

# Package ‘Voss’

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**Type** Package

**Title** Generic Voss Algorithm (Random Sequential Additions)

**Version** 0.1.5

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**Description**

Generating realizations of a fractal Brownian function on uniform 1D & 2D grid with classic and generic versions of the Voss algorithm (random sequential additions).

**License** GPL-3

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Voss-package

*Generic Voss algorithm (random sequential additions)*


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### Description

Generating realizations of fractal Brownian functions on uniform 1D & 2D grid with classic and generic versions of the Voss algorithm (random sequential additions).

### Details

Package: Voss  
 Type: Package  
 Version: 0.1.5  
 Date: 2022-05-09  
 License: GPL-3

voss1d() and voss2d() functions generate realizations of fractal Brownian functions on uniform 1D & 2D grid with a classic version of the Voss algorithm (random sequential additions).

voss1g() and voss2g() functions generate realizations of fractal Brownian functions on uniform 1D & 2D grid with a generic version of the Voss algorithm (random sequential additions).

### Author(s)

Pavel V. Moskalev

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voss1d

*Fractal Brownian function on 1D grid with a classic Voss algorithm*


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### Description

voss1d() function generates realizations of a fractal Brownian function on uniform 1D grid (FBF(x)) with a classic version of the Voss algorithm (random sequential additions).

### Usage

```
voss1d(g=7, H=0.5, r=0.5, center=TRUE)
```

### Arguments

g	a number of iteration.
H	a Hurst parameter: $(0 < H) \& (H < 1)$ .
r	a partition coefficient for iteration segments.
center	logical; if center=TRUE then the y-coordinates of prefractal points will be centered.

**Details**

The Voss algorithm on 1D grid is based on an iterative partitioning of the initial segment into smaller subsegments by linear interpolation of additional points.

At each iteration, all values of the fractal Brownian function get normal pseudorandom additions with zero mean and standard deviation, which depends on the iteration index  $i$ .

In the classical version of the Voss algorithm a standard deviation is exponentially distributed by iteration:  $s[i] \leftarrow s_0 * r^{(i * H)}$ , where the initial value  $s_0 \leftarrow H * \log(1/r)$ .

**Value**

A list of Cartesian coordinates of prefractal points.

**Author(s)**

Pavel V. Moskalev

**References**

Moskalev P.V. (2008) Visualization of wavelet spectra of fractal Brownian motion, Technical Physics, Vol.53, No.10, pp.1261-1266, doi:10.1134/S1063784208100022.

**See Also**

[voss2d](#), [voss1g](#)

**Examples**

```
set.seed(20120522)
plot(voss1d(), type="l", xlab="x", ylab="y",
     main="FBF(x) with a parameter H=0.5")
abline(h=0, lty=2)
```

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voss1g

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*Fractal Brownian function on 1D grid with a generic Voss algorithm*


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**Description**

`voss1g()` function generates realizations of a fractal Brownian function on uniform 1D grid (FBF(x)) with a generic version of the Voss algorithm (random sequential additions).

**Usage**

```
voss1g(p=cbind(n=0.5^seq(0,7)+1,
              s=dchisq(seq(0,7), df=2)),
      center=TRUE)
```

**Arguments**

p	a matrix of parameters: nrow(p) a number of iterations; p[, "n"] a number of partition points in the iteration process; p[, "s"] a standard deviation of normal pseudorandom additions;
center	logical; if center=TRUE then the y-coordinates of prefractal points will be centered.

**Details**

The Voss algorithm on 1D grid is based on an iterative partitioning of the initial segment into smaller subsegments by linear interpolation of additional points.

At each iteration, all values of the fractal Brownian function get normal pseudorandom additions with zero mean and standard deviation, which depends on the iteration index  $s[i]$ .

By default, the iterative distribution of standard deviation in the generic version of the Voss algorithm is equal to the probability density of the chi-square distribution with 2 degrees of freedom:  $s[i] \leftarrow dchisq(i, df=2)$ .

**Value**

A list of Cartesian coordinates of prefractal points.

**Author(s)**

Pavel V. Moskalev

**References**

Moskalev P.V. (2008) Visualization of wavelet spectra of fractal Brownian motion, Technical Physics, Vol.53, No.10, pp.1261-1266, doi:10.1134/S1063784208100022.

**See Also**

[voss2g](#), [voss1d](#)

**Examples**

```
# Example 1: FBF(x) with a s[i]=dchisq(i,df=2)
set.seed(20120522)
plot(voss1g(), type="l", xlab="x", ylab="y",
     main="FBF(x) with a s[i]=dchisq(i,df=2)")
abline(h=0, lty=2)

# Example 2: FBF(x) with a s[i]=dlnorm(i,sdlog=1)
set.seed(20120522)
voss <- voss1g(p=cbind(n=0.5^-seq(0,7)+1,
                      s=dlnorm(seq(0,7), sdlog=1)))
plot(voss, type="l", xlab="x", ylab="y",
     main="FBF(x) with a s[i]=dlnorm(i,sdlog=1)")
```

```

abline(h=0, lty=2)

# Example 3: FBF(x,y) with a s[i]=df(i,df1=7,df2=7)
set.seed(20120522)
voss <- voss1g(p=cbind(n=0.5^-seq(0,7)+1,
                      s=df(seq(0,7), df1=7, df2=7)))
plot(voss, type="l", xlab="x", ylab="y",
     main="FBF(x) with a s[i]=df(i,df1=7,df2=7)")
abline(h=0, lty=2)

```

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voss2d

*Fractal Brownian function on 2D grid with a classic Voss algorithm*


---

### Description

voss2d() function generates realizations of a fractal Brownian fFunction on uniform 2D grid (FBF(x,y)) with a classic version of the Voss algorithm (random sequential additions).

### Usage

```
voss2d(g=7, H=0.5, r=0.5, center=TRUE)
```

### Arguments

g	a number of iteration.
H	a Hurst parameter: $(0 < H) \& (H < 1)$ .
r	a partition coefficient for iteration segments.
center	logical; if center=TRUE then the y-coordinates of prefractal points will be centered.

### Details

The Voss algorithm on 2D grid is based on an iterative partitioning of the initial domain into smaller subdomains by bilinear interpolation of additional points.

At each iteration, all values of the fractal Brownian function get normal pseudorandom additions with zero mean and standard deviation, which depends on the iteration index  $i$ .

In the classical version of the Voss algorithm standard deviation is exponentially distributed by iteration:  $s[i] <- s_0 * r^{(i * H)}$ , where the initial value  $s_0 <- H * \log(1/r)$ .

### Value

A list of Cartesian coordinates of prefractal points.

### Author(s)

Pavel V. Moskalev

## References

Shitov V.V. and Moskalev P.V. (2005) Modification of the Voss algorithm for simulation of the internal structure of a porous medium, Technical Physics, Vol.50, No.2, pp.141-145, doi:10.1134/1.1866426.

## See Also

[voss1d](#), [voss2g](#)

## Examples

```
set.seed(20120522)
voss <- voss2d()
image(voss, xlab="x", ylab="y",
      main="FBF(x,y) with a parameter H=0.5")
contour(voss, levels=0, add=TRUE)
```

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voss2g

*Fractal Brownian function on 2D grid with a generic Voss algorithm*

---

## Description

voss2g() function generates realizations of a fractal Brownian function on uniform 2D grid (FBF(x,y)) with a generic version of the Voss algorithm (random sequential additions).

## Usage

```
voss2g(p=cbind(n=0.5^seq(0,7)+1,
              s=dchisq(seq(0,7), df=2)),
      center=TRUE)
```

## Arguments

p	a matrix of parameters: nrow(p) a number of iterations; p[, "n"] a number of partition points in the iteration process; p[, "s"] a standard deviation of normal pseudorandom additions;
center	logical; if center=TRUE then the y-coordinates of prefractal points will be centered.

## Details

The Voss algorithm on 2D grid is based on an iterative partitioning of the initial domain into smaller subdomains by bilinear interpolation of additional points.

At each iteration, all values of the fractal Brownian function get normal pseudorandom additions with zero mean and standard deviation, which depends on the iteration index  $s[i]$ .

By default, the iterative distribution of standard deviation in the generic version of the Voss algorithm is equal to the probability density of the chi-square distribution with 2 degrees of freedom:  $s[i] <- dchisq(i, df=2)$ .

**Value**

A list of Cartesian coordinates of prefractal points.

**Author(s)**

Pavel V. Moskalev

**References**

Shitov V.V. and Moskalev P.V. (2005) Modification of the Voss algorithm for simulation of the internal structure of a porous medium, Technical Physics, Vol.50, No.2, pp.141-145, doi:10.1134/1.1866426.

**See Also**

[voss1g](#), [voss2d](#)

**Examples**

```
# Example 1: FBF(x,y) with a s[i]=dchisq(i,df=2)
set.seed(20120522)
voss <- voss2g()
image(voss, xlab="x", ylab="y",
      main="FBF(x,y) with a s[i]=dchisq(i,df=2)")
contour(voss, levels=0, add=TRUE)

# Example 2: FBF(x,y) with a s[i]=dlnorm(i,sdlog=1)
set.seed(20120522)
voss <- voss2g(p=cbind(n=0.5^-seq(0,7)+1,
                      s=dlnorm(seq(0,7), sdlog=1)))
image(voss, xlab="x", ylab="y",
      main="FBF(x,y) with a s[i]=dlnorm(i,sdlog=1)")
contour(voss, levels=0, add=TRUE)

# Example 3: FBF(x,y) with a s[i]=df(i,df1=7,df2=7)
set.seed(20120522)
voss <- voss2g(p=cbind(n=0.5^-seq(0,7)+1,
                      s=df(seq(0,7), df1=7, df2=7)))
image(voss, xlab="x", ylab="y",
      main="FBF(x,y) with a s[i]=df(i,df1=5,df2=5)")
contour(voss, levels=0, add=TRUE)
```

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