Package 'Vdgraph'

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Type Package

Title Variance dispersion graphs and Fraction of design space plots for response surface designs

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Description

Uses a modification of the published FORTRAN code in ``A Computer Program for Generating Variance Dispersion Graphs" by G. Vining, Journal of Quality Technology, Vol. 25 No. 1 January 1993, to produce variance dispersion graphs. Also produces fraction of design space plots, and contains data frames for several minimal run response surface designs.

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`Vdgraph-package` *This package creates variance dispersion graphs and fraction of design space plots for response surface designs*

Description

The **Vdgraph** package provides functions for creating Variance Dispersion Graphs and Fraction of Design Space Plots of a standardized response surface design stored in a matrix or a data frame.

The function `Vdgraph(des)` creates the variance dispersion graph of the response surface design stored in the matrix or data frame `des`. The function `FDSPlot(des)` creates the fraction of design space plot of the response surface design stored in the matrix or data frame `des`. Useful response surface designs are also included as matricies in the package. These include the hexagonal design for two factors `Hex2`, the small composite designs for 3 to 6 factors and Roquemore's hybrid designs for 3 to 6 factors. The function Compare2Vdg makes the variance dispersion graphs of two designs on the same scale for comparison.

Details

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Index:

Compare2Vdg	this function makes Variance Dispersion Graphs of two response surface designs on the same graph for comparison
Compare2FDS	this function makes fraction of design space plots of two response surface designs on the same graph for comparison
D310	Roquemore (1976) Hybrid design D310
D311A	Roquemore (1976) Hybrid design 311A
D311B	Roquemore (1976) Hybrid design D311B
D416A	Roquemore (1976) Hybrid design 416A
D416B	Roquemore (1976) Hybrid design D416B
D416C	Roquemore (1976) Hybrid design D416C
D628A	Roquemore (1976) Hybrid design D628A
FDSPlot	this function makses a fraction of design space plot of a response surface design
Hex2	Hexagonal design for two factors
SCDDL5	Draper and Lin's Small Composite Design for five factors
SCDH2	Hartley's Small Composite Design for two factors
SCDH3	Hartley's Small Composite Design for three factors
SCDH4	Hartley's Small Composite Design for four factors
SCDH5	Hartley's Small Composite Design for five factors
SCDH6	Hartley's Small Composite Design for six factors
Vardsgr	Loads compiled fortran in shared file vdg
Vdgraph	this function makes a Variance Dispersion Graph of a response surface design

Author(s)

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Compare2FDS *This function compares Fraction of Design Space Plots for two response surface designs.*

Description

This function compares Fraction of Design Space Plots for two response surface designs with the same number of factors over the unit hypercube design space.

Usage

```
Compare2FDS(des1, des2, name1, name2, mod=2)
```

Arguments

des1	des1 is a matrix or a data frame containing the first response surface design to be compared in coded or uncoded units. There should be one column for each factor in the design, and one row for each run in the design. The maximum number of rows allowed is 99, and the maximum number of columns is 7.
des2	des2 is a matrix or a data frame containing the second response surface design to be compared in coded or uncoded units. There should be one column for each factor in the design, and one row for each run in the design. The maximum number of rows allowed is 99, and the maximum number of columns is 7.
name1	name1 is a character string containing a descriptive name for the first design. This descriptive name should be no more than 40 characters in order to fit in the space for a legend. If left out name1 defaults to des1
name2	name2 is a character string containing a descriptive name for the second design. This descriptive name should be no more than 40 characters in order to fit in the space for a legend. If left out name2 defaults to des2
mod	mod is the model to be represented. 0 = linear model 1 = linear main effects plus linear by linear 2-factor interactions 2 = full quadratic response surface model (default.

Author(s)

John S. Lawson <lawson@byu.edu>

References

1.Zahran, A., Anderson-Cook, C. M. and Myers,R. H. "Fraction of Design Space to Assess Prediction Capability of Response Surface Designs" Journal of Quality Technology, Vol 35, No. 4, pp 377-386. 2003.

Examples

```
data(SCDH5)
data(SCDDL5)
Compare2FDS(SCDH5, SCDDL5, "Hartley SCD-5", "Draper-Lin SCD5", mod=2)
```

Compare2Vdg — *this function compares Variance Dispersion Graph of two response surface designs with the same number of factors on the same scale*

Description

This function calls the function Vardsgr which uses Vining's (1993) fortran code to get the coordinates of a two variance dispersion graph, and then makes the plot.

Usage

```
Compare2Vdg(des,des2,name1,name2,ncolleg)
```

Arguments

des	des is a matrix or a data frame containing the first response surface design to be compared in coded or uncoded units. There should be one column for each factor in the design, and one row for each run in the design. The maximum number of rows allowed is 99, and the maximum number of columns is 7.
des2	des2 is a matrix or a data frame containing the second response surface design to be compared in coded or uncoded units. There should be one column for each factor in the design, and one row for each run in the design. The maximum number of rows allowed is 99, and the maximum number of columns is 7.
name1	name1 is a character string containing a descriptive name for the first design. This descriptive name should be no more than 40 characters in order to fit in the space for a legend. If left out name1 defaults to des
name2	name2 is a character string containing a descriptive name for the second design. This descriptive name should be no more than 40 characters in order to fit in the space for a legend. If left out name2 defaults to des2
ncolleg	The number of columns in the legend this can be 1 or 2

Value

vdgpl

vdgpl	This is a graph containing the two Variance Dispersion Graphs, one for each design

Note

This function calls the function Vardsgr to get the coordinates for the plot.

Author(s)

John S. Lawson <lawson@byu.edu>

References

1. Vining, G. "A Computer Program for Generating Variance Dispersion Graphs" Journal of Quality Technology, Vol 25, No. 1, pp. 45-58, 1993. 2. Vining, G. "Corrigenda" Journal of Quality Technology, Vol 25, No. 4, pp 333-335. 1993.

Examples

```
data(SCDH5)
data(SCDDL5)
Compare2Vdg(SCDH5,SCDDL5,"Hartley's SCD-5","Draper-Lin's SCD-5 fac",ncolleg=1)
```

D310 *Roquemore (1976) Hybrid design D310*

Description

A This is an .rda file containing the design in a matrix.

Usage

```
data(D310)
```

Format

Three columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

D311A *Roquemore (1976) Hybrid design 311A*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(D311A)
```

Format

Three columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

`D311B` *Roquemore (1976) Hybrid design D311B*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(D311B)
```

Format

Three columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

`D416A` *Roquemore (1976) Hybrid design 416A*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(D416A)
```

Format

Four columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

D416B *Roquemore (1976) Hybrid design D416B*

Description

this is an .rda file containing the design in a matrix.

Usage

```
data(D416B)
```

Format

Four columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

D416C *Roquemore (1976) Hybrid design D416C*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(D416C)
```

Format

Three columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

D628A *Roquemore (1976) Hybrid design D628A*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(D628A)
```

Format

Three columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

---

f *Calculate column means of design*

Description

This function calculates means of design.

Usage

```
f(x)
```

Arguments

x	This is a design matrix

Value

mean

mean	This is the mean of the design x

Note

This function is called by the function Vdgraph.

Author(s)

John S. Lawson <lawson@byu.edu>

FDSPlot *This function makes a Fraction of Design Space Plot of a response surface design.*

Description

This function creates a Fraction of Design Space Plot over the hypercube design space from -1 to 1 on each component.

Usage

```
FDSPlot(des, mod=2)
```

Arguments

des	des is a matrix or a data frame containing a response surface design in coded or uncoded units. There should be one column for each factor in the design, and one row for each run in the design. The maximum number of rows allowed is 99, and the maximum number of columns is 7.
mod	mod is the model to be represented. 0 = linear model 1 = linear main effects plus linear by linear 2-factor interactions 2 = full quadratic response surface model (default.

Author(s)

John S. Lawson <lawson@byu.edu>

References

1.Zahran, A., Anderson-Cook, C. M. and Myers,R. H. "Fraction of Design Space to Assess Prediction Capability of Response Surface Designs" Journal of Quality Technology, Vol 35, No. 4, pp 377-386. 2003.

Examples

```
data(D310)
FDSPlot(D310)
```

Hex2 *Hexagonal design for two factors*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(Hex2)
```

Format

Two columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

---

mx *Calculate column maximums of design*

Description

This function calculates maximums of design.

Usage

```
mx(x)
```

Arguments

x	This is a design matrix

Value

mean

max This is the maximum of the design x

Note

This function is called by the function FDSPlot.

Author(s)

John S. Lawson <lawson@byu.edu>

SCDDL5 *Draper and Lin's Small Composite Design for five factors*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(SCDDL5)
```

Format

Five columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

SCDH2 *Hartley's Small Composite Design for two factors*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(SCDH2)
```

Format

Two columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

SCDH3 *Hartley's Small Composite Design for three factors*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(SCDH3)
```

Format

Three columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

SCDH4 *Hartley's Small Composite Design for four factors*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(SCDH4)
```

Format

Four columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

SCDH5 *Hartley's Small Composite Design for five factors*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(SCDH5)
```

Format

Five columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

SCDH6 *Hartley's Small Composite Design for six factors*

Description

This is an .rda file containing the design in a matrix.

Usage

```
data(SCDH6)
```

Format

Six columns of independent variables

Source

source

References

Myers, R. H. and Montgomery D. C. *Response Surface Methodology* 2nd Ed., John Wiley and Sons NY, 2002. p.386

Vardsgr *Loads compiled fortran in shared file vdg*

Description

This function loads and runs the compiled fortran code vdg. vdg is Vining's 1999 JQT fortran code for producing variance dispersion graphs.

Usage

```
Vardsgr(ndpts, kvar1, kdv1, rdes)
```

Arguments

ndpts	This is the number of runs in the response surface design (maximum=99).
kvar1	This is the number of factors in the design matrix (maximum=6).
kdv1	This is the product of ndpts and kvar1.
rdes	This is the response surface design matrix stored as a vector of the concatenated columns of the design matrix, one column for each factor in the design.

Value

vdgr

vdgr — This is the matrix of coordinates for the variance dispersion graph. It is stored as a vector of concatenated columns. Each column is of length 20, and there are four columns in the matrix. The first column is the radius from the center of the response surface design. The second column is the maximum variance of a predicted value, the third column is the minimum variance of a predicted value, and the fourth column is the average variance of a predicted value.

Note

This function is called by the function Vdgraph.

Author(s)

John S. Lawson <lawson@byu.edu>

References

1. Vining, G. "A Computer Program for Generating Variance Dispersion Graphs" Journal of Quality Technology, Vol 25, No. 1, pp. 45-58, 1993. 2. Vining, G. "Corrigenda" Journal of Quality Technology, Vol 25, No. 4, pp 333-335. 1993.

Vdgraph — *this function makes a Variance Dispersion Graph of a response surface design*

Description

This function calls the function Vardsgr which uses Vining's (1993) fortran code to get the coordinates of a variance dispersion graph, and then makes the plot.

Usage

```
Vdgraph(des)
```

Arguments

des — des is a matrix or a data frame containing a response surface design in coded or uncoded units. There should be one column for each factor in the design, and one row for each run in the design. The maximum number of rows allowed is 99, and the maximum number of columns is 7.

Value

vdgpl

vdgpl — This is a graph containing the Variance Dispersion Graph

Note

This function calls the function Vardsgr to get the coordinates for the plot.

Author(s)

John S. Lawson <lawson@byu.edu>

References

1. Vining, G. "A Computer Program for Generating Variance Dispersion Graphs" Journal of Quality Technology, Vol 25, No. 1, pp. 45-58, 1993. 2. Vining, G. "Corrigenda" Journal of Quality Technology, Vol 25, No. 4, pp 333-335. 1993.

Examples

```
data(D310)
Vdgraph(D310)
```

Index