

# Package ‘acfMPeriod’

October 12, 2022

**Type** Package

**Title** Robust Estimation of the ACF from the M-Periodogram

**Version** 1.0.0

**Author** Higor Cotta, Valderio Reisen, Pascal Bondon and Céline Lévy-Leduc

**Maintainer** Higor Cotta <cotta.higor@gmail.com>

**Depends** R (>= 3.2.2), MASS

**Description** Non-robust and robust computations of the sample autocovariance (ACOVF) and sample autocorrelation functions (ACF) of univariate and multivariate processes. The methodology consists in reversing the diagonalization procedure involving the periodogram or the cross-periodogram and the Fourier transform vectors, and, thus, obtaining the ACOVF or the ACF as discussed in Fuller (1995) <doi:10.1002/9780470316917>. The robust version is obtained by fitting robust M-regressors to obtain the M-periodogram or M-cross-periodogram as discussed in Reisen et al. (2017) <doi:10.1016/j.jspi.2017.02.008>.

**License** GPL (>= 2)

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.1.1

**NeedsCompilation** no

**Repository** CRAN

**Date/Publication** 2019-07-23 14:22:05 UTC

## R topics documented:

CovCorMPer . . . . .	2
CovCorPer . . . . .	2
CrossPeriodogram . . . . .	3
MCrossPeriodogram . . . . .	4
MPerACF . . . . .	4
MPerioReg . . . . .	6
PerACF . . . . .	6
PerioReg . . . . .	8
plot.robacf . . . . .	8

**Index****10**


---

CovCorMPer	<i>Robust covariance or correlation matrix from the MPer-ACF</i>
------------	--

---

**Description**

Wrapper that computes the covariance or correlation matrix of  $x$  at lag 0 obtained from the robust MPer-ACF.

**Usage**

```
CovCorMPer(x, type = c("correlation", "covariance"))
```

**Arguments**

$x$	a numeric matrix
type	character string giving the type of acf to be computed. Allowed values are "correlation" (the default) or "covariance".

**Value**

a numeric matrix

**Examples**

```
data.set <- cbind(fdeaths, mdeaths)
CovCorMPer(data.set)
```

---

CovCorPer	<i>Covariance or correlation matrix from the Per-ACF</i>
-----------	--

---

**Description**

Wrapper that computes the covariance or correlation matrix of  $x$  at lag 0 obtained from the Per-ACF.

**Usage**

```
CovCorPer(x, type = c("correlation", "covariance"))
```

**Arguments**

$x$	a numeric matrix
type	character string giving the type of acf to be computed. Allowed values are "correlation" (the default) or "covariance".

**Value**

a numeric matrix

**Examples**

```
data.set <- cbind(fdeaths, mdeaths)
CovCorPer(data.set)
```

---

CrossPeriodogram      *Cross-periodogram*

---

**Description**

This function computes the cross-periodogram using harmonic regression.

**Usage**

```
CrossPeriodogram(series1, series2)
```

**Arguments**

series1	univariate time series
series2	univariate time series

**Value**

a numeric vector containing the estimates of the cross-spectral density

**Author(s)**

Higor Cotta, Valdério A. Reisen, Pascal Bondon and Céline Lévy-Leduc

**References**

Fuller, Wayne A. Introduction to statistical time series. John Wiley & Sons, 2009.

---

MCrossPeriodogram	<i>Robust M-cross-periodogram</i>
-------------------	-----------------------------------

---

**Description**

This function computes the Robust M-cross-periodogram using M-regression.

**Usage**

```
MCrossPeriodogram(series1, series2)
```

**Arguments**

series1	univariate time series
series2	univariate time series

**Value**

a numeric vector containing the estimates of the cross-spectral density

**Author(s)**

Higor Cotta, Valdério A. Reisen, Pascal Bondon and Céline Lévy-Leduc

**References**

Fuller, Wayne A. Introduction to statistical time series. John Wiley & Sons, 2009.

---

MPerACF	<i>Robust autocorrelation or autocovariance function estimation from the robust M-periodogram</i>
---------	---

---

**Description**

This function computer and plots(by default) the robust estimates of the autocovariance or the autocorrelation function for univariate and multivariate time series based on the M-periodogram and the M-cross-periodogram.

**Usage**

```
MPerACF(x, lag.max = NULL, type = c("correlation", "covariance"),
plot = TRUE, na.action = na.fail, demean = TRUE, ...)
```

**Arguments**

<code>x</code>	a numeric vector or matrix.
<code>lag.max</code>	maximum lag at which to calculate the acf. Default is $10 \cdot \log_{10}(N/m)$ where $N$ is the number of observations and $m$ the number of series. Will be automatically limited to one less than the number of observations in the series.
<code>type</code>	character string giving the type of acf to be computed. Allowed values are "correlation" (the default) or "covariance". Accepts partial names.
<code>plot</code>	logical. If TRUE (the default) the acf is plotted.
<code>na.action</code>	function to be called to handle missing values. <code>na.pass</code> can be used.
<code>demean</code>	logical. Should the covariances be about the sample means?
<code>...</code>	further arguments to be passed to <code>plot.acf</code> .

**Value**

An object of class "robacf", which is a list with the following elements:

`lag` A three dimensional array containing the lags at which the acf is estimated.

`acf` An array with the same dimensions as `lag` containing the estimated acf.

`type` The type of correlation (same as the `type` argument).

`n.used` The number of observations in the time series.

`series` The name of the series `x`.

`snames` The series names for a multivariate time series.

The result is returned invisibly if `plot` is TRUE.

**Author(s)**

Higor Cotta, Valderio Reisen, Pascal Bondon and Céline Lévy-Leduc. Part of the code re-used from the `acf()` function.

**References**

Fuller, Wayne A. Introduction to statistical time series. John Wiley & Sons, 2009

**Examples**

```
data.set <- cbind(fdeaths, mdeaths)
MPerACF(data.set)
```

---

MPerioReg	<i>Robust M-periodogram</i>
-----------	-----------------------------

---

**Description**

This function computes the univariate robust M-periodogram using M-regression.

**Usage**

```
MPerioReg(series)
```

**Arguments**

series            univariate time series

**Value**

a numeric vector containing the robust estimates of the spectral density

**Author(s)**

Higor Cotta, Valdério A. Reisen, Pascal Bondon and Céline Lévy-Leduc.

**References**

Reisen, V. A. and Lévy-Leduc, C. and Taquq, M. (2017) An M-estimator for the long-memory parameter. *Journal of Statistical Planning and Inference*, 187, 44-55.

Fuller, Wayne A. Introduction to statistical time series. John Wiley & Sons, 2009.

**Examples**

```
MPerioReg(ldeaths)
```

---

PerACF	<i>Autocorrelation or autocovariance function estimation from the periodogram</i>
--------	---

---

**Description**

This function computer and plots(by default) the estimates of the autocovariance or the autocorrelation function for univariate and multivariate time series based on the periodogram and the cross-periodogram..

**Usage**

```
PerACF(x, lag.max = NULL, type = c("correlation", "covariance"),
       plot = TRUE, na.action = na.fail, demean = TRUE, ...)
```

**Arguments**

<code>x</code>	a numeric vector or matrix.
<code>lag.max</code>	maximum lag at which to calculate the acf. Default is $10 \cdot \log_{10}(N/m)$ where $N$ is the number of observations and $m$ the number of series. Will be automatically limited to one less than the number of observations in the series.
<code>type</code>	character string giving the type of acf to be computed. Allowed values are "correlation" (the default) or "covariance". Accepts partial names.
<code>plot</code>	logical. If TRUE (the default) the acf is plotted.
<code>na.action</code>	function to be called to handle missing values. <code>na.pass</code> can be used.
<code>demean</code>	logical. Should the covariances be about the sample means?
<code>...</code>	further arguments to be passed to <code>plot.acf</code> .

**Value**

An object of class "acf", which is a list with the following elements:

`lag` A three dimensional array containing the lags at which the acf is estimated.

`acf` An array with the same dimensions as `lag` containing the estimated acf.

`type` The type of correlation (same as the `type` argument).

`n.used` The number of observations in the time series.

`series` The name of the series `x`.

`snames` The series names for a multivariate time series.

The result is returned invisibly if `plot` is TRUE.

**Author(s)**

Higor Cotta, Valderio Reisen, Pascal Bondon and Céline Lévy-Leduc. Part of the code re-used from the `acf()` function.

**References**

Fuller, Wayne A. Introduction to statistical time series. John Wiley & Sons, 2009.

**Examples**

```
data.set <- cbind(fdeaths, mdeaths)
PerACF(data.set)
PerACF(data.set, type = "covariance", lag.max = 10)
```

---

PerioReg

*Periodogram*

---

### Description

This function computes the univariate periodogram using harmonic regression.

### Usage

```
PerioReg(series)
```

### Arguments

series            univariate time series

### Value

a numeric vector containing the robust estimates of the spectral density

### Author(s)

Higor Cotta, Valdério A. Reisen, Pascal Bondon and Céline Lévy-Leduc.

### References

Reisen, V. A. and Lévy-Leduc, C. and Taqqu, M. (2017) An M-estimator for the long-memory parameter. *Journal of Statistical Planning and Inference*, 187, 44-55.

Fuller, Wayne A. Introduction to statistical time series. John Wiley & Sons, 2009.

### Examples

```
PerioReg(ldeaths)
```

---

plot.robacf

*Plot Robust Autocovariance and Robust Autocorrelation Functions*

---

### Description

Plot method for objects of class "robacf". Mostly of the code re-used from the standard acf class.



**Usage**

```
## S3 method for class 'robacf'
plot(x, type = "h", xlab = "Lag", ylab = NULL,
     ylim = NULL, main = NULL, max.mfrow = 6, ask = Npgs > 1 &&
     dev.interactive(), mar = if (nser > 2) c(3, 2, 2, 0.8) else par("mar"),
     oma = if (nser > 2) c(1, 1.2, 1, 1) else par("oma"), mgp = if (nser >
     2) c(1.5, 0.6, 0) else par("mgp"), xpd = par("xpd"), cex.main = if
     (nser > 2) 1 else par("cex.main"), verbose = getOption("verbose"), ...)
```

**Arguments**

x	an object of class "robacf".
type	the type of plot to be drawn, default to histogram like vertical lines.
xlab	the x label of the plot.
ylab	the y label of the plot.
ylim	numeric of length 2 giving the y limits for the plot.
main	overall title for the plot.
max.mfrow	positive integer; for multivariate x indicating how many rows and columns of plots should be put on one page, using <code>par(mfrow = c(m,m))</code> (see <a href="#">par</a> ).
ask	logical; if TRUE, the user is asked before a new page is started.
mar, oma, mgp, xpd, cex.main	graphics parameters as in <code>par(*)</code> , by default adjusted to use smaller than default margins for multivariate x only.
verbose	logical. Should R report extra information on progress?
...	graphics parameters to be passed to the plotting routines.

**Value**

None

**Contributions**

plot.acf (stats) - R Core

# Index

CovCorMPer, 2

CovCorPer, 2

CrossPeriodogram, 3

MCrossPeriodogram, 4

MPerACF, 4

MPerioReg, 6

par, 9

PerACF, 6

PerioReg, 8

plot.robacf, 8