

# Package ‘descomponer’

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**Type** Package

**Title** Seasonal Adjustment by Frequency Analysis

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**Author** Francisco Parra <parra\_fj@cantabria.es>

**Maintainer** Francisco Parra <parra\_fj@cantabria.es>

**Description** Decompose a time series into seasonal, trend and irregular components using transformations to amplitude-frequency domain.

**License** GPL (>= 2)

**Depends** R(>= 2.10)

**Repository** CRAN

**NeedsCompilation** no

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<i>cdf</i>	<i>Get Auxiliary Matrix</i>
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**Description**

Gets the auxiliary matrix to vector in time domain, pre-multiplies the vector by the orthogonal matrix,  $W$ , and its transpose, Parra F. (2013)

**Usage**

`cdf(y)`

**Arguments**

`y` a vector of the observed time-serie values

**Value**

a matrix of sine and cosine waves adjusted to time-serie

**Author(s)**

Francisco Parra

**References**

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, International Economic Review, 19, 507-512.

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**Examples**

```
n<-100;x<-seq(0,24*pi,length=n);y<-sin(x)+rnorm(n,sd=.3)
cdf(y)
```

---

celec	<i>Consumption of electricity in Spain</i>
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---

**Description**

A vector: celec, Miles de Tep, 1995 a 2013

**Usage**

```
data(celec)
```

**Source**

Instituto Nacional de Estadística Spain

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descomponer	<i>Time series decomposition</i>
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---

**Description**

Decompose a time series into seasonal, trend and irregular components using the transform amplitude-frequency domain to time series.

**Usage**

```
descomponer(y, frequency, type)
```

**Arguments**

y	a Vector of the observed time-serie values
frequency	Number of times in each unit time interval
type	lineal (1), quadratic(2)

**Details**

One could use a value of 7 for frequency when the data are sampled daily, and the natural time period is a week, or 4 and 12 when the data are sampled quarterly and monthly and the natural time period is a year.

Transforms the time series in amplitude-frequency domain, by a band spectrum regression (Parra, F., 2013) of the serie  $y_t$  and a OLS lineal trend, in which regression is carried out in the low and the seasonal amplitude-frequency domain. The low frequency are the periodicity  $n/2 * frequency$  or  $(n-1)/2 * frequency$ , if  $n$  is odd. The seasonal frequency are the periodicity:  $2n/2 * frequency, 3n/2 * frequency, 4n/2 * frequency, \dots$

Use the "sort.data.frame" function, Kevin Wright (<http://tolstoy.newcastle.edu.au/R/help/04/07/1076.html>).

Slow computer in time series higher 1000 data.

The output is a data.frame object.

**Value**

y	The Vector of the observed time-series values
TDST	The trend and seasonal time serie of y
TD	The trend time serie of y
ST	The seasonal time serie of y
IR	The remainder time serie of y
regresoresTD	The regressors matrix use to the trend estimated
regresoresST	The regressors matrix use to the seasonal estimated
coeficientesTD	The coefficient vector use to the trend estimated
coeficientesSD	The coefficient vector use to the seasonal estimated

**References**

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, International Economic Review, 19, 507-512.

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**Examples**

```
data(ipi)
datos <- descomponer(ipi,12,2)
plot(ts(datos$datos, frequency=12))
```

---

 estimardf

*Prediction whit Regression in domain frequency*


---

**Description**

Make a prediction for a rdf object

**Usage**

```
estimardf(a,b)
```

**Arguments**

a	a model rdf
b	An optional data frame in which to look for variables with which to predict. If omitted, the fitted values are used.

**Details**

Use predict.lm, with interval="prediction"

Slow computer in time series higher 1000 data.

**Value**

fit                      vector or matrix as above

**References**

DURBIN, J., "Tests for Serial Correlation in Regression Analysis based on the Periodogram of Least-Squares Residuals," *Biometrika*, 56, (No. 1, 1969), 1-15.

Engle, Robert F. (1974), Band Spectrum Regression, *International Economic Review* 15,1-11.

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, *International Economic Review*, 19, 507-512.

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**Examples**

```
data(PIB)
data(celec)
mod1=rdf(celec,PIB)
newdata=c(20000)
estimardf(mod1,newdata)
```

---

FFF

*Regression in Fourier Flexible Form*


---

**Description**

Make a Fourier Flexible Form Regression

**Usage**

```
FFF(y, x)
```

**Arguments**

y                      a Vector of the dependent variable  
x                      a Vector of the independent variable

**Details**

The regression FFF use LM for fitted into the serie  $y_t$  and the fourier coefficients expansion described in Gallant (1984).

The output is a data.frame object.

**Value**

fitted	The time - serie fitted
X	The X time - series fourier coefficients
residuals	The time - serie fitted

**References**

DURBIN, J., "Tests for Serial Correlation in Regression Analysis based on the Periodogram of Least-Squares Residuals," *Biometrika*, 56, (No. 1, 1969), 1-15.

Engle, Robert F. (1974), Band Spectrum Regression, *International Economic Review* 15,1-11.

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, *International Economic Review*, 19, 507-512.

Gallant; A. R.(1984), The Fourier Flexible Form. *Amer. J. Agr. Econ.*66(1984):204-15.

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

Parra, F.(2021), Econometria con Series de Fourier (<https://econometria.files.wordpress.com/2020/12/curso-de-econometria-avanzado.pdf>)

**Examples**

```
data(PIB)
data(celec)
FFF(celec,PIB)
```

---

gdescomponer

*Plotting the trend and seasonal*

---

**Description**

Plotting the trend and seasonal of time series.

**Usage**

```
gdescomponer(y, freq, type, year, q)
```

**Arguments**

y	a vector of the observed time-serie values
freq	Number of times in each unit time interval
type	lineal (1), quadratic(2)
year	the year of the first observation
q	the time of the first observation

**References**

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**See Also**

[descomponer](#)

**Examples**

```
data(ipi)
gdescomponer(ipi, 12, 1, 2002, 1)
```

---

gdf

*Get Frequency Data*

---

**Description**

Transforms the data from the amplitude-time domain the amplitude-frequency domain pre-multiplied by the orthogonal matrix  $W$ , whose elements are defined in Harvey A.C. (1978).

**Usage**

```
gdf(y)
```

**Arguments**

`y` a vector of the observed time-series values

**Value**

a vector of the estimated coefficients fourier

**Author(s)**

Francisco Parra

**References**

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, International Economic Review, 19, 507-512.

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**See Also**

[gdt](#)

**Examples**

```
n<-100;x<-seq(0,24*pi,length=n);y<-sin(x)+rnorm(n,sd=.3)
gdf(y)
```

---

gdt

*Get Time Data*

---

**Description**

Transforms the data from the amplitude-frequency domain the amplitude-time domain pre-multiplied by inverse of the orthogonal matrix  $W$ , whose elements are defined in Harvey A.C. (1978).

**Usage**

```
gdt(y)
```

**Arguments**

`y` a vector of the coefficients fourier

**Value**

a vector of the observed time-series values

**Author(s)**

Francisco Parra

**References**

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, International Economic Review, 19, 507-512.

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**See Also**

[gdf](#)

**Examples**

```
n<-100;x<-seq(0,24*pi,length=n);y<-sin(x)+rnorm(n,sd=.3)
coef <- gdf(y)
gdt(coef)
```

---

`gperiodograma`*Plotting method for specturm*

---

**Description**

Plotting method for specturm calculate by periodograma function.

**Usage**

```
gperiodograma(y)
```

**Arguments**

`y` a vector of the observed time-serie values

**References**

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**See Also**

[periodograma](#)

**Examples**

```
n<-100;x<-seq(0,24*pi,length=n);y<-sin(x)+rnorm(n,sd=.3)
gperiodograma(y)
```

---

`gtd`*Plotting method for specturm*

---

**Description**

Plotting cumulative periodogram test.

**Usage**

```
gtd(y)
```

**Arguments**

`y` a vector of the observed time-serie values

**References**

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**See Also**

[td](#)

**Examples**

```
data(PIB)
gtd(PIB)
```

---

ipi

*Indice de Produccion Industrial de Cantabria*

---

**Description**

A vector: IPI, Base: 2010. Enero 2002 a Abril 2014

**Usage**

```
data(ipi)
```

**Source**

Instituto Nacional de Estadistica Spain

---

MW

*Get Frequency Data*

---

**Description**

Orthogonal matrix defined in Harvey (1978)

**Usage**

```
MW(n)
```

**Arguments**

n                      rows and columns number

**Value**

Orthogonal matrix of n X n dimensions

**Author(s)**

Francisco Parra

**References**

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, *International Economic Review*, 19, 507-512.

**See Also**

[gdt](#), [gdf](#), [cdf](#)

**Examples**

MW(80)

---

periodograma

*Periodogram*

---

**Description**

Calculates and displays the spectrum of the time serie

**Usage**

periodograma(y)

**Arguments**

y                    a vector of the observed time-serie values

**Value**

frecuencia	Vector of frequencies at which the spectral density is estimated. The units are the reciprocal of cycles per unit time.
omega	Is calculated by $\pi * \text{frecuencia} / (n/2)$
periodos	$n / \text{frecuencia}$
densidad	Vector of estimates of the spectral density at frequencies corresponding to frecuencia.

**References**

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**See Also**

[gperiodograma](#)

**Examples**

```
n<-100;x<-seq(0,24*pi,length=n);y<-sin(x)+rnorm(n,sd=.3)
periodograma(y)
```

---

PIB	<i>GDP Volume Index in Spain</i>
-----	----------------------------------

---

**Description**

A vector: PIB, Base: 2010. 1995 a 2013

**Usage**

```
data(PIB)
```

**Source**

Instituto Nacional de Estadística Spain

---

predictFFF	<i>Prediction whit Regression in FFF</i>
------------	--

---

**Description**

Make a prediction for a rdf object

**Usage**

```
predictFFF(y,x,new)
```

**Arguments**

y	a Vector of the dependent variable
x	a Vector of the independent variable
new	A data frame in which to look for variables with which to predict. If omitted, the fitted values are used.

**Details**

Use predict.lm, with interval="confidence"

**Value**

fit	vector or matrix as above
-----	---------------------------

## References

- DURBIN, J., "Tests for Serial Correlation in Regression Analysis based on the Periodogram of Least-Squares Residuals," *Biometrika*, 56, (No. 1, 1969), 1-15.
- Engle, Robert F. (1974), Band Spectrum Regression, *International Economic Review* 15, 1-11.
- Harvey, A.C. (1978), Linear Regression in the Frequency Domain, *International Economic Review*, 19, 507-512.
- Gallant; A. R. (1984), The Fourier Flexible Form. *Amer. J. Agr. Econ.* 66(1984):204-15.
- Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)
- Parra, F. (2021), *Econometria con Series de Fourier* (<https://econometria.files.wordpress.com/2020/12/curso-de-econometria-avanzado.pdf>)

## Examples

```
data("ipi")
t=seq(1:length(ipi))
Mod1=FFF(ipi, t)
plot(ipi)
lines(Mod1$fitted)
new=(length(t)+1):(length(t)+12)
Mod2=predictFFF(ipi, t, new)
```

---

predictrdf

*Prediction whit Regression in domain frequency*

---

## Description

Make a prediction for a rdf object

## Usage

```
predictrdf(a,b)
```

## Arguments

- |   |  |
|---|--|
| a | a model rdf  |
| b | An optional data frame in which to look for variables with which to predict. If omitted, the fitted values are used. |

## Details

Use `predict.lm`, with `interval="prediction"`  
 Slow computer in time series higher 1000 data.

**Value**

fit                      vector or matrix as above

**References**

DURBIN, J., "Tests for Serial Correlation in Regression Analysis based on the Periodogram of Least-Squares Residuals," *Biometrika*, 56, (No. 1, 1969), 1-15.

Engle, Robert F. (1974), Band Spectrum Regression, *International Economic Review* 15, 1-11.

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, *International Economic Review*, 19, 507-512.

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**Examples**

```
data(PIB)
data(celec)
mod1=rdf(celec,PIB)
newdata=c(100)
predictrdf(mod1,newdata)
```

---

 rdf

*Regression in domain frequency*


---

**Description**

Make a Band Spectrum Regression using the comun frequencies in cross-spectrum .

**Usage**

```
rdf(y,x)
```

**Arguments**

y                      a Vector of the dependent variable  
 x                      a Vector of the independent variable

**Details**

Transforms the time series in amplitude-frequency domain, order the fourier coefficient by the comun frequencies in cross-spectrum, make a band spectrum regresion (Parra, F. ,2013) of the serie  $y_t$  and  $x_t$  for every set of fourier coefficients, and select the model to pass the Durbin test in the significance chosen.

If not find significance for Band Spectrum Regression, make a OLS.

The generalized cross validation (gcv), is calculated by:  $gcv = n * sse / ((n-k)^2)$

where "sse" is the residual sums of squares, "n" the observation, and k the coefficients used in the band spectrum regression.

Slow computer in time series higher 1000 data.

The output is a data.frame object.

### Value

datos\$Y	The Y time-serie
datos\$X	The X time-serie
datos\$F	The time - serie fitted
datos\$reg	The error time-serie
Fregresores	The matrix of regressors choosen in frequency domain
Tregresores	The matrix of regressors choosen in time domain
Nregresores	The coefficient number of fourier chosen
sse	Residual sums of squares
gcv	Generalized Cross Validation

### References

DURBIN, J., "Tests for Serial Correlation in Regression Analysis based on the Periodogram of Least-Squares Residuals," *Biometrika*, 56, (No. 1, 1969), 1-15.

Engle, Robert F. (1974), Band Spectrum Regression, *International Economic Review* 15,1-11.

Harvey, A.C. (1978), Linear Regression in the Frequency Domain, *International Economic Review*, 19, 507-512.

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

### Examples

```
data(PIB)
data(celec)
rdf(celec,PIB)
```

---

td	<i>Cumulative periodogram test</i>
----	------------------------------------

---

### Description

Cumulative periodogram test.

### Usage

```
td(y)
```

**Arguments**

`y` a vector of the observed time-serie values

**Details**

The output is a `data.frame` object.

**Value**

<code>s2</code>	Cumulative periodogram.
<code>min</code>	Is calculated by $-c+(t/\text{length}(y))$
<code>max</code>	Is calculated by $c+(t/\text{length}(y))$

**References**

Parra, F. (2014), Amplitude time-frequency regression, (<http://econometria.wordpress.com/2013/08/21/estimation-of-time-varying-regression-coefficients/>)

**See Also**

[periodograma](#)

**Examples**

```
data(PIB)
td(PIB)
```

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