

Package ‘uncertainty’

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Type Package

Title Uncertainty Estimation and Contribution Analysis

Version 0.3.0

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Description Implements the Gaussian method of first and second order, the Kragten numerical method and the Monte Carlo simulation method for uncertainty estimation and analysis.

Depends graphics ($\geq 3.4.0$), stats ($\geq 3.4.0$), mvtnorm (≥ 0.9),
triangle (≥ 0.7), R ($\geq 3.4.0$)

License GPL (≥ 2)

Encoding UTF-8

NeedsCompilation no

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uncertainty-package *Uncertainty Estimation and Contribution Analysis*

Description

Implements the Gaussian method of first and second order, the Kragten numerical method and the Monte Carlo simulation method for uncertainty estimation and analysis.

Details

The DESCRIPTION file:

```
Package:          uncertainty
Type:            Package
Title:           Uncertainty Estimation and Contribution Analysis
Version:         0.3.0
Date:           2025-12-14
Authors@R:       person(given = "Hugo", family = "Gasca-Aragon", role = c("aut", "cre"), email = "hugo_gasca_aragon@
Maintainer:      Hugo Gasca-Aragon <hugo_gasca_aragon@hotmail.com>
Description:     Implements the Gaussian method of first and second order, the Kragten numerical method and the Mont
Depends:         graphics (>= 3.4.0), stats (>= 3.4.0), mvtnorm (>= 0.9), triangle (>= 0.7), R (>= 3.4.0)
License:         GPL (>=2)
Encoding:        UTF-8
NeedsCompilation: no
Author:          Hugo Gasca-Aragon [aut, cre] (ORCID: <https://orcid.org/0000-0002-5384-2530>)
```

Index of help topics:

```
plot.summary.uncertainty      Plots an output quantity's uncertainty summary.
                               It shows the uncertainty contribution from each
                               involved input quantity
plot.uncertainty              Plots a probability density function related to
                               the measurement model
print.summary.uncertainty     Displays a list with the uncertainty
                               contribution from each input quantity
print.uncertainty             Displays the detailed content of a measurement
                               model including its uncertainty estimate.
print.uncertaintyBudget       Prints an uncertainty budget object
summary.uncertainty           Creates an uncertainty summary object
uncertainty                   Creates an uncertainty object for the output
                               quantity of a measurement model
uncertainty-package           Uncertainty Estimation and Contribution
                               Analysis
```

```

uncertainty.default      Generic function for calling an uncertainty
                          object
uncertaintyBudget        Generic function for uncertainty budget object
uncertaintyBudget.default
                          Generic function for calling an uncertainty
                          budget object

```

Define an "uncertainty budget" object, including all the involved input quantities. Then estimate the output quantity object by defining a measurement model, using the "uncertainty budget" and applying an estimation method. Print or plot the output quantity estimates or create a "summary uncertainty" object to print or plot the uncertainty contributions to the output quantity described in the measurement model.

Author(s)

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 Maintainer: Hugo Gasca-Aragon <hugo_gasca_aragon@hotmail.com>

References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*
 JCGM 100:2008. *Guide to the expression of uncertainty of measurement*
 JCGM 101:2008. *Supplement 1 Propagation of distributions using a Monte Carlo method*
 S.L.R. Ellison and A. Williams (2012) EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*, ISBN 978-0-948926-30-3.
 Becker, R.A., Chambers, J.M. and Wilks, A.R. (1988) *The New S Language*. Wadsworth & Brooks/Cole.

See Also

[uncertaintyBudget](#), [print.uncertaintyBudget](#), [uncertainty](#), [print.uncertainty](#), [plot.uncertainty](#), [summary.uncertainty](#), [print.summary.uncertainty](#), [plot.summary.uncertainty](#)

Examples

```

require(mvtnorm)

cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)

u.budget <- uncertaintyBudget(x=list(name = c("x0", "x1"),
  mean = c(10, 20), u=c(1, 5), unit = c("kg", "kg"),
  dof = c(10, 10), type = c("A", "A"),
  description = c("measurand mass", "sample mass"),
  label = c("x[0]", "x[1]"), distribution = c("normal", "normal")),
  y = cor.mat)
u.budget

## Gaussian first order estimates
GFO.res <- uncertainty(x = u.budget,

```

```

y = list(measurand_name = "ratio.GF0",
        measurand_label = expression(ratio[GF0]),
        measurand_model = "x0/x1",
        measurand_description = "ratio of masses at 20 degrees celsius",
        method = "GF0", alpha = 0.05))

contr.GF0 <- summary(GF0.res)

## Monte Carlo estimates
MC.res <- uncertainty(x = u.budget,
y = list(measurand_name = "ratio.MC",
        measurand_label = expression(ratio[MC]),
        measurand_model = "x0/x1",
        measurand_description = "ratio of masses at 20 degrees celsius",
        method = "MC", alpha = 0.05, B = 1e5))

contr.MC <- summary(MC.res)

## print the estimates
MC.res
GF0.res

## print the uncertainty summary
contr.MC
contr.GF0

## Displaying both estimated distributions
## Not run:
plot(MC.res, col = 4, xlab = MC.res$measurand_model)
plot(GF0.res, lty = 2, col = 2, add = TRUE)
legend(0.7, 2.5, legend = c("Monte Carlo", "Gaussian First Order"),
lty = c(1, 2), col = c(4, 2), lwd = 2, bg = "white")

## End(Not run)

## Display both uncertainty summaries

## Not run:
barplot(cbind(contr.GF0$budget$contrib, contr.MC$budget$contrib),
beside = TRUE, horiz = TRUE, main = "Uncertainty contribution by method",
xlab = "percent Variance",
names.arg = c(GF0.res$measurand_label, MC.res$measurand_label))

## End(Not run)

#####
## Example H.1 from GUM ##
#####

# define the uncertainty budget

u.budget <- uncertaintyBudget(
  x = list(

```

```

    name = c("lambda.s", "alpha.s", "theta.bar", "Delta", "delta.alpha",
            "delta.theta", "d.bar", "d.cr", "d.cnr"),
    label = c("lambda[s]", "alpha[s]", "bar(theta)", "Delta", "delta[alpha]",
            "delta[theta]", "bar(d)", "d[cr]", "d[cnr]"),
    description = c("certified length of the reference gauge block", "reference gauge block cte",
            "mean temperature", "Delta", "difference in the cte", "difference in temperature",
            "mean difference in length", "d.cr", "d.dnr"),
    mean = c(50.000623, 11.5e-6, -1e-1, 0, 0, 0, 2.15e-4, 0, 0),
    unit = c("mm", "oC^-1", "oC", "oC", "oC^-1", "oC", "mm", "mm", "mm"),
    u = c(25e-6, 1.2e-6, 0.2, 0.35, 0.58e-6, 0.029, 5.8e-6, 3.9e-6, 6.7e-6),
    distribution = c("t", "unif", "unif", "arcsine", "unif", "unif", "t", "t",
            "t"),
    dof = c(18, 1, 1, 1, 50, 2, 24, 5, 8),
    type = c("B", "B", "A", "B", "A", "A", "A", "A", "A")
  ),
  y = diag(1, 9)
)

# define the measurand
measurand_name <- "lambda"
measurand_label <- "lambda"
measurand_model <- paste("(lambda.s*(1+alpha.s*(theta.bar+Delta+delta.theta))",
"+d.bar+d.cr+d.cnr)/(1+(alpha.s+delta.alpha)*(theta.bar+Delta))", sep = "")
measurand_description = "length of end gauge block under calibration at 20 degrees celsius"

# estimate the measurand using the Gaussian First Order method (GUM)

u.GFO <- uncertainty(
  x = u.budget,
  y = list(measurand_name = measurand_name,
measurand_label = measurand_label,
measurand_model = measurand_model,
measurand_description = measurand_description,
alpha = 0.01,
method = "GFO"
)
)

u.GFO
# same result as reported in Table H.1

# estimate the measurand using the Gaussian Second Order method

u.GSO <- uncertainty(
  x = u.budget,
  y = list(measurand_name = measurand_name,
measurand_label = measurand_label,
measurand_model = measurand_model,
measurand_description = measurand_description,
alpha = 0.01,
method = "GSO"
)
)

```

```

u.GSO
# same results as reported in section H.1.6, U(99) = 93 nm,
# the difference is due to rounding error.
# u = 34 nm.

# estimate the measurand using the Monte Carlo method (GUM supplement 1)

u.MC <- uncertainty(
  x = u.budget,
  y = list(measurand_name = measurand_name,
    measurand_label = measurand_label,
    measurand_model = measurand_model,
    measurand_description = measurand_description,
    alpha = 0.01,
    method = "MC", B = 1e5
  )
)

u.MC
# this result is not reported in the GUM

```

```
plot.summary.uncertainty
```

Plots an output quantity's uncertainty summary. It shows the uncertainty contribution from each involved input quantity

Description

Builds a barplot with a bar for each source of uncertainty. If correlation is present then an additional entry is added. The current metric used to display is When correlation is present its contribution may be negative.

Usage

```
## S3 method for class 'summary.uncertainty'
plot(x, y = NULL, ...)
```

Arguments

x	an uncertainty summary object
y	not used.
...	additional parameters to customize the plot

Details

none

Value

None (invisible NULL)

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*

JCGM 100:2008. *Guide to the expression of uncertainty of measurement*

JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method.*

EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*

See Also

[summary.uncertainty](#), [plot](#)

Examples

```
# create an uncertainty budget
cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)

u.budget <- uncertaintyBudget(x = list(name = c("x0", "x1"),
mean = c(10, 20), u = c(1, 5), unit = c("kg", "kg"), dof = c(10, 10),
description = c("measurand mass", "sample mass"),
label = c("x[0]", "x[1]"), type = c("A", "A"), distribution = c("normal", "normal")),
y = cor.mat)

# estimate the measurand uncertainty using an uncertainty budget,
# a measurand definition and a selected estimating method.
GFO.res <- uncertainty(x = u.budget,
y = list(measurand_name = "ratio.GFO",
measurand_label = "ratio[GFO]",
measurand_model = "x0/x1",
measurand_description = "ratio of masses at 20 degrees celsius",
method = "GFO", alpha = 0.05))

# create an uncertainty summary object
GFO.sum <- summary(GFO.res)

# display the chart
## Not run: plot(GFO.sum)
```

plot.uncertainty *Plots a probability density function related to the measurement model*

Description

Plot a probability density function attributed to the measurand, depending on the selected method to estimate the uncertainty.

Usage

```
## S3 method for class 'uncertainty'  
plot(x, y = NULL, xlab = parse(text = x$measurand_label),  
main = "", ylab = "Probability density", from = x$mean - 4 * x$u, to = x$mean + 4 * x$u,  
lwd = 2, add = FALSE, ...)
```

Arguments

x	An uncertainty object
y	not used, exists only for compatibility with the S3 generic function.
xlab	string or expression, label for the x-axis.
main	string or expression, label for the plot.
ylab	string or expression, label for the y-axis.
from	numeric, lower value of the x-axis to display.
to	numeric, upper value of the x-axis to display.
lwd	numeric, line width.
add	logic, decides to add the curve into an existing plot or to create a new plot.
...	additional parameters.

Details

none

Value

None (invisible NULL)

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*

JCGM 100:2008. *Guide to the expression of uncertainty of measurement*

JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method*

EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*

See Also

[uncertainty.default](#), [plot](#)

Examples

```
# create an uncertainty budget
cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)

u.budget <- uncertaintyBudget(x = list(name=c("x0", "x1"),
mean = c(10, 20), u = c(1, 5), unit = c("kg", "kg"), dof = c(10, 10),
description = c("measurand mass", "sample mass"),
label = c("x[0]", "x[1]"), type = c("A", "A"), distribution = c("normal", "normal")),
y = cor.mat)

# estimate the measurand uncertainty using an uncertainty budget,
# a measurand definition and a selected estimating method.
GF0.res <- uncertainty(x = u.budget,
y = list(measurand_name = "ratio.GF0",
measurand_label = "ratio[GF0]",
measurand_model = "x0/x1",
measurand_description = "ratio of masses at 20 degrees celsius",
method = "GF0", alpha = 0.05))

# plot the estimated pdf of the measurand
## Not run: plot(GF0.res)
```

```
print.summary.uncertainty
```

Displays a list with the uncertainty contribution from each input quantity

Description

For each input quantity (source of uncertainty) it shows the uncertainty contribution, measured in percent of variance of the measurand model.

Usage

```
## S3 method for class 'summary.uncertainty'
print(x, ...)
```

Arguments

x An uncertainty summary object
 ... Additional parameters

Details

none

Value

None (invisible NULL)

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*
 JCGM 100:2008. *Guide to the expression of uncertainty of measurement*
 JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method*
 EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*
 Becker, R.A., Chambers, J.M. and Wilks, A.R. (1988) *The New S Language*. Wadsworth & Brooks/Cole.

See Also

[summary.uncertainty, print](#)

Examples

```
# create an uncertainty budget
cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)

u.budget <- uncertaintyBudget(x = list(name = c("x0", "x1"),
mean = c(10, 20), u = c(1, 5), unit = c("kg", "kg"), dof = c(10, 10),
label = c("x[0]", "x[1]"), distribution = c("normal", "normal"),
description = c("measurand mass", "sample mass"),
type = c("A", "A")),
y = cor.mat)
u.budget

# estimate the measurand uncertainty using an uncertainty budget,
# a measurand definition and a selected estimating method.
```

```

GF0.res <- uncertainty(x = u.budget,
  y = list(measurand_name = "ratio.GF0",
    measurand_label = "ratio[GF0]",
    measurand_model = "x0/x1",
    measurand_description = "ratio of masses at 20 degrees celsius",
    method = "GF0", alpha = 0.05))

GF0.res

# create an uncertainty summary object
GF0.sum <- summary(GF0.res)

# implicit call to the print method
GF0.sum

# same as
print(GF0.sum)

# uncertainty summary structure
attributes(GF0.sum)

```

print.uncertainty	<i>Displays the detailed content of a measurement model including its uncertainty estimate.</i>
-------------------	---

Description

Displays the estimated value of the output quantity of the measurement model, its standard deviation, its standard uncertainty, the degrees of freedom and the significance level and an CI with that significance level.

Usage

```
## S3 method for class 'uncertainty'
print(x, ...)
```

Arguments

x	an uncertainty object
...	additional parameters

Details

none

Value

None (invisible NULL)

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*

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JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method*

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Becker, R.A., Chambers, J.M. and Wilks, A.R. (1988) *The New S Language*. Wadsworth & Brooks/Cole.

See Also

[uncertainty.default](#), [print](#)

Examples

```
# create an uncertainty budget
cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)

u.budget <- uncertaintyBudget(x = list(name = c("x0", "x1"),
mean = c(10, 20), unit = c("kg", "kg"), u = c(1, 5), dof = c(10, 10),
label = c("x[0]", "x[1]"), distribution = c("normal", "normal"),
description = c("measurand mass", "sample mass"),
type = c("A", "A")),
y = cor.mat)
u.budget

# estimate the measurand uncertainty using an uncertainty budget,
# a measurand definition and a selected estimating method.
GFO.res <- uncertainty(x = u.budget,
y = list(measurand_name = "ratio.GFO",
measurand_label = "ratio[GFO]",
measurand_model = "x0/x1",
measurand_description = "ratio of masses at 20 degrees celsius",
method = "GFO", alpha = 0.05))

# implicit call to print method
GFO.res

# same as
print(GFO.res)
```

```
# structure of an uncertainty estimation object
attributes(GF0.res)
```

```
print.uncertaintyBudget
```

Prints an uncertainty budget object

Description

Print the description of each uncertainty source

Usage

```
## S3 method for class 'uncertaintyBudget'
print(x, ...)
```

Arguments

x	an uncertainty budget object
...	additional parameters

Details

none

Value

None (invisible NULL)

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*

JCGM 100:2008. *Guide to the expression of uncertainty of measurement*

JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method*

EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*

Becker, R.A., Chambers, J.M. and Wilks, A.R. (1988) *The New S Language*. Wadsworth & Brooks/Cole.

See Also

[uncertaintyBudget.default](#), [print](#)

Examples

```
cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)

u.budget <- uncertaintyBudget(x = list(name=c("x0", "x1"),
mean = c(10, 20), u = c(1, 5), unit = c("kg", "kg"), dof = c(10, 10),
label = c("x[0]", "x[1]"), distribution = c("normal", "normal"),
description = c("measurand mass", "sample mass"),
type = c("A", "A")),
y = cor.mat)

# implicitly calls the print method
u.budget

# same as
print(u.budget)

# uncertainty budget structure
attributes(u.budget)
```

summary.uncertainty *Creates an uncertainty summary object*

Description

Performs an uncertainty contribution estimation for the uncertainty object. The metric used to measure the contribution is percent of variance. If correlation is present an additional entry is shown with the whole contribution due to correlated input quantities.

Usage

```
## S3 method for class 'uncertainty'
summary(object, ndigits = 3, ...)
```

Arguments

object	an uncertainty object
ndigits	numeric, the number of digits for displaying.
...	additional parameters

Details

none

Value

An uncertainty summary object:

call	the call invocation
measurand.name	name of the measurand
measurand.label	label of the measurand for displaying purposes
budget	a list with the name, mean, label, u(uncertainty), dof and uncertainty contribution for each input quantity plus a correlation entry if any

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*

JCGM 100:2008. *Guide to the expression of uncertainty of measurement*

JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method*

EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*

Venables, W. N. and Ripley, B. D. (2002) *Modern Applied Statistics with S*. Fourth edition. Springer.

See Also

[uncertainty.default](#), [print.summary.uncertainty](#), [summary](#)

Examples

```
# create an uncertainty budget
cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)

u.budget <- uncertaintyBudget(x = list(name = c("x0", "x1"),
mean = c(10, 20), u = c(1, 5), unit = c("kg", "kg"), dof = c(10, 10),
label = c("x[0]", "x[1]"), distribution = c("normal", "normal"),
description = c("measurand mass", "sample mass"),
type = c("A", "A")),
y = cor.mat)
u.budget

# estimate the measurand uncertainty using an uncertainty budget,
# a measurand definition and a selected estimating method.
GFO.res <- uncertainty(x = u.budget,
```

```

y = list(measurand_name = "ratio.GF0",
        measurand_label = "ratio[GF0]",
        measurand_model = "x0/x1",
        measurand_description = "ratio of masses at 20 degrees celsius",
        method = "GF0", alpha = 0.05))

GF0.res

# create an uncertainty summary object
GF0.sum <- summary(GF0.res)

# implicit call to the print method
GF0.sum

# same as
print(GF0.sum)

# uncertainty summary structure
attributes(GF0.sum)

```

uncertainty	<i>Creates an uncertainty object for the output quantity of a measurement model</i>
-------------	---

Description

Builds an uncertainty estimation object using a measurement model and an uncertainty budget object

Usage

```
uncertainty(x, ...)
```

Arguments

x	an uncertainty budget object
...	additional parameters

Details

Creates an uncertainty estimation object. Uses an uncertainty budget object to estimate the expected value and uncertainty of a measurement model by applying a selected estimation method.

Value

An uncertainty estimation object for the output quantity

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*

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JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method*

EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*

Becker, R.A., Chambers, J.M. and Wilks, A.R. (1988) *The New S Language*. Wadsworth & Brooks/Cole.

See Also

[uncertainty.default](#)

uncertainty.default *Generic function for calling an uncertainty object*

Description

Creates an uncertainty estimation object using a measurand model and an uncertainty budget object

Usage

```
## Default S3 method:
uncertainty(x, y, ...)
```

Arguments

x	an uncertainty budget object
y	a list with the measurand description and selected estimation method, the measurand includes: measurand_name, measurand_model, measurand_label, measurand_description, alpha (significance level), method and method parameters. the valid methods are: GFO, GSO, MC. currently the only method parameter implemented is the number of simulated samples (B) for the method MC. use.correlation is a boolean field, if there are correlations and this flag is TRUE then the correlation is used to adjust the effective degrees of freedom for correlation, according to Castrup adjustment to Welch-Satterthwaite algorithm. if missing or NULL it is assumed as FALSE
...	additional parameters

Details

Creates an uncertainty estimation object. Uses an uncertainty budget object to estimate the expected value and uncertainty of a measurand by applying a selected estimation method.

Value

An uncertainty estimation object with the structure: method selected estimating method, call current call invocation, uncertaintyBudget an uncertainty budget object, measurand name, label, model describing the measurand, mean the estimated mean, sd the estimated standard deviation, u the estimated standard uncertainty, alpha the significance level used in the estimation, dof the estimated degrees of freedom, U the estimated expanded uncertainty, lcl the lower confidence interval, ucl the upper confidence interval, variables a vector with the input quantities, contribution a vector with the uncertainty contributions, cor.contribution the uncertainty contribution due to overall correlation, partial a vector of the partial derivatives of the measurand.model with respect to each input quantity, coeff a vector of the sensibility coefficients for each input quantity.

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*

JCGM 100:2008. *Guide to the expression of uncertainty of measurement*

JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method*

EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*

See Also

[uncertainty](#), [uncertaintyBudget.default](#), [print.uncertainty](#), [plot.uncertainty](#), [summary.uncertainty](#)

Examples

```
# create an uncertainty budget
cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)

u.budget <- uncertaintyBudget(x = list(name = c("x0", "x1"),
mean = c(10, 20), units = c("kg", "kg"), u = c(1, 5), dof = c(10, 10),
label = c("x[0]", "x[1]"), distribution = c("normal", "normal"),
description = c("measurand mass", "sample mass"),
type = c("A", "A")),
y = cor.mat)
u.budget
```

```
# estimate the measurand uncertainty using an uncertainty budget,
# a measurand definition and a selected estimating method.
GFO.res <- uncertainty(x = u.budget,
y = list(measurand_name = "ratio.GFO",
         measurand_label = "ratio[GFO]",
         measurand_model = "x0/x1",
         measurand_description = "ratio of masses",
         method = "GFO", alpha = 0.05))

GFO.res
```

uncertaintyBudget *Generic function for uncertainty budget object*

Description

Generic function for creating an uncertainty budget object

Usage

```
uncertaintyBudget(x, ...)
```

Arguments

x	a list with the vector entries name, label, mean, u(uncertainty), distribution and dof, one for each quantity.
...	additional parameters

Details

uncertaintyBudget is a generic function (under S3 protocol) for searching the default method.

Value

An uncertainty budget object with attributes:

name the name of each input quantity

mean the mean value of each input quantity

u the uncertainty of each input quantity

unit the unit of each input quantity

dof the degrees of freedom of each input quantity

label the label of each input quantity

distribution the distribution of each input quantity, valid values are (normal, unif, t, chisq, f, triangle, binomial, bernoulli, beta, gamma)

cor the correlation matrix among the input quantities

Note

none

Author(s)

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References

JCGM 200:2012. *International vocabulary of metrology—Basic and general concepts and associated terms (VIM)*

JCGM 100:2008. *Guide to the expression of uncertainty of measurement*

JCGM 100:2005. *Supplement 1 Propagation of distributions using a Monte Carlo method*

EURACHEM/CITAC Guide CG 4. *Quantifying Uncertainty in Analytical Measurement*

Becker, R.A., Chambers, J.M. and Wilks, A.R. (1988) *The New S Language*. Wadsworth & Brooks/Cole.

See Also

[uncertaintyBudget.default](#)

uncertaintyBudget.default

Generic function for calling an uncertainty budget object

Description

Creates an uncertainty budget.

Usage

```
## Default S3 method:
uncertaintyBudget(x, y, ...)
```

Arguments

x	a list with the vector entries name, label, mean, unit, u(uncertainty), type, description, distribution and dof, one for each input quantity.
y	a correlation matrix of the input quantities, interpreted in the same order of input quantities as the vector name
...	additional parameters

Details

Creates an uncertainty budget object

Value

An uncertainty budget object with attributes:

name the name of each input quantity, this is the identifier used in the measurement model computation

mean the mean value of each input quantity

u the uncertainty of each input quantity

unit the measurement unit of each input quantity

dof the degrees of freedom of each input quantity

type the type of source "A"=experimental, "B"=other means

label the label of each input quantity, used for displaying and plotting

description the full description of the input quantity

distribution the distribution of each input quantity, valid values are (bernoulli, beta, binomial, cuachy, chisq, exp, f, gamma, lognormal, poission, normal, unif, t, traingular, weibull, arcsine)

cor the correlation matrix among the input quantities

Note

none

Author(s)

Hugo Gasca-Aragon

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References

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See Also

[uncertaintyBudget](#), [uncertainty](#), [print.uncertaintyBudget](#)

Examples

```
require(mvtnorm)
```

```
cor.mat <- matrix(c(1, -0.7, -0.7, 1), 2, 2)
```

```
u.budget <- uncertaintyBudget(x = list(name = c("x0", "x1"),
mean = c(10, 20), u = c(1, 5), unit = c("kg", "kg"), dof = c(10, 10),
```

```
label = c("x[0]", "x[1]"), type = c("A", "A"),
description = c("measurand mass", "sample mass"),
distribution = c("normal", "normal"),
  y = cor.mat)
u.budget
```

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