |
| col | Graphical parameter. Single numerical value or character string giving the color for the points (e.g., 1: black, 2: red, 3: green). |
| border | Graphical parameter. Single numerical value or character string giving the color of the border line. |

Details

If the given `facDesign.c` object `fdo` contains replicates this function will deliver a normal plot i.e.: effects divided by the standard deviation (t-value) will be plotted against an appropriate probability scaling (see: 'ppoints'). If the given `facDesign.c` object `fdo` contains no replications the standard error can not be calculated. In that case the function will deliver an effect plot. i.e.: the effects will be plotted against an appropriate probability scaling. (see: 'ppoints').

Value

The function `normalPlot` returns an invisible list containing:

| | |
|---------|---|
| effects | a list of effects for each response in the <code>facDesign.c</code> object. |
| plot | The generated normal plot. |

See Also

[facDesign](#), [paretoPlot](#), [interactionPlot](#)

Examples

```
# Example 1: Create a normal probability plot for a full factorial design
dfac <- facDesign(k = 3, centerCube = 4)
dfac$names(c('Factor 1', 'Factor 2', 'Factor 3'))

# Assign performance to the factorial design
rend <- c(simProc(120,140,1), simProc(80,140,1), simProc(120,140,2),
          simProc(120,120,1), simProc(90,130,1.5), simProc(90,130,1.5),
          simProc(80,120,2), simProc(90,130,1.5), simProc(90,130,1.5),
          simProc(120,120,2), simProc(80,140,2), simProc(80,120,1))
dfac$.response(rend)

normalPlot(dfac)

# Example 2: Create a normal probability plot with custom colors and symbols
normalPlot(dfac, col = "blue", pch = 4)
```

`oaChoose`*oaChoose: Taguchi Designs*

Description

Shows a matrix of possible taguchi designs.

Usage

```
oaChoose(factors1, factors2, level1, level2, ia)
```

Arguments

| | |
|-----------------------|------------------------------|
| <code>factors1</code> | Number of factors on level1. |
| <code>factors2</code> | Number of factors on level2. |
| <code>level1</code> | Number of levels on level1. |
| <code>level2</code> | Number of levels on level2. |
| <code>ia</code> | Number of interactions. |

Details

`oaChoose` returns possible taguchi designs. Specifying the number of factor1 factors with level1 levels (`factors1 = 2`, `level1 = 3` means 2 factors with 3 factor levels) and factor2 factors with level2 levels and desired interactions one or more taguchi designs are suggested. If all parameters are set to '0', a matrix of possible taguchi designs is shown.

Value

`oaChoose` returns an object of class `taguchiDesign`.

See Also

- [facDesign](#): for 2^k factorial designs.
- [rsmDesign](#): for response surface designs.
- [fracDesign](#): for fractional factorial design.
- [gageRRDesign](#): for gage designs.

Examples

```
oaChoose()
```

optimum *optimum: Optimal factor settings*

Description

This function calculates the optimal factor settings based on defined desirabilities and constraints. It supports two approaches: (I) evaluating all possible factor settings via a grid search and (II) using optimization methods such as ``optim`` or ``gso1np`` from the `Rsolnp` package. Using ``optim`` initial values for the factors to be optimized over can be set via `start`. The optimality of the solution depends critically on the starting parameters which is why it is recommended to use `type=`gso1np`` although calculation takes a while.

Usage

```
optimum(fdo, constraints, steps = 25, type = "grid", start)
```

Arguments

| | |
|--------------------------|--|
| <code>fdo</code> | An object of class <code>facDesign.c</code> with fits and desires set. |
| <code>constraints</code> | A list specifying the constraints for the factors, e.g., <code>list(A = c(-2, 1), B = c(0, 0.8))</code> . |
| <code>steps</code> | Number of grid points per factor if <code>type = `grid`</code> . Default is <code>'25'</code> . |
| <code>type</code> | The type of search to perform. Supported values are <code>`grid`</code> , <code>`optim`</code> , and <code>`gso1np`</code> . See Details for more information. |
| <code>start</code> | A numeric vector providing the initial values for the factors when using <code>type = `optim`</code> . |

Details

The function allows you to optimize the factor settings either by evaluating a grid of possible settings (`type = `grid``) or by using optimization algorithms (`type = `optim`` or ``gso1np``). The choice of optimization method may significantly affect the result, especially for desirability functions that lack continuous first derivatives. When using `type = `optim``, it is advisable to provide `start` values to avoid local optima. The ``gso1np`` method is recommended for its robustness, although it may be computationally intensive.

Value

Return an object of class `desOpt`.

See Also

[overall](#), [desirability](#),

Examples

```

#Example 1: Simultaneous Optimization of Several Response Variables
#Define the response surface design as given in the paper and sort via Standard Order
fdo = rsmDesign(k = 3, alpha = 1.633, cc = 0, cs = 6)
fdo = randomize(fdo, so = TRUE)
#Attaching the 4 responses
y1 = c(102, 120, 117, 198, 103, 132,
       132, 139, 102, 154, 96, 163,
       116, 153, 133, 133, 140, 142,
       145, 142)

y2 = c(900, 860, 800, 2294, 490, 1289,
       1270, 1090, 770, 1690, 700, 1540,
       2184, 1784, 1300, 1300, 1145, 1090,
       1260, 1344)

y3 = c(470, 410, 570, 240, 640, 270,
       410, 380, 590, 260, 520, 380,
       520, 290, 380, 380, 430, 430,
       390, 390)

y4 = c(67.5, 65, 77.5, 74.5, 62.5, 67,
       78, 70, 76, 70, 63, 75,
       65, 71, 70, 68.5, 68, 68,
       69, 70)

fdo$response(data.frame(y1, y2, y3, y4)[c(5,2,3,8,1,6,7,4,9:20),])
#Setting names and real values of the factors
fdo$names(c("silica", "silan", "sulfur"))
fdo$highs(c(1.7, 60, 2.8))
fdo$lowes(c(0.7, 40, 1.8))
#Setting the desires
fdo$desires(desirability(y1, 120, 170, scale = c(1,1), target = "max"))
fdo$desires(desirability(y2, 1000, 1300, target = "max"))
fdo$desires(desirability(y3, 400, 600, target = 500))
fdo$desires(desirability(y4, 60, 75, target = 67.5))
#Setting the fits
fdo$set.fits(fdo$lm(y1 ~ A + B + C + A:B + A:C + B:C + I(A^2) + I(B^2) + I(C^2)))
fdo$set.fits(fdo$lm(y2 ~ A + B + C + A:B + A:C + B:C + I(A^2) + I(B^2) + I(C^2)))
fdo$set.fits(fdo$lm(y3 ~ A + B + C + A:B + A:C + B:C + I(A^2) + I(B^2) + I(C^2)))
fdo$set.fits(fdo$lm(y4 ~ A + B + C + A:B + A:C + B:C + I(A^2) + I(B^2) + I(C^2)))
#Calculate the best factor settings using type = "optim"
optimum(fdo, type = "optim")
#Calculate the best factor settings using type = "grid"
optimum(fdo, type = "grid")

```

Description

This function calculates the desirability for each response as well as the overall desirability. The resulting data.frame can be used to plot the overall desirability as well as the desirabilities for each response. This function is designed to visualize the desirability approach for multiple response optimization.

Usage

```
overall(fdo, steps = 20, constraints, ...)
```

Arguments

| | |
|-------------|--|
| fdo | An object of class <code>facDesign.c</code> containing fits and desires. |
| steps | A numeric value indicating the number of points per factor to be evaluated, which also specifies the grid size. Default is '20'. |
| constraints | A list of constraints for the factors in coded values, such as <code>list(A > 0.5, B < 0.2)</code> . |
| ... | Further arguments passed to other methods. |

Value

A data.frame with a column for each factor, the desirability for each response, and a column for the overall desirability.

See Also

[facDesign](#), [rsmDesign](#), [desirability](#).

Examples

```
#Example 1: Arbitrary example with random data
rsdo = rsmDesign(k = 2, blocks = 2, alpha = "both")
rsdo$response(data.frame(y = rnorm(rsdo$nrow()), y2 = rnorm(rsdo$nrow())))
rsdo$set.fits(rsdo$lm(y ~ A*B + I(A^2) + I(B^2)))
rsdo$set.fits(rsdo$lm(y2 ~ A*B + I(A^2) + I(B^2)))
rsdo$desires(desirability(y, -1, 2, scale = c(1, 1), target = "max"))
rsdo$desires(desirability(y2, -1, 0, scale = c(1, 1), target = "min"))
dVals = overall(rsdo, steps = 10, constraints = list(A = c(-0.5,1), B = c(0, 1)))
```

paretoChart

paretoChart: Pareto Chart

Description

Function to create a Pareto chart, displaying the relative frequency of categories.

Usage

```
paretoChart(
  x,
  weight,
  main,
  col,
  border,
  xlab,
  ylab = "Frequency",
  percentVec,
  showTable = TRUE,
  showPlot = TRUE
)
```

Arguments

| | |
|------------|---|
| x | A vector of qualitative values. |
| weight | A numeric vector of weights corresponding to each category in x. |
| main | A character string for the main title of the plot. |
| col | A numerical value or character string defining the fill-color of the bars. |
| border | A numerical value or character string defining the border-color of the bars. |
| xlab | A character string for the x-axis label. |
| ylab | A character string for the y-axis label. By default, ylab is set to `Frequency`. |
| percentVec | A numerical vector giving the position and values of tick marks for percentage axis. |
| showTable | Logical value indicating whether to display a table of frequencies. By default, showTable is set to TRUE. |
| showPlot | Logical value indicating whether to display the Pareto chart. By default, showPlot is set to TRUE. |

Value

paretoChart returns a Pareto chart along with a frequency table if showTable is TRUE. Additionally, the function returns an invisible list containing:

| | |
|-------|--|
| plot | The generated Pareto chart. |
| table | A data.frame with the frequencies and percentages of the categories. |

Examples

```
# Example 1: Creating a Pareto chart for defect types
defects1 <- c(rep("E", 62), rep("B", 15), rep("F", 3), rep("A", 10),
             rep("C", 20), rep("D", 10))
paretoChart(defects1)

# Example 2: Creating a Pareto chart with weighted frequencies
```

```
defects2 <- c("E", "B", "F", "A", "C", "D")
frequencies <- c(62, 15, 3, 10, 20, 10)
weights <- c(1.5, 2, 0.5, 1, 1.2, 1.8)
names(weights) <- defects2 # Assign names to the weights vector

paretoChart(defects2, weight = frequencies * weights)
```

paretoPlot

paretoPlot

Description

Display standardized effects and interactions of a `facDesign.c` object in a pareto plot.

Usage

```
paretoPlot(
  dfac,
  abs = TRUE,
  decreasing = TRUE,
  alpha = 0.05,
  response = NULL,
  ylim,
  xlab,
  ylab,
  main,
  p.col,
  legend_left = TRUE
)
```

Arguments

| | |
|-------------------------|--|
| <code>dfac</code> | An object of class <code>facDesign</code> . |
| <code>abs</code> | Logical. If <code>TRUE</code> , absolute effects and interactions are displayed. Default is <code>TRUE</code> . |
| <code>decreasing</code> | Logical. If <code>TRUE</code> , effects and interactions are sorted decreasing. Default is <code>TRUE</code> . |
| <code>alpha</code> | The significance level used to calculate the critical value |
| <code>response</code> | Response variable. If the response data frame of <code>fdo</code> consists of more than one responses, this variable can be used to choose just one column of the response data frame. <code>response</code> needs to be an object of class <code>character</code> with length of '1'. It needs to be the same character as the name of the response in the response data frame that should be plotted. By default <code>response</code> is set to <code>NULL</code> . |
| <code>ylim</code> | Numeric vector of length 2: limits for the y-axis. If missing, the limits are set automatically. |
| <code>xlab</code> | Character string: label for the x-axis. |

| | |
|-------------|---|
| ylab | Character string: label for the y-axis. |
| main | Character string: title of the plot. |
| p.col | Character string specifying the color palette to use for the plot. Must be one of the following values from the RColorBrewer package: <ul style="list-style-type: none"> • `Set1` • `Set2` • `Set3` • `Pastel1` • `Pastel2` • `Paired` • `Dark2` • `Accent` |
| legend_left | Logical value indicating whether to place the legend on the left side of the plot. Default is TRUE. |

Details

paretoPlot displays a pareto plot of effects and interactions for an object of class facDesign (i.e. 2^k full or 2^{k-p} fractional factorial design). For a given significance level α , a critical value is calculated and added to the plot. Standardization is achieved by dividing estimates with their standard error. For unreplicated fractional factorial designs a Lenth Plot is generated.

Value

The function paretoPlot returns an invisible list containing:

| | |
|---------|---|
| effects | a list of effects for each response in the facDesign.c object |
| plot | The generated PP plot. |

See Also

[fracDesign](#), [facDesign](#)

Examples

```
# Create the facDesign object
dfac <- facDesign(k = 3, centerCube = 4)
dfac$names(c('Factor 1', 'Factor 2', 'Factor 3'))

# Assign performance to the factorial design
rend <- c(simProc(120,140,1), simProc(80,140,1), simProc(120,140,2),
          simProc(120,120,1), simProc(90,130,1.5), simProc(90,130,1.5),
          simProc(80,120,2), simProc(90,130,1.5), simProc(90,130,1.5),
          simProc(120,120,2), simProc(80,140,2), simProc(80,120,1))
dfac$.response(rend)

paretoPlot(dfac)
paretoPlot(dfac, decreasing = TRUE, abs = FALSE, p.col = "Pastel1")
```

pbDesign

pbDesign: Plackett-Burman Designs

Description

Function to create a Plackett-Burman design.

Usage

```
pbDesign(n, k, randomize = TRUE, replicates = 1)
```

Arguments

| | |
|------------|--|
| n | Integer value giving the number of trials. |
| k | Integer value giving the number of factors. |
| randomize | A logical value (TRUE/FALSE) that specifies whether to randomize the RunOrder of the design. By default, randomize is set to TRUE. |
| replicates | An integer specifying the number of replicates for each run in the design. |

Value

A pbDesign returns an object of class pbDesign.

Note

This function creates Plackett-Burman Designs down to $n=26$. Bigger Designs are not implemented because of lack in practicability. For the creation either the number of factors or the number of trials can be denoted. Wrong combinations will lead to an error message. Originally Plackett-Burman-Design are applicable for number of trials divisible by 4. If n is not divisible by 4 this function will take the next larger Plackett-Burman Design and truncate the last rows and columns.

See Also

- [facDesign](#): for 2^k factorial designs.
- [rsmDesign](#): for response surface designs.
- [fracDesign](#): for fractional factorial design.
- [gageRRDesign](#): for gage designs.

Examples

```
pbdo<- pbDesign(n=5)
pbdo$summary()
```

pbDesign.c

pbDesign

Description

An R6 class representing a Plackett-Burman design.

Public fields

`name` A character string specifying the name of the design. Default is `NULL`.

`factors` A list of factors included in the Taguchi design. Each factor is typically an instance of the `pbFactor` class.

`design` A `data.frame` representing the design matrix of the experiment. This includes the levels of each factor for every run of the experiment. Default is an empty `data.frame`.

`designType` A character string specifying the type of Taguchi design used. Default is `NULL`.

`replic` A `data.frame` containing the replication information for the design. Default is an empty `data.frame`.

`response` A `data.frame` storing the response values collected from the experiment. Default is an empty `data.frame`.

`Type` A `data.frame` specifying the type of responses or factors involved in the design. Default is an empty `data.frame`.

`block` A `data.frame` indicating any blocking factors used in the design. Default is an empty `data.frame`.

`runOrder` A `data.frame` detailing the order in which the experimental runs were conducted. Default is an empty `data.frame`.

`standardOrder` A `data.frame` detailing the standard order of the experimental runs. Default is an empty `data.frame`.

`desireVal` A list storing desired values for responses in the experiment. Default is an empty list.

`desirability` A list storing desirability functions used to evaluate the outcomes of the experiment. Default is an empty list.

`fits` A `data.frame` containing model fits or other statistical summaries from the analysis of the experimental data. Default is an empty `data.frame`.

Methods

Public methods:

- `pbDesign.c$values()`
- `pbDesign.c$units()`
- `pbDesign.c$.factors()`
- `pbDesign.c$names()`
- `pbDesign.c$as.data.frame()`
- `pbDesign.c$print()`

- `pbDesign.c$.response()`
- `pbDesign.c$.nfp()`
- `pbDesign.c$summary()`
- `pbDesign.c$clone()`

Method `values()`: Get and set the values for an object of class `pbDesign`.

Usage:

```
pbDesign.c$values(value)
```

Arguments:

value New value, If missing value get the values.

Method `units()`: Get and set the units for an object of class `pbDesign`.

Usage:

```
pbDesign.c$units(value)
```

Arguments:

value New units, If missing value get the units.

Method `.factors()`: Get and set the factors in an object of class `pbDesign`.

Usage:

```
pbDesign.c$.factors(value)
```

Arguments:

value New factors, If missing value get the factors.

Method `names()`: Get and set the names in an object of class `pbDesign`.

Usage:

```
pbDesign.c$names(value)
```

Arguments:

value New names, If missing value get the names.

Method `as.data.frame()`: Return a data frame with the information of the object `pbDesign`.

Usage:

```
pbDesign.c$as.data.frame()
```

Method `print()`: Methods for function `print` in Package base.

Usage:

```
pbDesign.c$print()
```

Method `.response()`: Get and set the the response in an object of class `pbDesign`.

Usage:

```
pbDesign.c$.response(value)
```

Arguments:

value New response, If missing value get the response.

Method `.nfp()`: Prints a summary of the factors attributes including their low, high, name, unit, and type.

Usage:

```
pbDesign.c$.nfp()
```

Method `summary()`: Methods for function summary in Package base.

Usage:

```
pbDesign.c$summary()
```

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
pbDesign.c$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

pbFactor

pbFactor

Description

An R6 class representing a factor in a Plackett-Burman design.

Public fields

`values` A vector containing the levels or values associated with the factor. Default is NA.

`name` A character string specifying the name of the factor. Default is an empty string ``.

`unit` A character string specifying the unit of measurement for the factor. Default is an empty string ``.

`type` A character string specifying the type of the factor, which can be either `numeric` or `categorical`. Default is `numeric`.

Methods

Public methods:

- [pbFactor\\$attributes\(\)](#)
- [pbFactor\\$.values\(\)](#)
- [pbFactor\\$.unit\(\)](#)
- [pbFactor\\$names\(\)](#)
- [pbFactor\\$clone\(\)](#)

Method `attributes()`: Get the attributes of the factor.

Usage:

```
pbFactor$attributes()
```

Method `.values()`: Get and set the values for the factors in an object of class `pbFactor`.

Usage:

```
pbFactor$.values(value)
```

Arguments:

value New values, If missing value get the values.

Method `.unit()`: Get and set the units for the factors in an object of class `pbFactor`.

Usage:

```
pbFactor$.unit(value)
```

Arguments:

value New unit, If missing value get the units.

Method `names()`: Get and set the names in an object of class `pbFactor`.

Usage:

```
pbFactor$names(value)
```

Arguments:

value New names, If missing value get the names.

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
pbFactor$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

pcr

pcr: Process Capability Indices

Description

Calculates the process capability `cp`, `cpk`, `cpkL` (onesided) and `cpkU` (onesided) for a given dataset and distribution. A histogram with a density curve is displayed along with the specification limits and a Quantile-Quantile Plot for the specified distribution. Lower-, upper and total fraction of nonconforming entities are calculated. Box-Cox Transformations are supported as well as the calculation of Anderson Darling Test Statistics.

Usage

```
pcr(  
  x,  
  distribution = "normal",  
  lsl,  
  usl,  
  target,
```

```

boxcox = FALSE,
lambda = c(-5, 5),
main,
xlim,
grouping = NULL,
std.dev = NULL,
conf.level = 0.9973002,
bounds.lty = 3,
bounds.col = "red",
col.fill = "lightblue",
col.border = "black",
col.curve = "red",
plot = TRUE,
ADtest = TRUE
)

```

Arguments

| | |
|--------------|--|
| x | Numeric vector containing the values for which the process capability should be calculated. |
| distribution | Character string specifying the distribution of x. The function cp will accept the following character strings for distribution: <ul style="list-style-type: none"> • `normal` • `log-normal` • `exponential` • `logistic` • `gamma` • `weibull` • `cauchy` • `gamma3` • `weibull3` • `lognormal3` • `beta` • `f` • `geometric` • `poisson` • `negative-binomial` By default distribution is set to `normal`. |
| lsl | A numeric value specifying the lower specification limit. |
| usl | A numeric value specifying the upper specification limit. |
| target | (Optional) numeric value giving the target value. |
| boxcox | Logical value specifying whether a Box-Cox transformation should be performed or not. By default boxcox is set to FALSE. |
| lambda | (Optional) lambda for the transformation, default is to have the function estimate lambda. |

| | |
|-------------------------|--|
| <code>main</code> | A character string specifying the main title of the plot. |
| <code>xlim</code> | A numeric vector of length 2 specifying the x-axis limits for the plot. |
| <code>grouping</code> | (Optional) If grouping is given the standard deviation is calculated as mean standard deviation of the specified subgroups corrected by the factor <code>c4</code> and expected fraction of nonconforming is calculated using this standard deviation. |
| <code>std.dev</code> | An optional numeric value specifying the historical standard deviation (only provided for normal distribution). If <code>NULL</code> , the standard deviation is calculated from the data. |
| <code>conf.level</code> | Numeric value between 0 and 1 giving the confidence interval. By default <code>conf.level</code> is 0.9973 (99.73%) which is the reference interval bounded by the 99.865% and 0.135% quantile. |
| <code>bounds.lty</code> | graphical parameter. For further details see <code>ppPlot</code> or <code>qqPlot</code> . |
| <code>bounds.col</code> | A character string specifying the color of the capability bounds. Default is "red". |
| <code>col.fill</code> | A character string specifying the fill color for the histogram plot. Default is "lightblue". |
| <code>col.border</code> | A character string specifying the border color for the histogram plot. Default is "black". |
| <code>col.curve</code> | A character string specifying the color of the fitted distribution curve. Default is "red". |
| <code>plot</code> | A logical value indicating whether to generate a plot. Default is <code>TRUE</code> . |
| <code>ADtest</code> | A logical value indicating whether to print the Anderson-Darling. Default is <code>TRUE</code> . |

Details

Distribution fitting is delegated to the function `FitDistr` from this package, as well as the calculation of lambda for the Box-Cox Transformation. p-values for the Anderson-Darling Test are reported for the most important distributions.

The process capability indices are calculated as follows:

- **cpk**: minimum of `cpK` and `cpL`.
- **pt**: total fraction nonconforming.
- **pu**: upper fraction nonconforming.
- **pl**: lower fraction nonconforming.
- **cp**: process capability index.
- **cpkL**: lower process capability index.
- **cpkU**: upper process capability index.
- **cpk**: minimum process capability index.

For a Box-Cox transformation, a data vector with positive values is needed to estimate an optimal value of lambda for the Box-Cox power transformation of the values. The Box-Cox power transformation is used to bring the distribution of the data vector closer to normality. Estimation of the optimal lambda is delegated to the function `boxcox` from the MASS package. The Box-Cox transformation has the form $y(\lambda) = \frac{y^\lambda - 1}{\lambda}$ for $\lambda \neq 0$, and $y(\lambda) = \log(y)$ for $\lambda = 0$. The function `boxcox`

computes the profile log-likelihoods for a range of values of the parameter lambda. The function `boxcox.lambda` returns the value of lambda with the maximum profile log-likelihood.

In case no specification limits are given, `lsl` and `usl` are calculated to support a process capability index of 1.

Value

The function returns a list with the following components:

The function `pcr` returns a list with `lambda`, `cp`, `cp1`, `cpu`, `ppt`, `pp1`, `ppu`, `A`, `usl`, `lsl`, `target`, `asTest`, `plot`.

Examples

```
set.seed(1234)
data <- rnorm(20, mean = 20)
pcr(data, "normal", lsl = 17, usl = 23)

set.seed(1234)
weib <- rweibull(20, shape = 2, scale = 8)
pcr(weib, "weibull", usl = 20)
```

pgamma3

pgamma3: The gamma Distribution (3 Parameter)

Description

Density function, distribution function, and quantile function for the Gamma distribution.

Usage

```
pgamma3(q, shape, scale, threshold)
```

Arguments

| | |
|------------------------|--|
| <code>q</code> | A numeric vector of quantiles. |
| <code>shape</code> | The shape parameter, default is 1. |
| <code>scale</code> | The scale parameter, default is 1. |
| <code>threshold</code> | The threshold parameter, default is 0. |

Details

The Gamma distribution with scale parameter alpha, shape parameter c, and threshold parameter zeta has a density given by:

$$f(x) = \frac{c}{\alpha} \left(\frac{x - \zeta}{\alpha} \right)^{c-1} \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

The cumulative distribution function is given by:

$$F(x) = 1 - \exp\left(-\left(\frac{x - \zeta}{\alpha}\right)^c\right)$$

Value

dgamma3 gives the density, pgamma3 gives the distribution function, and qgamma3 gives the quantile function.

Examples

```
dgamma3(x = 1, scale = 1, shape = 5, threshold = 0)
temp <- pgamma3(q = 1, scale = 1, shape = 5, threshold = 0)
temp
qgamma3(p = temp, scale = 1, shape = 5, threshold = 0)
```

plnorm3

plnorm3: The Lognormal Distribution (3 Parameter)

Description

Density function, distribution function, and quantile function for the Lognormal distribution.

Usage

```
plnorm3(q, meanlog, sdlog, threshold)
```

Arguments

| | |
|----------------|---|
| q | A numeric vector of quantiles. |
| meanlog, sdlog | The mean and standard deviation of the distribution on the log scale with default values of 0 and 1 respectively. |
| threshold | The threshold parameter, default is 0. |

Details

The Lognormal distribution with meanlog parameter zeta, sdlog parameter sigma, and threshold parameter theta has a density given by:

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma(x - \theta)} \exp\left(-\frac{(\log(x - \theta) - \zeta)^2}{2\sigma^2}\right)$$

The cumulative distribution function is given by:

$$F(x) = \Phi\left(\frac{\log(x - \theta) - \zeta}{\sigma}\right)$$

where Φ is the cumulative distribution function of the standard normal distribution.

Value

dlnorm3 gives the density, plnorm3 gives the distribution function, and qlnorm3 gives the quantile function.

Examples

```
dlnorm3(x = 2, meanlog = 0, sdlog = 1/8, threshold = 1)
temp <- plnorm3(q = 2, meanlog = 0, sdlog = 1/8, threshold = 1)
temp
qlnorm3(p = temp, meanlog = 0, sdlog = 1/8, threshold = 1)
```

ppPlot

*ppPlot: Probability Plots for various distributions***Description**

Function ppPlot creates a Probability plot of the values in x including a line.

Usage

```
ppPlot(
  x,
  distribution,
  confbounds = TRUE,
  alpha,
  probs,
  main,
  xlab,
  ylab,
  xlim,
  ylim,
  border = "red",
  bounds.col = "black",
  bounds.lty = 1,
  start,
  showPlot = TRUE,
  axis.y.right = FALSE,
  bw.theme = FALSE
)
```

Arguments

- | | |
|--------------|---|
| x | Numeric vector containing the sample data for the ppPlot. |
| distribution | Character string specifying the distribution of x. The function ppPlot will support the following character strings for distribution: <ul style="list-style-type: none"> • <code>`beta`</code> |

| | |
|---------------------------|--|
| | <ul style="list-style-type: none"> • <code>`cauchy`</code> • <code>`chi-squared`</code> • <code>`exponential`</code> • <code>`f`</code> • <code>`gamma`</code> • <code>`geometric`</code> • <code>`log-normal`</code> • <code>`lognormal`</code> • <code>`logistic`</code> • <code>`negative binomial`</code> • <code>`normal`</code> • <code>`Poisson`</code> • <code>`weibull`</code> |
| | By default distribution is set to <code>`normal`</code> . |
| <code>confbounds</code> | Logical value: whether to display confidence bounds. Default is TRUE. |
| <code>alpha</code> | Numeric value: significance level for confidence bounds, default is <code>'0.05'</code> . |
| <code>probs</code> | Vector containing the percentages for the y axis. All the values need to be between <code>'0'</code> and <code>'1'</code> . If <code>'probs'</code> is missing it will be calculated internally. |
| <code>main</code> | Character string: title of the plot. |
| <code>xlab</code> | Character string: label for the x-axis. |
| <code>ylab</code> | Character string: label for the y-axis. |
| <code>xlim</code> | Numeric vector of length 2: limits for the x-axis. |
| <code>ylim</code> | Numeric vector of length 2: limits for the y-axis. |
| <code>border</code> | Character or numeric: color for the border of the line through the quantiles. Default is <code>`red`</code> . |
| <code>bounds.col</code> | Character or numeric: color for the confidence bounds lines. Default is <code>`black`</code> . |
| <code>bounds.lty</code> | Numeric or character: line type for the confidence bounds lines. This can be specified with either an integer (0-6) or a name: <ul style="list-style-type: none"> • 0: blank • 1: solid • 2: dashed • 3: dotted • 4: dotdash • 5: longdash • 6: twodash |
| | Default is <code>'1'</code> (solid line). |
| <code>start</code> | A named list giving the parameters to be fitted with initial values. Must be supplied for some distributions (see Details). |
| <code>showPlot</code> | Logical value indicating whether to display the plot. By default, <code>showPlot</code> is set to TRUE. |
| <code>axis.y.right</code> | Logical value indicating whether to display the y-axis on the right side. By default, <code>axis.y.right</code> is set to FALSE. |
| <code>bw.theme</code> | Logical value indicating whether to use a black-and-white theme from the <code>ggplot2</code> package for the plot. By default, <code>bw.theme</code> is set to FALSE. |

Details

Distribution fitting is performed using the `FitDistr` function from this package. For the computation of the confidence bounds, the variance of the quantiles is estimated using the delta method, which involves the estimation of the observed Fisher Information matrix as well as the gradient of the CDF of the fitted distribution. Where possible, those values are replaced by their normal approximation.

Value

The function `ppPlot` returns an invisible list containing:

| | |
|--------------------|------------------------|
| <code>x</code> | x coordinates. |
| <code>y</code> | y coordinates. |
| <code>int</code> | Intercept. |
| <code>slope</code> | Slope. |
| <code>plot</code> | The generated PP plot. |

See Also

[qqPlot](#), [FitDistr](#).

Examples

```
set.seed(123)
ppPlot(rnorm(20, mean=90, sd=5), "normal", alpha=0.30)
ppPlot(rcauchy(100), "cauchy")
ppPlot(rweibull(50, shape = 1, scale = 1), "weibull")
ppPlot(rlogis(50), "logistic")
ppPlot(rlnorm(50), "log-normal")
ppPlot(rbeta(10, 0.7, 1.5), "beta")
ppPlot(rpois(20,3), "poisson")
ppPlot(rchisq(20, 10), "chi-squared")
ppPlot(rgeom(20, prob = 1/4), "geometric")
ppPlot(rnbinom(n = 20, size = 3, prob = 0.2), "negative binomial")
ppPlot(rf(20, df1 = 10, df2 = 20), "f")
```

print_adtest

print_adtest: Test Statistics

Description

Function to show `adtest`.

Usage

```
print_adtest(x, digits = 4, quote = TRUE, prefix = "", ...)
```

Arguments

| | |
|--------|--|
| x | Needs to be an object of class adtest. |
| digits | Minimal number of significant digits. |
| quote | Logical, indicating whether or not strings should be printed with surrounding quotes. By default quote is set to TRUE. |
| prefix | Single character or character string that will be printed in front of x. |
| ... | Further arguments passed to or from other methods. |

Value

The function returns a summary of Anderson Darling Test

Examples

```
data <- rnorm(20, mean = 20)
pcr1<-pcr(data, "normal", lsl = 17, usl = 23, plot = FALSE)
print_adtest(pcr1$adTest)
```

pweibull3

pweibull3: The Weibull Distribution (3 Parameter)

Description

Density function, distribution function, and quantile function for the Weibull distribution with a threshold parameter.

Usage

```
pweibull3(q, shape, scale, threshold)
```

Arguments

| | |
|-----------|--|
| q | A numeric vector of quantiles. |
| shape | The shape parameter of the Weibull distribution. Default is 1. |
| scale | The scale parameter of the Weibull distribution. Default is 1. |
| threshold | The threshold (or location) parameter of the Weibull distribution. Default is 0. |

Details

The Weibull distribution with the scale parameter alpha, shape parameter c, and threshold parameter zeta has a density function given by:

$$f(x) = \frac{c}{\alpha} \left(\frac{x - \zeta}{\alpha} \right)^{c-1} \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

The cumulative distribution function is given by:

$$F(x) = 1 - \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

Value

dweibull3 returns the density, pweibull3 returns the distribution function, and qweibull3 returns the quantile function for the Weibull distribution with a threshold.

Examples

```
dweibull3(x = 1, scale = 1, shape = 5, threshold = 0)
temp <- pweibull3(q = 1, scale = 1, shape = 5, threshold = 0)
temp
qweibull3(p = temp, scale = 1, shape = 5, threshold = 0)
```

qgamma3

qgamma3: The gamma Distribution (3 Parameter)

Description

Density function, distribution function, and quantile function for the Gamma distribution.

Usage

```
qgamma3(p, shape, scale, threshold, ...)
```

Arguments

| | |
|-----------|---|
| p | A numeric vector of probabilities. |
| shape | The shape parameter, default is 1. |
| scale | The scale parameter, default is 1. |
| threshold | The threshold parameter, default is 0. |
| ... | Additional arguments that can be passed to uniroot. |

Details

The Gamma distribution with scale parameter alpha, shape parameter c, and threshold parameter zeta has a density given by:

$$f(x) = \frac{c}{\alpha} \left(\frac{x - \zeta}{\alpha} \right)^{c-1} \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

The cumulative distribution function is given by:

$$F(x) = 1 - \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

Value

dgamma3 gives the density, pgamma3 gives the distribution function, and qgamma3 gives the quantile function.

Examples

```
dgamma3(x = 1, scale = 1, shape = 5, threshold = 0)
temp <- pgamma3(q = 1, scale = 1, shape = 5, threshold = 0)
temp
qgamma3(p = temp, scale = 1, shape = 5, threshold = 0)
```

qlnorm3

*qlnorm3: The Lognormal Distribution (3 Parameter)***Description**

Density function, distribution function, and quantile function for the Lognormal distribution.

Usage

```
qlnorm3(p, meanlog, sdlog, threshold, ...)
```

Arguments

| | |
|----------------|---|
| p | A numeric vector of probabilities. |
| meanlog, sdlog | The mean and standard deviation of the distribution on the log scale with default values of 0 and 1 respectively. |
| threshold | The threshold parameter, default is 0. |
| ... | Additional arguments that can be passed to uniroot. |

Details

The Lognormal distribution with meanlog parameter zeta, sdlog parameter sigma, and threshold parameter theta has a density given by:

$$f(x) = \frac{1}{\sqrt{2\pi\sigma}(x - \theta)} \exp\left(-\frac{(\log(x - \theta) - \zeta)^2}{2\sigma^2}\right)$$

The cumulative distribution function is given by:

$$F(x) = \Phi\left(\frac{\log(x - \theta) - \zeta}{\sigma}\right)$$

where Φ is the cumulative distribution function of the standard normal distribution.

Value

dlnorm3 gives the density, plnorm3 gives the distribution function, and qlnorm3 gives the quantile function.

Examples

```
dlnorm3(x = 2, meanlog = 0, sdlog = 1/8, threshold = 1)
temp <- plnorm3(q = 2, meanlog = 0, sdlog = 1/8, threshold = 1)
temp
qlnorm3(p = temp, meanlog = 0, sdlog = 1/8, threshold = 1)
```

qqPlot

qqPlot: Quantile-Quantile Plots for various distributions

Description

Function qqPlot creates a QQ plot of the values in x including a line which passes through the first and third quartiles.

Usage

```
qqPlot(
  x,
  y,
  confbounds = TRUE,
  alpha,
  main,
  xlab,
  ylab,
  xlim,
  ylim,
  border = "red",
  bounds.col = "black",
  bounds.lty = 1,
  start,
  showPlot = TRUE,
  axis.y.right = FALSE,
  bw.theme = FALSE
)
```

Arguments

- | | |
|---|---|
| x | The sample for qqPlot. |
| y | Character string specifying the distribution of x. The function qqPlot supports the following character strings for y: <ul style="list-style-type: none">• <code>`beta`</code>• <code>`cauchy`</code>• <code>`chi-squared`</code>• <code>`exponential`</code>• <code>`f`</code> |

| | |
|---------------------------|---|
| | <ul style="list-style-type: none"> • <code>`gamma`</code> • <code>`geometric`</code> • <code>`log-normal`</code> • <code>`lognormal`</code> • <code>`logistic`</code> • <code>`negative binomial`</code> • <code>`normal`</code> • <code>`Poisson`</code> • <code>`weibull`</code> |
| | By default distribution is set to <code>`normal`</code> . |
| <code>confbounds</code> | Logical value indicating whether to display confidence bounds. By default, <code>confbounds</code> is set to <code>TRUE</code> . |
| <code>alpha</code> | Numeric value specifying the significance level for the confidence bounds, set to <code>'0.05'</code> by default. |
| <code>main</code> | A character string for the main title of the plot. |
| <code>xlab</code> | A character string for the x-axis label. |
| <code>ylab</code> | A character string for the y-axis label. |
| <code>xlim</code> | A numeric vector of length 2 to specify the limits of the x-axis. |
| <code>ylim</code> | A numeric vector of length 2 to specify the limits of the y-axis. |
| <code>border</code> | A numerical value or single character string giving the color of the interpolation line. By default, <code>border</code> is set to <code>`red`</code> . |
| <code>bounds.col</code> | A numerical value or single character string giving the color of the confidence bounds lines. By default, <code>bounds.col</code> is set to <code>`black`</code> . |
| <code>bounds.lty</code> | A numeric or character: line type for the confidence bounds lines. This can be specified with either an integer (0-6) or a name: <ul style="list-style-type: none"> • 0: blank • 1: solid • 2: dashed • 3: dotted • 4: dotdash • 5: longdash • 6: twodash Default is <code>'1'</code> (solid line). |
| <code>start</code> | A named list giving the parameters to be fitted with initial values. Must be supplied for some distributions (see <code>Details</code>). |
| <code>showPlot</code> | Logical value indicating whether to display the plot. By default, <code>showPlot</code> is set to <code>TRUE</code> . |
| <code>axis.y.right</code> | Logical value indicating whether to display the y-axis on the right side. By default, <code>axis.y.right</code> is set to <code>FALSE</code> . |
| <code>bw.theme</code> | Logical value indicating whether to use a black-and-white theme from the <code>ggplot2</code> package for the plot. By default, <code>bw.theme</code> is set to <code>FALSE</code> . |

Details

Distribution fitting is performed using the `FitDistr` function from this package. For the computation of the confidence bounds, the variance of the quantiles is estimated using the delta method, which involves the estimation of the observed Fisher Information matrix as well as the gradient of the CDF of the fitted distribution. Where possible, those values are replaced by their normal approximation.

Value

The function `qqPlot` returns an invisible list containing:

| | |
|--------------------|-------------------------------|
| <code>x</code> | Sample quantiles. |
| <code>y</code> | Theoretical quantiles. |
| <code>int</code> | Intercept of the fitted line. |
| <code>slope</code> | Slope of the fitted line. |
| <code>plot</code> | The generated QQ plot. |

See Also

[ppPlot](#), [FitDistr](#).

Examples

```
set.seed(123)
qqPlot(rnorm(20, mean=90, sd=5), "normal", alpha=0.30)
qqPlot(rcauchy(100), "cauchy")
qqPlot(rweibull(50, shape = 1, scale = 1), "weibull")
qqPlot(rlogis(50), "logistic")
qqPlot(rlnorm(50), "log-normal")
qqPlot(rbeta(10, 0.7, 1.5), "beta")
qqPlot(rpois(20,3), "poisson")
qqPlot(rchisq(20, 10), "chi-squared")
qqPlot(rgeom(20, prob = 1/4), "geometric")
qqPlot(rnbinom(n = 20, size = 3, prob = 0.2), "negative binomial")
qqPlot(rf(20, df1 = 10, df2 = 20), "f")
```

qweibull3

qweibull3: The Weibull Distribution (3 Parameter)

Description

Density function, distribution function, and quantile function for the Weibull distribution with a threshold parameter.

Usage

```
qweibull3(p, shape, scale, threshold, ...)
```

Arguments

| | |
|-----------|--|
| p | A numeric vector of probabilities. |
| shape | The shape parameter of the Weibull distribution. Default is 1. |
| scale | The scale parameter of the Weibull distribution. Default is 1. |
| threshold | The threshold (or location) parameter of the Weibull distribution. Default is 0. |
| ... | Additional arguments passed to uniroot for qweibull3. |

Details

The Weibull distribution with the scale parameter alpha, shape parameter c, and threshold parameter zeta has a density function given by:

$$f(x) = \frac{c}{\alpha} \left(\frac{x - \zeta}{\alpha} \right)^{c-1} \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

The cumulative distribution function is given by:

$$F(x) = 1 - \exp \left(- \left(\frac{x - \zeta}{\alpha} \right)^c \right)$$

Value

dweibull3 returns the density, pweibull3 returns the distribution function, and qweibull3 returns the quantile function for the Weibull distribution with a threshold.

Examples

```
dweibull3(x = 1, scale = 1, shape = 5, threshold = 0)
temp <- pweibull3(q = 1, scale = 1, shape = 5, threshold = 0)
temp
qweibull3(p = temp, scale = 1, shape = 5, threshold = 0)
```

randomize

randomize: Randomization

Description

Function to do randomize the run order of factorial designs.

Usage

```
randomize(fdo, random.seed = 93275938, so = FALSE)
```

Arguments

| | |
|-------------|---|
| fdo | An object of class facDesign.c . |
| random.seed | Seed for randomness. |
| so | Logical value specifying whether the standard order should be used or not. By default so is set to FALSE. |

Value

An object of class [facDesign.c](#) with the run order randomized.

Examples

```
dfrac <- fracDesign(k = 3)
randomize(dfrac)
```

rsmChoose

rsmChoose: Choosing a response surface design from a table

Description

Designs displayed are central composite designs with orthogonal blocking and near rotatability. The function allows users to choose a design by clicking with the mouse into the appropriate field.

Usage

```
rsmChoose()
```

Value

Returns an object of class [facDesign.c](#).

See Also

[fracChoose](#), [rsmDesign](#)

Examples

```
rsmChoose()
```

 rsmDesign

rsmDesign: Generate a response surface design.

Description

Generates a response surface design containing a cube, centerCube, star, and centerStar portion.

Usage

```
rsmDesign(
  k = 3,
  p = 0,
  alpha = "rotatable",
  blocks = 1,
  cc = 1,
  cs = 1,
  fp = 1,
  sp = 1,
  faceCentered = FALSE
)
```

Arguments

| | |
|--------------|---|
| k | Integer value giving the number of factors. By default, k is set to '3'. |
| p | Integer value giving the number of additional factors in the response surface design by aliasing effects. Default is '0'. |
| alpha | Character string indicating the type of star points to generate. Should be 'rotatable' (default), 'orthogonal', or 'both'. If 'both', values for cc and cs will be discarded. |
| blocks | Integer value specifying the number of blocks in the response surface design. Default is '1'. |
| cc | Integer value giving the number of centerpoints (per block) in the cube portion (i.e., the factorial 2^k design) of the response surface design. Default is '1'. |
| cs | Integer value specifying the number of centerpoints in the star portion. Default is '1'. |
| fp | Integer value giving the number of replications per factorial point (i.e., corner points). Default is '1'. |
| sp | Integer value specifying the number of replications per star point. Default is '1'. |
| faceCentered | Logical value indicating whether to use a faceCentered response surface design (i.e., alpha = '1'). Default is FALSE. |

Details

Generated designs consist of a cube, centerCube, star, and centerStar portion. The replication structure can be set with the parameters cc (centerCube), cs (centerStar), fp (factorialPoints), and sp (starPoints).

Value

The function returns an object of class `facDesign.c`.

See Also

`facDesign`, `fracDesign`, `fracChoose`, `pbDesign`, `rsmChoose`

Examples

```
# Example 1: Central composite design for 2 factors with 2 blocks, alpha = 1.41,
# 5 centerpoints in the cube portion and 3 centerpoints in the star portion:
rsmDesign(k = 2, blocks = 2, alpha = sqrt(2), cc = 5, cs = 3)

# Example 2: Central composite design with both, orthogonality and near rotatability
rsmDesign(k = 2, blocks = 2, alpha = "both")

# Example 3: Central composite design with:
# 2 centerpoints in the factorial portion of the design (i.e., 2)
# 1 centerpoint in the star portion of the design (i.e., 1)
# 2 replications per factorial point (i.e., 2^3*2 = 16)
# 3 replications per star point (i.e., 3*2*3 = 18)
# Makes a total of 37 factor combinations
rsdo = rsmDesign(k = 3, blocks = 1, alpha = 2, cc = 2, cs = 1, fp = 2, sp = 3)
```

 simProc

simProc: Simulated Process

Description

This is a function to simulate a black box process for teaching the use of designed experiments. The optimal factor settings can be found using a sequential assembly strategy i.e. apply a 2^k factorial design first, calculate the path of the steepest ascent, again apply a 2^k factorial design and augment a star portion to find the optimal factor settings. Of course, other strategies are possible.

Usage

```
simProc(x1, x2, x3, noise = TRUE)
```

Arguments

| | |
|-------|---|
| x1 | numeric vector containing the values for factor 1. |
| x2 | numeric vector containing the values for factor 2. |
| x3 | numeric vector containing the values for factor 3. |
| noise | logical value deciding whether noise should be added or not. Default setting is TRUE. |

Value

simProc returns a numeric value within the range [0,1].

Examples

```
simProc(120, 140, 1)
simProc(120, 220, 1)
simProc(160, 140, 1)
```

 snPlot

snPlot: Signal-to-Noise-Ratio Plots

Description

Creates a Signal-to-Noise Ratio plot for designs of type `taguchiDesign.c` with at least two replicates.

Usage

```
snPlot(object, type = "nominal", factors, fun = mean, response = NULL,
       points = FALSE, classic = FALSE, lty, xlab, ylab,
       main, ylim, l.col, p.col, ld.col, pch)
```

Arguments

| | |
|-----------------------|--|
| <code>object</code> | An object of class <code>taguchiDesign.c</code> . |
| <code>type</code> | A character string specifying the type of the Signal-to-Noise Ratio plot. Possible values are: <ul style="list-style-type: none"> • <code>`nominal`</code>: Nominal-the-best plot to equalize observed values to a nominal value. • <code>`smaller`</code>: Smaller-the-better plot to minimize observed values. • <code>`larger`</code>: Larger-the-better plot to maximize observed values. Default is <code>`nominal`</code> . |
| <code>factors</code> | The factors for which the effect plot is to be created. |
| <code>fun</code> | A function for constructing the effect plot such as <code>mean</code> , <code>median</code> , etc. Default is <code>mean</code> . |
| <code>response</code> | A character string specifying the response variable. If <code>object</code> contains multiple responses, this parameter selects one column to plot. Default is <code>NULL</code> . |
| <code>points</code> | A logical value. If <code>TRUE</code> , points are shown in addition to values derived from <code>fun</code> . Default is <code>FALSE</code> . |
| <code>classic</code> | A logical value. If <code>TRUE</code> , creates an effect plot as depicted in most textbooks. Default is <code>FALSE</code> . |
| <code>lty</code> | A numeric value specifying the line type to be used. |
| <code>xlab</code> | A title for the x-axis. |

| | |
|--------|---|
| ylab | A title for the y-axis. |
| main | An overall title for the plot. |
| ylim | A numeric vector of length 2 specifying the limits of the y-axis. |
| l.col | A color for the lines. |
| p.col | A color for the points. |
| ld.col | A color for the dashed line. |
| pch | The symbol for plotting points. |

Details

The Signal-to-Noise Ratio (SNR) is calculated based on the type specified:

- ``nominal``:

$$SN = 10 \cdot \log(\text{mean}(y)/\text{var}(y))$$

- ``smaller``:

$$SN = -10 \cdot \log((1/n) \cdot \text{sum}(y^2))$$

- ``larger``:

$$SN = -10 \cdot \log((1/n) \cdot \text{sum}(1/y^2))$$

Signal-to-Noise Ratio plots are used to estimate the effects of individual factors and to judge the variance and validity of results from an effect plot.

Value

An invisible `data.frame` containing all the single Signal-to-Noise Ratios.

Examples

```
tdo <- taguchiDesign("L9_3", replicates = 3)
tdo$response(rnorm(27))
snPlot(tdo, points = TRUE, l.col = 2, p.col = 2, ld.col = 2, pch = 16, lty = 3)
```

starDesign

starDesign: Axial Design

Description

`starDesign` is a function to create the star portion of a response surface design. The `starDesign` function can be used to create a star portion of a response surface design for a sequential assembly strategy. One can either specify `k` and `p` and `alpha` and `cs` and `cc` OR simply simply pass an object of class `facDesign.c` to the data. In the latter an object of class `facDesign.c` otherwise a list containing the axial runs and centerpoints is returned.

Usage

```
starDesign(
  k,
  p = 0,
  alpha = c("both", "rotatable", "orthogonal"),
  cs,
  cc,
  data
)
```

Arguments

| | |
|-------|--|
| k | Integer value giving number of factors. |
| p | Integer value giving the number of factors via aliasing. By default set to '0'. |
| alpha | If no numeric value is given defaults to 'both' i.e. 'orthogonality' and 'rotatability' which can be set as character strings too. |
| cs | Integer value giving the number of centerpoints in the star portion of the design. |
| cc | Integer value giving the number of centerpoints in the cube portion of the design. |
| data | Optional. An object of class facDesign.c . |

Value

starDesign returns a [facDesign.c](#) object if an object of class [facDesign.c](#) is given or a list containing entries for axial runs and center points in the cube and the star portion of a design.

See Also

[facDesign](#), [fracDesign](#), [rsmDesign](#), [mixDesign](#)

Examples

```
# Example 1: sequential assembly
# Factorial design with one center point in the cube portion
fdo = facDesign(k = 3, centerCube = 1)
# Set the response via generic response method
fdo$response(1:9)
# Sequential assembly of a response surface design (rsd)
rsd = starDesign(data = fdo)

# Example 2: Returning a list of star point designs
starDesign(k = 3, cc = 2, cs = 2, alpha = "orthogonal")
starDesign(k = 3, cc = 2, cs = 2, alpha = "rotatable")
starDesign(k = 3, cc = 2, cs = 2, alpha = "both")
```

| | |
|-------------|-------------------------------------|
| steepAscent | <i>steepAscent: Steepest Ascent</i> |
|-------------|-------------------------------------|

Description

steepAscent is a method to calculate the steepest ascent for a [facDesign.c](#) object.

Usage

```
steepAscent(factors, response, size = 0.2, steps = 5, data)
```

Arguments

| | |
|----------|---|
| factors | List containing vector of factor names (coded) to be included in calculation, first factor is the reference factor. |
| response | A character of response given in data. |
| size | Numeric integer value giving the step size in coded units for the first factor given in factors. By default size is set to 0.2. |
| steps | Numeric integer value giving the number of steps. By default step is set to '5'. |
| data | An object of class facDesign.c . |

Value

steepAscent returns an object of class [steepAscent.c](#).

See Also

[optimum](#), [desirability](#)

Examples

```
# Example 1
fdo = facDesign(k = 2, centerCube = 5)
fdo$ lows(c(170, 150))
fdo$ highs(c(230, 250))
fdo$ names(c("temperature", "time"))
fdo$ unit(c("C", "minutes"))
yield = c(32.79, 24.07, 48.94, 52.49, 38.89, 48.29, 29.68, 46.5, 44.15)
fdo$.response(yield)
fdo$.summary()

sao = steepAscent(factors = c("B", "A"), response = "yield", size = 1,
                 data = fdo)
```

`steepAscent.c`*steepAscent-class: Class 'steepAscent'*

Description

The `steepAscent.c` class represents a steepest ascent algorithm in a factorial design context. This class is used for optimizing designs based on iterative improvements.

Public fields

`name` A character string representing the name of the steep ascent design.

`X` A data frame containing the design matrix for the steepest ascent procedure. This matrix represents the factors and their levels at each iteration.

`response` A data frame containing the response values associated with the design matrix.

Methods

Public methods:

- `steepAscent.c$.response()`
- `steepAscent.c$get()`
- `steepAscent.c$as.data.frame()`
- `steepAscent.c$print()`
- `steepAscent.c$plot()`
- `steepAscent.c$clone()`

Method `.response()`: Get and set the 'response' values in an object of class 'steepAscent.c'.

Usage:

```
steepAscent.c$.response(value)
```

Arguments:

`value` A data frame or numeric vector to set as the new 'response'. If missing, returns the current 'response'.

Method `get()`: Access specific elements in the design matrix or response data of the object.

Usage:

```
steepAscent.c$get(i, j)
```

Arguments:

`i` An integer specifying the row index to retrieve.

`j` An integer specifying the column index to retrieve.

Method `as.data.frame()`: Convert the object to a data frame.

Usage:

```
steepAscent.c$as.data.frame()
```

Method print(): Print the details of the object.

Usage:

```
steepAscent.c$print()
```

Method plot(): Plot the results of the steepest ascent procedure for an object of class 'steep-Ascent.c'.

Usage:

```
steepAscent.c$plot(main, xlab, ylab, l.col, p.col, line.type, point.shape)
```

Arguments:

main The main title of the plot.

xlab The label for the x-axis.

ylab The label for the y-axis.

l.col Color for the line in the plot.

p.col Color for the points in the plot.

line.type Type of the line used in the plot.

point.shape Shape of the points used in the plot.

Method clone(): The objects of this class are cloneable with this method.

Usage:

```
steepAscent.c$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

See Also

[steepAscent](#), [desirability.c](#), [optimum](#)

summaryFits

summaryFits: Fit Summary

Description

Function to provide an overview of fitted linear models for objects of class [facDesign.c](#).

Usage

```
summaryFits(fdo, lmFit = TRUE, curvTest = TRUE)
```

Arguments

fdo An object of class [facDesign.c](#).

lmFit A logical value deciding whether the fits from the object fdo should be included or not. By default, lmFit is set to TRUE.

curvTest A logical value deciding whether curvature tests should be performed or not. By default, curvTest is set to TRUE.

Value

A summary output of the fitted linear models, which may include the linear fits, curvature tests, and original fit values, depending on the input parameters.

Examples

```
dfac <- facDesign(k = 3)
dfac$response(data.frame(y = rnorm(8), y2 = rnorm(8)))
dfac$set.fits(lm(y ~ A + B , data = dfac$as.data.frame()))
dfac$set.fits(lm(y2 ~ A + C, data = dfac$as.data.frame()))
summaryFits(dfac)
```

taguchiChoose

*taguchiChoose: Taguchi Designs***Description**

Shows a matrix of possible taguchi designs

Usage

```
taguchiChoose(
  factors1 = 0,
  factors2 = 0,
  level1 = 0,
  level2 = 0,
  ia = 0,
  col = 2,
  randomize = TRUE,
  replicates = 1
)
```

Arguments

| | |
|------------|--|
| factors1 | Integer number of factors on level1. By default set to '0'. |
| factors2 | Integer number of factors on level2. By default set to '0'. |
| level1 | Integer number of levels on level1. By default set to '0'. |
| level2 | Integer number of levels on level2. By default set to '0'. |
| ia | Integer number of interactions. By default set to '0'. |
| col | Select the color scheme for the selection matrix: use 1 for blue, 2 for pink (default), and 3 for a variety of colors. |
| randomize | A logical value (TRUE/FALSE) that specifies whether to randomize the RunOrder of the design. By default, randomize is set to TRUE. |
| replicates | An integer specifying the number of replicates for each run in the design. |

Details

taguchiChoose returns possible taguchi designs. Specifying the number of factor1 factors with level1 levels (factors1 = 2, level1 = 3 means 2 factors with 3 factor levels) and factor2 factors with level2 levels and desired interactions one or more taguchi designs are suggested. If all parameters are set to 0, a matrix of possible taguchi designs is shown.

Value

taguchiChoose returns an object of class taguchiDesign.

See Also

- [facDesign](#): for 2^k factorial designs.
- [rsmDesign](#): for response surface designs.
- [fracDesign](#): for fractional factorial design.
- [gageRRDesign](#): for gage designs.

Examples

```
tdo1 <- taguchiChoose()
tdo1 <- taguchiChoose(factors1 = 3, level1 = 2)
```

| | |
|---------------|---------------------------------------|
| taguchiDesign | <i>taguchiDesign: Taguchi Designs</i> |
|---------------|---------------------------------------|

Description

Function to create a taguchi design.

Usage

```
taguchiDesign(design, randomize = TRUE, replicates = 1)
```

Arguments

| | |
|--------|--|
| design | <p>A character string specifying the orthogonal array of the Taguchi design. The available options are:</p> <ul style="list-style-type: none"> • 'L4_2' for three two-level factors. • 'L8_2' for seven two-level factors. • 'L9_3' for four three-level factors. • 'L12_2' for 11 two-level factors. • 'L16_2' for 16 two-level factors • 'L16_4' for 16 four-level factors. • 'L18_2_3' for one two-level and seven three-level factors. • 'L25_5' for six five-level factors. |
|--------|--|

- 'L27_3" for 13 three-level factors.
- 'L32_2" for 32 two-level factors.
- 'L32_2_4" for one two-level factor and nine four-level factors.
- 'L36_2_3_a" for 11 two-level factors and 12 three-level factors.
- 'L36_2_3_b" for three two-level factors and 13 three-level factors.
- 'L50_2_5" for one two-level factor and eleven five-level factors.
- 'L8_4_2" for one four-level factor and four two-level factors.
- 'L16_4_2_a" for one four-level factor and 12 two-level factors.
- 'L16_4_2_b" for two four-level factors and nine two-level factors.
- 'L16_4_2_c" for three four-level factors and six two-level factors.
- 'L16_4_2_d" for five four-level factors and two two-level factors.
- 'L18_6_3" for one six-level factor and six three-level factors.

| | |
|------------|--|
| randomize | A logical value (TRUE/FALSE) that specifies whether to randomize the RunOrder of the design. By default, randomize is set to TRUE. |
| replicates | An integer specifying the number of replicates for each run in the design. |

Details

An overview of possible taguchi designs is possible with `taguchiChoose`.

Value

A `taguchiDesign` returns an object of class `taguchiDesign`.

See Also

- [facDesign](#): for 2^k factorial designs.
- [rsmDesign](#): for response surface designs.
- [fracDesign](#): for fractional factorial design.
- [pbDesign](#): for response surface designs.
- [gageRRDesign](#): for gage designs.

Examples

```
tdo <- taguchiDesign("L9_3")
tdo$values(list(A = c("material 1", "material 2", "material 3"), B = c(29, 30, 35)))
tdo$names(c("Factor 1", "Factor 2", "Factor 3", "Factor 4"))
tdo$.response(rnorm(9))
tdo$summary()
```

| | |
|-----------------|----------------------|
| taguchiDesign.c | <i>taguchiDesign</i> |
|-----------------|----------------------|

Description

An R6 class representing a Taguchi experimental design.

Public fields

`name` A character string specifying the name of the design. Default is `NULL`.

`factors` A list of factors included in the Taguchi design. Each factor is typically an instance of the `taguchiFactor` class.

`design` A 'data.frame' representing the design matrix of the experiment. This includes the levels of each factor for every run of the experiment. Default is an empty `data.frame`.

`designType` A character string specifying the type of Taguchi design used. Default is `NULL`.

`replic` A 'data.frame' containing the replication information for the design. Default is an empty `data.frame`.

`response` A 'data.frame' storing the response values collected from the experiment. Default is an empty `data.frame`.

`Type` A 'data.frame' specifying the type of responses or factors involved in the design. Default is an empty `data.frame`.

`block` A 'data.frame' indicating any blocking factors used in the design. Default is an empty `data.frame`.

`runOrder` A 'data.frame' detailing the order in which the experimental runs were conducted. Default is an empty `data.frame`.

`standardOrder` A 'data.frame' detailing the standard order of the experimental runs. Default is an empty `data.frame`.

`desireVal` A list storing desired values for responses in the experiment. Default is an empty list.

`desirability` A list storing desirability functions used to evaluate the outcomes of the experiment. Default is an empty list.

`fits` A 'data.frame' containing model fits or other statistical summaries from the analysis of the experimental data. Default is an empty `data.frame`.

Methods

Public methods:

- `taguchiDesign.c$values()`
- `taguchiDesign.c$units()`
- `taguchiDesign.c$.factors()`
- `taguchiDesign.c$names()`
- `taguchiDesign.c$as.data.frame()`
- `taguchiDesign.c$print()`

- `taguchiDesign.c$.response()`
- `taguchiDesign.c$.nfp()`
- `taguchiDesign.c$.summary()`
- `taguchiDesign.c$.effectPlot()`
- `taguchiDesign.c$.identity()`
- `taguchiDesign.c$.clone()`

Method `values()`: Get and set the values for an object of class `taguchiDesign`.

Usage:

```
taguchiDesign.c$values(value)
```

Arguments:

value New value, If missing value get the values.

Method `units()`: Get and set the units for an object of class `taguchiDesign`.

Usage:

```
taguchiDesign.c$units(value)
```

Arguments:

value New units, If missing value get the units.

Method `.factors()`: Get and set the factors in an object of class `taguchiDesign`.

Usage:

```
taguchiDesign.c$.factors(value)
```

Arguments:

value New factors, If missing value get the factors.

Method `names()`: Get and set the names in an object of class `taguchiDesign`.

Usage:

```
taguchiDesign.c$names(value)
```

Arguments:

value New names, If missing value get the names.

Method `as.data.frame()`: Return a data frame with the information of the object `taguchiDesign.c`.

Usage:

```
taguchiDesign.c$as.data.frame()
```

Method `print()`: Methods for function `print` in Package base.

Usage:

```
taguchiDesign.c$print()
```

Method `.response()`: Get and set the the response in an object of class `taguchiDesign`.

Usage:

```
taguchiDesign.c$.response(value)
```

Arguments:

value New response, If missing value get the response.

Method .nfp(): Prints a summary of the factors attributes including their low, high, name, unit, and type.

Usage:

```
taguchiDesign.c$.nfp()
```

Method summary(): Methods for function summary in Package base.

Usage:

```
taguchiDesign.c$summary()
```

Method effectPlot(): Plots the effects of factors on the response variables.

Usage:

```
taguchiDesign.c$effectPlot(
  factors,
  fun = mean,
  response = NULL,
  points = FALSE,
  l.col,
  p.col,
  ld.col,
  lty,
  xlab,
  ylab,
  main,
  ylim,
  pch
)
```

Arguments:

factors Factors to be plotted.

fun Function applied to the response variables (e.g., mean).

response Optional; specifies which response variables to plot.

points Logical; if TRUE, plots data points.

l.col A color for the lines.

p.col A color for the points.

ld.col A color for the dashed line.

lty Line type for plotting.

xlab Label for the x-axis.

ylab Label for the y-axis.

main Main title for the plot.

ylim Limits for the y-axis.

pch The symbol for plotting points.

Examples:

```
tdo = taguchiDesign("L9_3")
tdo$.response(rnorm(9))
tdo$effectPlot(points = TRUE, pch = 16, lty = 3)
```

Method `identity()`: Calculates the alias table for a fractional factorial design and prints an easy to read summary of the defining relations such as 'I = ABCD' for a standard 2^{4-1} factorial design.

Usage:

```
taguchiDesign.c$identity()
```

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
taguchiDesign.c$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

Examples

```
## -----
## Method `taguchiDesign.c$effectPlot`
## -----

tdo = taguchiDesign("L9_3")
tdo$.response(rnorm(9))
tdo$effectPlot(points = TRUE, pch = 16, lty = 3)
```

taguchiFactor

taguchiFactor

Description

An R6 class representing a factor in a Taguchi design.

Public fields

`values` A vector containing the levels or values associated with the factor. Default is NA.

`name` A character string specifying the name of the factor. Default is an empty string ``.

`unit` A character string specifying the unit of measurement for the factor. Default is an empty string ``.

`type` A character string specifying the type of the factor, which can be either `numeric` or `categorical`. Default is `numeric`.

Methods

Public methods:

- [taguchiFactor\\$attributes\(\)](#)
- [taguchiFactor\\$.values\(\)](#)
- [taguchiFactor\\$.unit\(\)](#)
- [taguchiFactor\\$.names\(\)](#)

- [taguchiFactor\\$clone\(\)](#)

Method `attributes()`: Get the attributes of the factor.

Usage:

```
taguchiFactor$attributes()
```

Method `.values()`: Get and set the values for the factors in an object of class `taguchiFactor`.

Usage:

```
taguchiFactor$.values(value)
```

Arguments:

value New values, If missing value get the values.

Method `.unit()`: Get and set the units for the factors in an object of class `taguchiFactor`.

Usage:

```
taguchiFactor$.unit(value)
```

Arguments:

value New unit, If missing value get the units.

Method `names()`: Get and set the names in an object of class `taguchiFactor`.

Usage:

```
taguchiFactor$names(value)
```

Arguments:

value New names, If missing value get the names.

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
taguchiFactor$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

wirePlot

wirePlot: 3D Plot

Description

Creates a wireframe diagram for an object of class `facDesign.c`.

Usage

```

wirePlot(
  x,
  y,
  z,
  data = NULL,
  xlim,
  ylim,
  zlim,
  main,
  xlab,
  ylab,
  sub,
  sub.a = TRUE,
  zlab,
  form = "fit",
  col = "Rainbow",
  steps,
  fun,
  plot = TRUE,
  show.scale = TRUE,
  n.scene = "scene"
)

```

Arguments

| | |
|-------|---|
| x | Name providing the Factor A for the plot. |
| y | Name providing the Factor B for the plot. |
| z | Name giving the Response variable. |
| data | Needs to be an object of class <code>facDesign</code> and contains the names of x, y, z. |
| xlim | Numeric vector of length 2: limits for the x-axis. If missing, limits are set automatically. |
| ylim | Numeric vector of length 2: limits for the y-axis. If missing, limits are set automatically. |
| zlim | Numeric vector of length 2: limits for the z-axis. If missing, limits are set automatically. |
| main | Character string: title of the plot. |
| xlab | Character string: label for the x-axis. |
| ylab | Character string: label for the y-axis. |
| sub | Character string: subtitle for the plot. Default is NULL. |
| sub.a | Logical value indicating whether to display the subtitle. Default is TRUE. |
| zlab | Character string: label for the z-axis. |
| form | Character string specifying the form of the surface to be plotted. Options include <ul style="list-style-type: none"> • <code>`quadratic`</code> |

| | |
|-------------------------|--|
| | <ul style="list-style-type: none"> • <code>`full`</code> • <code>`interaction`</code> • <code>`linear`</code> • <code>`fit`</code> |
| | Default is <code>`fit`</code> . |
| <code>col</code> | Character string specifying the color palette to use for the plot (e.g., <code>`Rainbow`</code> , <code>`Jet`</code> , <code>`Earth`</code> , <code>`Electric`</code>). Default is <code>`Rainbow`</code> . |
| <code>steps</code> | Numeric value specifying the number of steps for the grid in the plot. Higher values result in a smoother surface. |
| <code>fun</code> | Optional function to be applied to the data before plotting. |
| <code>plot</code> | Logical value indicating whether to display the plot. Default is TRUE. |
| <code>show.scale</code> | Logical value indicating whether to display the color scale on the plot. Default is TRUE. |
| <code>n.scene</code> | Character string specifying the scene name for the plot. Default is <code>`scene`</code> . |

Details

The `wirePlot` function is used to create a 3D wireframe plot that visualizes the relationship between two factors and a response variable. The plot can be customized in various ways, including changing axis labels, adding subtitles, and choosing the color palette.

Value

The function `wirePlot` returns an invisible list containing:

| | |
|-------------------|----------------------------------|
| <code>plot</code> | The generated wireframe plot. |
| <code>grid</code> | The grid data used for plotting. |

See Also

[contourPlot](#), [paretoChart](#).

Examples

```
# Example 1: Basic wireframe plot
x <- seq(-10, 10, length = 30)
y <- seq(-10, 10, length = 30)
z <- outer(x, y, function(a, b) sin(sqrt(a^2 + b^2)))
wirePlot(x, y, z, main = "3D Wireframe Plot", xlab = "X-Axis", ylab = "Y-Axis", zlab = "Z-Axis")

fdo = rsmDesign(k = 3, blocks = 2)
fdo$.response(data.frame(y = rnorm(fdo$nrow())))

#I - display linear fit
wirePlot(A,B,y, data = fdo, form = "linear")

#II - display full fit (i.e. effect, interactions and quadratic effects)
wirePlot(A,B,y, data = fdo, form = "full")
```

```

#III - display a fit specified before
fdo$set.fits(fdo$lm(y ~ B + I(A^2)))
wirePlot(A,B,y, data = fdo, form = "fit")

#IV - display a fit given directly
wirePlot(A,B,y, data = fdo, form = "y ~ A*B + I(A^2)")

#V - display a fit using a different colorRamp
wirePlot(A,B,y, data = fdo, form = "full", col = 2)

```

wirePlot3

wirePlot3: function to create a ternary plot (3D wire plot)

Description

This function creates a ternary plot for mixture designs (i.e. object of class `mixDesign`).

Usage

```

wirePlot3(
  x,
  y,
  z,
  response,
  data = NULL,
  main,
  xlab,
  ylab,
  zlab,
  form = "linear",
  col = "Rainbow",
  steps,
  plot = TRUE
)

```

Arguments

| | |
|-----------------------|---|
| <code>x</code> | Factor 1 of the <code>mixDesign</code> object. |
| <code>y</code> | Factor 2 of the <code>mixDesign</code> object. |
| <code>z</code> | Factor 3 of the <code>mixDesign</code> object. |
| <code>response</code> | the response of the <code>mixDesign</code> object. |
| <code>data</code> | The <code>mixDesign</code> object from which <code>x,y,z</code> and the response are taken. |
| <code>main</code> | Character string specifying the main title of the plot. |
| <code>xlab</code> | Character string specifying the label for the x-axis. |

| | |
|-------|--|
| ylab | Character string specifying the label for the y-axis. |
| zlab | Character string specifying the label for the z-axis. |
| form | A character string or a formula with the syntax 'y ~ A + B + C'. If form is a character string, it has to be one of the following: <ul style="list-style-type: none"> • 'linear' • 'quadratic' How the form influences the output is described in the reference listed below. By default, form is set to 'linear'. |
| col | Character string specifying the color palette to use for the plot (e.g., 'Rainbow', 'Jet', 'Earth', 'Electric'). Default is 'Rainbow'. |
| steps | A numeric value specifying the resolution of the plot, i.e., the number of rows for the square matrix, which also represents the number of grid points per factor. By default, steps is set to 25. |
| plot | Logical value indicating whether to display the plot. Default is TRUE. |

Value

The function `wirePlot3` returns an invisible matrix containing the response values as NA's and numerics.

See Also

[mixDesign.c](#), [mixDesign](#), [contourPlot3](#).

Examples

```
#Example 1
mdo <- mixDesign(3, 2, center = FALSE, axial = FALSE, randomize = FALSE, replicates = c(1, 1, 2, 3))
elongation <- c(11.0, 12.4, 15.0, 14.8, 16.1, 17.7,
               16.4, 16.6, 8.8, 10.0, 10.0, 9.7,
               11.8, 16.8, 16.0)
mdo$response(elongation)
wirePlot3(A, B, C, elongation, data = mdo, form = "quadratic")

#Example 2
mdo <- mixDesign(3,2, center = FALSE, axial = FALSE, randomize = FALSE, replicates = c(1,1,2,3))
mdo$names(c("polyethylene", "polystyrene", "polypropylene"))
mdo$units("percent")
elongation <- c(11.0, 12.4, 15.0, 14.8, 16.1, 17.7,
               16.4, 16.6, 8.8, 10.0, 10.0, 9.7,
               11.8, 16.8, 16.0)
mdo$response(elongation)
wirePlot3(A, B, C, elongation, data = mdo, form = "linear")
wirePlot3(A, B, C, elongation, data = mdo, form = "quadratic",
          col = "Jet")
wirePlot3(A, B, C, elongation, data = mdo,
          form = "elongation ~ I(A^2) - B:A + I(C^2)",
          col = "Electric")
wirePlot3(A, B, C, elongation, data = mdo, form = "quadratic",
          col = "Earth")
```

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