Package ‘Voss’

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

Generic Voss algorithm (random sequential additions)

Description

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

Details

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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

voss1d

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

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)
voss1d

Arguments

- `g` a number of iteration.
- `H` a Hurst parameter: \((0 < H < 1)\).
- `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: \(s[i] <- s0*r^i\), where the initial value \(s0 <- H*\log(1/r)\).

Value

A list of Cartesian coordinates of prefractal points.

Author(s)

Pavel V. Moskalev

References


See Also

voss2d, voss1g

Examples

```r
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)```
voss1g

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

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] <- dchisq(i, df=2).

Value

A list of Cartesian coordinates of prefractal points.

Author(s)

Pavel V. Moskalev

References

See Also

voss2g, voss1d

Examples

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

# Example 2: FBF(x) with a $s[i] = \text{dlnorm}(i, sdlog=1)$
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 $s[i] = \text{dlnorm}(i, sdlog=1)$")
abline(h=0, lty=2)

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

voss2d Fractal Brownian function on 2D grid with a classic Voss algorithm

Description

voss2d() function generates realizations of a fractal Brownian function 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: $0 < H < 1$.

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: $s[i] <- s0*r^1*i$, where the initial value $s0 <- h*log(1/r)$.

Value

A list of Cartesian coordinates of prefractal points.

Author(s)

Pavel V. Moskalev

References


See Also

voss1d, voss2g

Examples

```r
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)
```

---

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

```r
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


See Also

- `voss1g`, `voss2d`

Examples

```r
# 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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