Package 'mpcv'

February 20, 2015

Type Package

Title Multivariate Process Capability Vector

Version 1.1

Date 2014-10-09

Author Krzysztof Ciupke <krzysztof.ciupke@polsl.pl>

Maintainer Krzysztof Ciupke <krzysztof.ciupke@polsl.pl>

Depends lpSolve

Description Multivariate process capability analysis using the multivariate process capability vector. Allows to analyze a multivariate process with both normally and non-normally distributed and also with dependent and independent quality characteristics.

License GPL (>= 2.0)

NeedsCompilation no

Repository CRAN

Date/Publication 2014-10-09 14:43:10

R topics documented:

---

automotive   *Automotive bivariate dataset*

Description

The dataset describing the problem of automatic screwing the car wheels. Two characteristics are observed: the torque T of tightening a screw, and the rotation angle A of the screw until the necessary value of the torque is acquired.

Usage

```
data("automotive")
```

Format

A list containing:

x a matrix with 47 observations and two quality characteristics T and A,

USL the vector of the upper specification limits,

LSL the vector of the lower specification limits,

Target the vector of the target.

References

Ciupke K. (2014)

Examples

```
data("automotive")
x <- automotive$x
LSL <- automotive$LSL
USL <- automotive$USL
Target <- automotive$Target
```

---

coef.mpcv   *Extracts leading coefficients of the one-sided models from the mpcv*
                                   object

Description

coef is a generic function which extracts the leading coefficients of the model of a process region; the coefficients are extracted from the object of class ″mpcv″.

Usage

```
## S3 method for class 'mpcv'
coef(object, ...)
```

Arguments

`object`	object of a class `"mpcv"`.
`...`	other arguments, currently not used.

Details

Shape of the process region is mainly defined by the leading coefficients of the process models (here one-sided models ale applied). To keep a similar shape of the process region in the future process analysis, minimal values of the leading coefficients are required. This function allows to extract the leading coefficients from the `object`.

Value

A matrix with 2 rows (named `coef.lo` and `coef.up`) and number of columns corresponding the number of variables.

Note

For the viariable used as the independent one in the mpcv function the NA value is returned.

Author(s)

Krzysztof Ciupke, <krzysztof.ciupke at polsl.pl>

References

Ciupke K. (2014) *Multivariate Process Capability Vector Based on One-Sided Model*, Quality and Reliability Engineering International, John Wiley & Sons.

See Also

mpcv

Examples

```
data(industrial)
x <- industrial$x
LSL <- industrial$LSL
USL <- industrial$USL
Target<- industrial$Target
res.ind <- mpcv(x, LSL=LSL, USL=USL, Target=Target, alpha=0.025)
coef(res.ind)
```

---

industrial   *Industrial bivariate dataset*

Description

The dataset represents the measurements of an industrial product with two quality characteristics: Brinell hardness H and tensile strength S.

Usage

```
data("industrial")
```

Format

A list containing:

x a matrix with 25 observations and two quality characteristics: Brinell hardness H and tensile strength S,

USL the vector of the upper specification limits,

LSL the vector of the lower specification limits,

Target the vector of the target.

References

Sultan T. (1986) *An acceptance chart for raw materials of two correlated properties*, Quality Assurance, Vol. 12, No. 3, 70-72. Quorum Books.

Examples

```
data("industrial")
x <- industrial$x
LSL <- industrial$LSL
USL <- industrial$USL
Target <- industrial$Target
```

---

mpcv   *Multivariate process capability vector*

Description

Performs the multivariate process capability analysis using three component multivariate process capability vector (mpcv).

Usage

```
mpcv(x, indepvar = 1, LSL, USL, Target, alpha = 0.0027, distance, n.integr = 100,
     coef.up, coef.lo)
```

Arguments

x	a numeric matrix containing the data (quality characteristics).
indepvar	a number or a name of the independent variable needed for building one-sided models.
LSL	a vector of lower specification limits defined for each variable.
USL	a vector of upper specification limits defined for each variable.
Target	a vector of target of the process defined for each variable.
alpha	the proportion of nonconforming products.
distance	the distance measure to be used for removing the nonconforming elements. This must be one of "mahalanobis" (default), "euclidean", "maximum", "manhattan", "canberra", "binary" or "minkowski". Any unambiguous substring can be given.
n.integr	a number of integration intervals
coef.up	a vector of minimal values of leading coefficients for "upper" one-sided models. Value given for indepvar is omitted (could be NA).
coef.lo	a vector of minimal values of leading coefficients for "lower" one-sided models. Value for indepvar is omitted (could be NA).

Details

If the parameter Target is not specified, then Target <- LSL + (USL - LSL)/2.

Using the applied methodology, the shape of a process region is mainly defined by the leading coefficients of the models. To obtain a certain shape of a process region (e.g. similar to the previous one) there is possible to specify minimal values of the leading coefficients coef.lo and coef.up of the models. By default all the minimal values of the coefficients equal zero.

Except the "mahalanobis" distance, the available distance measures are listed in dist.

Value

An mpcv object. See mpcv.object for details.

Author(s)

Krzysztof Ciupke, <krzysztof.ciupke at polsl.pl>

References

Ciupke K. (2014) *Multivariate Process Capability Vector Based on One-Sided Model*, Quality and Reliability Engineering International, John Wiley & Sons.

Examples

```
data(industrial)
x <- industrial$x
LSL <- industrial$LSL
USL <- industrial$USL
Target<- industrial$Target
res.ind <- mpcv(x, LSL=LSL, USL=USL, Target=Target, alpha=0.025)

data(automotive)
x <- automotive$x
LSL <- automotive$LSL
USL <- automotive$USL
Target<- automotive$Target
res.aut <- mpcv(x, indepvar="T",  LSL=LSL, USL=USL, Target=Target)

data(sleeves)
x <- sleeves$x
LSL <- sleeves$LSL
USL <- sleeves$USL
Target<- sleeves$Target
res.sle <- mpcv(x, indepvar=3, LSL=LSL, USL=USL, Target=Target, alpha=.02)
```

---

  mpcv.object   *MPCV (multivariate process capability vector) object*

Description

Structure of mpcv object

Value

An mpcv.object is a list containing the following elements:

CpV	the percentage value of the capability measurement component.
PS	the percentage value of the process shift component.
PSvar	the name of the variable which influences the process shift the most.
PD	the percentage value of the process distance component.
PDvar	the name of the variable which has the most negative influence on the value of the process distance component.
coef.lo	a named vector of leading coefficients of "lower" one-sided models; for the independent variable NA is returned.
coef.up	a named vector of leading coefficients of "upper" one-sided models; for the independent variable NA is returned.

Author(s)

Krzysztof Ciupke, <krzysztof.ciupke at polsl.pl>

See Also

mpcv

`plot.mpcv`	*Plots an mpcv object.*

Description

Plots a `mpcv` object on the current graphics device. This function is a method for the generic function `plot`, for objects of class ″mpcv″.

Usage

```
## S3 method for class 'mpcv'
plot(x, ...)
```

Arguments

x	object of a class ″mpcv″.
...	other argument, currently no used.

Details

This function presents graphically the dataset, the given tolerance region (specification limits), the identified process region, the target and the marginal median for all pairs of a process quality characteristics (variables).

Author(s)

Krzysztof Ciupke, <krzysztof.ciupke at polsl.pl>

See Also

mpcv

Examples

```
data(industrial)
x <- industrial$x
LSL <- industrial$LSL
USL <- industrial$USL
Target<- industrial$Target
res.ind <- mpcv(x, LSL=LSL, USL=USL, Target=Target, alpha=0.025, coef.lo=c(NA,.005))
plot(res.ind)
```

---

print | *Prints an mpcv object*

Description

This function prints a mpcv object. It is a method for the generic function print of class ″mpcv″.

Usage

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

Arguments

x   object of class ″mpcv″.

...   other arguments, all currently ignored.

Details

This function prints values of the three components: CpV, PS and PD with names of variable which influence the components values the most.

Author(s)

Krzysztof Ciupke, <krzysztof.ciupke at polsl.pl>

See Also

mpcv

Examples

```
data(industrial)
x <- industrial$x
LSL <- industrial$LSL
USL <- industrial$USL
Target<- industrial$Target
res.ind <- mpcv(x, LSL=LSL, USL=USL, Target=Target, alpha=0.025)
print(res.ind)
```

---

sleeves	*Dataset describing diameters of cylindrical sleeves*

Description

Dataset containing measurements of three identifiable diameters of cylindrical sleeves referred to as A, B and C.

Usage

```
data("sleeves")
```

Format

A list containing:

x a matrix with 28 observations and three quality characteristics A, B and C,

USL the vector of the upper specification limits,

LSL the vector of the lower specification limits,

Target the vector of the target.

References

Raissi S. (2009) *Multivariate process capability indices on the presence of priority for quality characteristics*, Journal of Industrial Engineering International, Vol. 5, No. 9, 27-36.

Examples

```
data("sleeves")
x <- sleeves$x
LSL <- sleeves$LSL
USL <- sleeves$USL
Target <- sleeves$Target
```

Index