

Package ‘tsapp’

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Type Package

Title Time Series, Analysis and Application

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Description Accompanies the book Rainer Schlittgen and Cristina Sattarhoff (2020) <<https://www.degruyter.com/>> ``Angewandte Zeitreihenanalyse mit R, 4. Auflage". The package contains the time series and functions used therein. It was developed over many years teaching courses about time series analysis.

License GPL

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LazyData true

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ACCIDENT *Monthly numbers of road traffic accidents with personal injury in BRD*

Description

Monthly numbers of road traffic accidents with personal injury in BRD

Usage

ACCIDENT

Format

ACCIDENT is a univariate time series of length 528, start January 1974, frequency = 12

ACCIDENT Monthly numbers of road traffic accidents with personal injury

Source

< <https://www-genesis.destatis.de/genesis//online?operation=table&code=46241-0002&levelindex=0&levelid=1583749114>

Examples

```
data(ACCIDENT)
## maybe tsp(ACCIDENT) ; plot(ACCIDENT)
```

acfmat	<i>acfmat computes a sequence of autocorrelation matrices for a multivariate time series</i>
--------	--

Description

acfmat computes a sequence of autocorrelation matrices for a multivariate time series

Usage

```
acfmat(y, lag.max)
```

Arguments

y	multivariate time series
lag.max	maximum number of lag

Value

out list with components:

M	array with autocovariance matrices
M1	array with indicators if autocovariances are significantly greater (+), lower (-) than the critical value or insignificant (.) at 95 percent level

Examples

```
data(ICECREAM)
out <- acfmat(ICECREAM,7)
```

acfpacf	<i>acfpacf produces a plot of the acf and the pacf of a time series</i>
---------	---

Description

acfpacf produces a plot of the acf and the pacf of a time series

Usage

```
acfpacf(x, lag)
```

Arguments

x	the series, a vector or a time series
lag	scalar, maximal lag to be plotted

Examples

```
data(LYNX)
acfpacf(log(LYNX), 15)
```

ALCINCOME	<i>Alcohol Demand, UK, 1870-1938.</i>
-----------	---------------------------------------

Description

Alcohol Demand, UK, 1870-1938.

Usage

```
ALCINCOME
```

Format

ALCINCOME is a threevariate time series of length 69 and 3 variables; start 1870, frequency = 1

Y log consumption per head

Z log real income per head

X log real price

Source

Durbin & Watson (1951) <<https://doi.org/10.1093/biomet/38.1-2.159>>

Examples

```
data(ALCINCOME)
## maybe tsp(ALCINCOME) ; plot(ALCINCOME)
```

armathspec	<i>armathspec determines the theoretical spectrum of an arma process</i>
------------	--

Description

armathspec determines the theoretical spectrum of an arma process

Usage

```
armathspec(a, b, nf, s = 1, pl = FALSE)
```

Arguments

a	ar-coefficients
b	ma-coefficients
nf	scalar, the number of equally spaced frequencies
s	variance of error process
pl	logical, if TRUE, the spectrum is plotted, FALSE for no plot

Value

out (nf+1,2) matrix, the frequencies and the spectrum

Examples

```
out <-armathspec(c(0.3, -0.5), c(-0.8, 0.7), 50, s=1, pl=FALSE)
```

aspectratio	<i>aspectratio determines the aspect ratio to plot a time series</i>
-------------	--

Description

aspectratio determines the aspect ratio to plot a time series

Usage

```
aspectratio(y)
```

Arguments

y time series

Value

a scalar, the aspect ratio

Examples

```
data(GDP)
a <- aspectratio(GDP)
```

bandfilt

bandfilt does a bandpass filtering of a time series

Description

bandfilt does a bandpass filtering of a time series

Usage

```
bandfilt(y, q, pl, pu)
```

Arguments

y the series, a vector or a time series
q scalar, half of length of symmetric weights
pl scalar, lower periodicity (≥ 2)
pu scalar, upper periodicity ($> pl$)

Value

yf (n,1) vector, the centered filtered time series with NA's at beginning and ending

Examples

```
data(GDP)
yf <- bandfilt(GDP,5,2,6)
plot(GDP); lines(yf+mean(GDP),col="red")
```

BEER	<i>Monthly beer production in Australia: megalitres. Includes ale and stout. Does not include beverages with alcohol percentage less than 1.15.</i>
------	---

Description

Monthly beer production in Australia: megalitres. Includes ale and stout. Does not include beverages with alcohol percentage less than 1.15.

Usage

BEER

Format

BEER is a univariate time series of length 476, start January 1956, end Aug 1995, frequency = 12

BEER Monthly production of beer in Australia

Source

R package tsdl <<https://github.com/FinYang/tsdl>>

Examples

```
data(BEER)
## maybe tsp(BEER) ; plot(BEER)
```

bispeces	<i>bispeces performs indirect bivariate spectral estimation of two series y1, y2 using lagwindows</i>
----------	---

Description

bispeces performs indirect bivariate spectral estimation of two series y1, y2 using lagwindows

Usage

```
bispeces(y1, y2, q, win = "bartlett")
```

Arguments

y1	vector, the first time series
y2	vector, the second time series
q	number of covariances used for indirect spectral estimation
win	lagwindow (possible: "bartlett", "parzen", "tukey")

Value

out data frame with columns:

f	frequencies 0, 1/n, 2/n, ... ($\leq 1/2$)
coh	estimated coherency at Fourier frequencies 0, 1/n, ...
ph	estimated phase at Fourier frequencies 0, 1/n, ...

Examples

```
data(ICECREAM)
y <- ICECREAM
out <- bispeces(y[,1],y[,2],8,win="bartlett")
```

BLACKOUT

Weekly number of births in New York

Description

Weekly number of births in New York

Usage

BLACKOUT

Format

BLACKOUT is a univariate time series of length 313, 1961 – 1966

BLACKOUT Weekly numbers of births in New York

Source

Izenman, A. J., and Zabell, S. L. (1981) <<https://www.sciencedirect.com/science/article/abs/pii/0049089X81900181>>

Examples

```
data(BLACKOUT)
## maybe tsp(BLACKOUT) ; plot(BLACKOUT)
```

BoxCox	<i>BoxCox determines the power of a Box-Cox transformation to stabilize the variance of a time series</i>
--------	---

Description

BoxCox determines the power of a Box-Cox transformation to stabilize the variance of a time series

Usage

```
BoxCox(y, seg, Plot = FALSE)
```

Arguments

y	the series, a vector or a time series
seg	scalar, number of segments
Plot	logical, should a plot be produced?

Value

1 scalar, the power of the Box-Cox transformation

Examples

```
data(INORDER)
lambda <-BoxCox(INORDER,6,Plot=FALSE)
```

COFFEE	<i>U.S. annual coffee consumption</i>
--------	---------------------------------------

Description

U.S. annual coffee consumption

Usage

```
COFFEE
```

Format

COFFEE is a univariate time series of length 61; start 1910, frequency = 1

COFFEE annual coffee-consumption USA, logarithmic transformed

Source

R package tsdl <<https://github.com/FinYang/tsdl>>

Examples

```
data(COFFEE)
## maybe tsp(COFFEE) ; plot(COFFEE)
```

DAX	<i>Market value of DAX</i>
-----	----------------------------

Description

Market value of DAX

Usage

DAX

Format

DAX is a multivariate time series of length 12180 and 4 variables

DAY Day of the week

MONTH Month

Year Year

DAX30 Market value

Examples

```
data(DAX)
## maybe tsp(DAX) ; plot(DAX)
```

DIABETES	<i>Incidences of insulin-dependent diabetes mellitus</i>
----------	--

Description

Incidences of insulin-dependent diabetes mellitus

Usage

DIABETES

Format

DIABETES is a univariate time series of length 72, start January 1979, frequency = 12

DIABETES Incidences of insulin-dependent diabetes mellitus

Source

Waldhoer, T., Schober, E. and Tuomilehto, J. (1997) <<https://www.sciencedirect.com/science/article/abs/pii/S0895435696003344>>

Examples

```
data(DIABETES)
## maybe tsp(DIABETES) ; plot(DIABETES)
```

DOMINANCE

Running yield of public bonds in Austria and Germany

Description

Running yield of public bonds in Austria and Germany

Usage

DOMINANCE

Format

DOMINANCE is a bivariate time series of length 167:

X Interest rate Germany

Y Interest rate Austria

Source

Jaenicke, J. and Neck, R. (1996) <<https://doi.org/10.17713/ajs.v25i2.555>>

Examples

```
data(DOMINANCE)
## maybe tsp(DOMINANCE) ; plot(DOMINANCE)
```

dyspecest	<i>dyspecest performs a dynamic spectrum estimation</i>
-----------	---

Description

dyspecest performs a dynamic spectrum estimation

Usage

```
dyspecest(y, nseg, nf, e, theta = 0, phi = 15, d, Plot = FALSE)
```

Arguments

y	time series or vector
nseg	number of segments for which the spectrum is estimated
nf	number of equally spaced frequencies
e	equal bandwidth
theta	azimuthal viewing direction, see R function persp
phi	colatitude viewing direction, see R function persp
d	a value to vary the strength of the perspective transformation, see R function persp
Plot	logical, should a plot be generated?

Value

out list with components

f	frequencies, vector of length nf
t	time, vector of length nseg
spec	the spectral estimates, (nf,nt)-matrix

Examples

```
data(IBM)
y <- diff(log(IBM))
out <- dyspecest(y, 60, 50, 0.2, theta=0, phi=15, d=1, Plot=FALSE)
```

ENGINES *Number of incoming orders for engines*

Description

Number of incoming orders for engines

Usage

ENGINES

Format

ENGINES is a univariate time series of length 188, start January 1972 frequency = 12

ENGINES Incoming orders for enginesn

Examples

```
data(ENGINES)
## maybe tsp(ENGINES) ; plot(ENGINES)
```

FINANCE *Portfolio-Insurance-Strategies*

Description

Portfolio-Insurance-Strategies

Usage

FINANCE

Format

FINANCE is a multivariate time series of length 7529:

CPPI first Portfolio-Insurance-Strategy

TIPP second Portfolio-Insurance-Strategy

StopLoss third Portfolio-Insurance-Strategy

SyntheticPut fourth Portfolio-Insurance-Strategy

CASH money market investment

Source

Dichtl, H. and Drobetz, W. (2011) <doi:10.1016/j.jbankfin.2010.11.012>

Examples

```
data(FINANCE)
## maybe tsp(FINANCE) ; plot(FINANCE)
```

GDP	<i>Germany's gross domestic product adjusted for price changes</i>
-----	--

Description

Germany's gross domestic product adjusted for price changes

Usage

GDP

Format

GDP is a univariate time series of length 159, start January 1970, frequency = 4

GDP Gross domestic product adjusted for price changes

Source

<<https://www-genesis.destatis.de/genesis//online?operation=table&code=81000-0002&levelindex=0&levelid=1583750132>>

Examples

```
data(GDP)
## maybe tsp(GDP) ; plot(GDP)
```

GDPORIG	<i>Germany's gross domestic product, values of Laspeyres index to base 2000</i>
---------	---

Description

Germany's gross domestic product, values of Laspeyres index to base 2000

Usage

GDPORIG

Format

GDPORIG is a univariate time series of length 159, start January 1970, frequency = 4

GDPORIG gross domestic product, values of Laspeyres index to the base 2000

Source

<https://www-genesis.destatis.de/genesis//online?operation=table&code=81000-0002&levelindex=0&levelid=15837501323>

Examples

```
data(GDPORIG)
## maybe tsp(GDPORIG) ; plot(GDPORIG)
```

Grangercaus	<i>Grangercaus determines three values of BIC from a twodimensional VAR process</i>
-------------	---

Description

Grangercaus determines three values of BIC from a twodimensional VAR process

Usage

```
Grangercaus(x, y, p)
```

Arguments

x	first time series
y	second time series
p	maximal order of VAR process

Value

out list with components

BIC vector of length 3:

BIC1	minimum aic value for all possible lag structures
BIC2	minimum aic value when Y is not included as regressor in the equation for X
BIC3	minimum aic value when X is not included as regressor in the equation for Y

out1 output of function lm for regression equation for x-series

out2 output of function lm for regression equation for y-series

Examples

```
data(ICECREAM)
out <- Grangercaus(ICECREAM[,1], ICECREAM[,2], 3)
```

HAC	<i>HAC Covariance Matrix Estimation</i> HAC computes the central quantity (the meat) in the HAC covariance matrix estimator, also called sandwich estimator. HAC is the abbreviation for "heteroskedasticity and autocorrelation consistent".
-----	---

Description

HAC Covariance Matrix Estimation HAC computes the central quantity (the meat) in the HAC covariance matrix estimator, also called sandwich estimator. HAC is the abbreviation for "heteroskedasticity and autocorrelation consistent".

Usage

```
HAC(mcond, method = "Bartlett", bw)
```

Arguments

mcond	a q-dimensional multivariate time series. In the case of OLS regression with q regressors mcond contains the series of the form regressor*residual (see example below).
method	kernel function, choose between "Truncated", "Bartlett", "Parzen", "Tukey-Hanning", "Quadratic Spectral".
bw	bandwidth parameter, controls the number of lags considered in the estimation.

Value

mat a (q,q)-matrix

Source

Heberle, J. and Sattarhoff, C. (2017) <doi:10.3390/econometrics5010009> "A Fast Algorithm for the Computation of HAC Covariance Matrix Estimators"

Examples

```
data(MUSKRAT)
y <- ts(log10(MUSKRAT))
n <- length(y)
t <- c(1:n)
t2 <- t^2
out2 <- lm(y ~ t +t2)
mat_xu <- matrix(c(out2$residuals,t*out2$residuals, t2*out2$residuals),nrow=62,ncol=3)
hac <- HAC(mat_xu, method="Bartlett", 4)

mat_regr<- matrix(c(rep(1,62),t,t2),nrow=62,ncol=3)
mat_q <- t(mat_regr)%*%mat_regr/62
```

```
vcov_HAC <- solve(mat_q)%*%hac%*%solve(mat_q)/62
# vcov_HAC is the HAC covariance matrix estimation for the OLS coefficients.
```

HEARTBEAT *Cardiac frequency of a patient*

Description

Cardiac frequency of a patient

Usage

```
HEARTBEAT
```

Format

HEARTBEAT is a univariate time series of length 30:

HEARTBEAT cardiac frequency of a patient

Examples

```
data(HEARTBEAT)
## maybe tsp(HEARTBEAT) ; plot(HEARTBEAT)
```

HSV *HSV's position in the first German soccer league*

Description

HSV's position in the first German soccer league

Usage

```
HSV
```

Format

HSV is a univariate time series of length 34:

HSV HSV's position in the first German soccer league

Source

<<https://www.transfermarkt.de/hamburger-sv/platzierungen/verein/41>>

Examples

```
data(HSV)
## maybe tsp(HSV) ; plot(HSV)
```

IBM

IBM's stock price

Description

IBM's stock price

Usage

IBM

Format

IBM is a univariate time series of length 369, start 17 May 1961

IBM IBM's daily stock price

Source

Box, G. E. P. and Jenkins, G. M. (1970, ISBN: 978-0816210947) "Time series analysis: forecasting and control"

Examples

```
data(IBM)
## maybe tsp(IBM) ; plot(IBM)
```

ICECREAM

Temperature and consumption of ice cream

Description

Temperature and consumption of ice cream

Usage

ICECREAM

Format

ICECREAM is a bivariate time series of length 160:

ICE consumption of ice cream

TEMP Temperature in Fahrenheit degrees

Source

Hand, D. J., et al. (1994, ISBN: 9780412399206) "A Handbook of Small Data Sets"

Examples

```
data(ICECREAM)
## maybe tsp(ICECREAM) ; plot(ICECREAM)
```

INORDER	<i>Income orders of a company</i>
---------	-----------------------------------

Description

Income orders of a company

Usage

```
INORDER
```

Format

INORDER is a univariate time series of length 237, start January 1968, frequency =12

INORDER Income orders of a company

Examples

```
data(INORDER)
## maybe tsp(INORDER) ; plot(INORDER)
```

interpol	<i>interpol help function for missls</i>
----------	--

Description

interpol help function for missls

Usage

```
interpol(rho, xcent)
```

Arguments

rho	autocorrelation function
xcent	centered time series

Value

z new version of xcent

kweightsHAC

kweightsHAC *help function for HAC*

Description

kweightsHAC help function for HAC

Usage

```
kweightsHAC(
  kernel = c("Truncated", "Bartlett", "Parzen", "Tukey-Hanning", "Quadratic Spectral"),
  dimN,
  bw
)
```

Arguments

kernel	kernel function, choose between "Truncated", "Bartlett", "Parzen", "Tukey-Hanning", "Quadratic Spectral".
dimN	number of observations
bw	bandwidth parameter

Value

ww weights

L921

Subsoil water level and precipitation at pilot well L921

Description

Subsoil water level and precipitation at pilot well L921

Usage

L921

Format

L921 is a trivariate time series of length 335:

T Day

Y Water level

Z Supplemented water level

Examples

```
data(L921)
## maybe tsp(L921) ; plot(L921)
```

lagwinba	lagwinba <i>Bartlett's Lag-window for indirect spectrum estimation</i>
----------	--

Description

lagwinba Bartlett's Lag-window for indirect spectrum estimation

Usage

```
lagwinba(NL)
```

Arguments

NL number of lags used for estimation

Value

win vector, one-sided weights

Examples

```
win <- lagwinba(5)
```

lagwinpa	lagwinpa <i>Parzen's Lag-window for indirect spectrum estimation</i>
----------	--

Description

lagwinpa Parzen's Lag-window for indirect spectrum estimation

Usage

```
lagwinpa(NL)
```

Arguments

NL number of lags used for estimation

Value

win vector, one-sided weights

Examples

```
win <- lagwinpa(5)
```

lagwintu	lagwintu <i>Tukey's Lag-window for indirect spectrum estimation</i>
----------	---

Description

lagwintu Tukey's Lag-window for indirect spectrum estimation

Usage

```
lagwintu(NL)
```

Arguments

NL number of lags used for estimation

Value

win vector, one-sided weights

Examples

```
win <- lagwintu(5)
```

ldrec	ldrec <i>does Levinson-Durbin recursion for determining all coefficients a(i,j)</i>
-------	---

Description

ldrec does Levinson-Durbin recursion for determining all coefficients a(i,j)

Usage

```
ldrec(a)
```

Arguments

a (p+1,1)-vector of acf of a time series: acov(0),...,acov(p) or 1,acor(1),...,acor(p)

Value

mat (p,p+2)-matrix, coefficients in lower triangular, pacf in colum p+2 and Q(p) in colum p+1

Examples

```
data(HEARTBEAT)
a <- acf(HEARTBEAT,5,plot=FALSE)
mat <- ldrec(a$acf)
```

LITH

Daily subsoil water level and precipitation at pilot well Lith

Description

Daily subsoil water level and precipitation at pilot well Lith

Usage

LITH

Format

LITH is a bivariate time series of length 1347:

N precipitation amount

G water level

Examples

```
data(LITH)
## maybe tsp(LITH) ; plot(LITH)
```

LjungBoxPierceTest

LjungBoxPierceTest determines the test statistic and p values for several lags for a residual series

Description

LjungBoxPierceTest determines the test statistic and p values for several lags for a residual series

Usage

```
LjungBoxPierceTest(y, n.par = 0, maxlag = 24)
```

Arguments

y the series of residuals, a vector or a time series
n.par number of parameters which had been estimated
maxlag maximal lag up to which the test statistic is computed

Value

BT matrix with columns: lags, degrees of freedom, test statistic, p-value

Examples

```
data(COFFEE)
out <- arima(COFFEE,order=c(1,0,0))
BT <- LjungBoxPierceTest(out$residuals,1,20)
```

 LUHORMONE

Level of Luteinzing hormone of a cow

Description

Level of Luteinzing hormone of a cow

Usage

LUHORMONE

Format

LUHORMONE is a bivariate time series of length 29:

T Time in minutes

X Level of the Luteinzing-hormone

 LYNX

Annual lynx trappings in a region of North-West Canada. Taken from Andrews and Herzberg (1985).

Description

Annual lynx trappings in a region of North-West Canada. Taken from Andrews and Herzberg (1985).

Usage

LYNX

Format

LYNX is a univariate time series of length 114; start 1821 frequency = 1

LYNX annual lynx trappings in a region of North-west Canada

Source

Andrews, D. F. and Herzberg, A. M. (1985) "Data" <<https://www.springer.com/gp/book/9781461295631>>

Examples

```
data(LYNX)
## maybe tsp(LYNX) ; plot(LYNX)
```

 LYNXHARE

Size of populations of lynxes and snow hares

Description

Size of populations of lynxes and snow hares

Usage

LYNXHARE

Format

LYNXHARE is a simulated bivariate time series from a VAR[1]-model of length 100:

X Number of lynxes

Y Number of snow hares

Examples

```
data(LYNXHARE)
```

 MAUNALOA

Atmospheric CO2 concentrations (ppmv) derived from in situ air samples collected at Mauna Loa Observatory, Hawaii

Description

Atmospheric CO2 concentrations (ppmv) derived from in situ air samples collected at Mauna Loa Observatory, Hawaii

Usage

MAUNALOA

Format

MAUNALOA is a univariate time series of length 735; start March 1958, frequency = 12

MAUNALOA CO2-concentration at Mauna Loa

Source

Keeling, C. D. , Piper, S. C., Bacastow, R. B., Wahlen, M. , Whorf, T. P., Heimann, M., and Meijer, H. A. (2001) <<https://library.ucsd.edu/dc/object/bb3859642r>>

Examples

```
data(MAUNALOA)
## maybe tsp(MAUNALOA) ; plot(MAUNALOA)
```

MDAX

Stock market price of MDAX

Description

Stock market price of MDAX

Usage

MDAX

Format

MDAX is a multivariate time series of length 6181 and 4 variables

DAY Day of the week

MONTH Month

YEAR Year

MDAX Opening stock market price

Source

<<https://www.onvista.de/index/MDAX-Index-323547>>

Examples

```
data(MDAX)
## maybe tsp(MDAX) ; plot(MDAX[,3])
```

MELANOM	<i>Melanoma incidence in Connecticut</i>
---------	--

Description

Melanoma incidence in Connecticut

Usage

MELANOM

Format

MELANOM is a multivariate time series of length 45 and 3 variables

POP Population

RATE Incidence

SUN Sunspots

Source

Andrews, D. F. and Herzberg, A. M. (1985) "Data" <<https://www.springer.com/gp/book/9781461295631>>

Examples

```
data(MELANOM)
## maybe tsp(MELANOM) ; plot(MELANOM[,-1])
```

missar	<i>missar Substitution of missing values in a time series by conditional expectations of AR(p) models</i>
--------	---

Description

missar Substitution of missing values in a time series by conditional expectations of AR(p) models

Usage

```
missar(x, p, iterout = 0)
```

Arguments

x	vector, the time series
p	integer, the maximal order of ar polynomial $0 \leq p < 18$, if $p=0$ linear interpolation without iteration
iterout	if = 1, iteration history is printed

Value

out list with elements

a (p,p)-matrix, estimated ar coefficients for ar-models

y (n,1)-vector, completed time series

iterhist matrix, NULL or the iteration history

Examples

```
data(HEARTBEAT)
x <- HEARTBEAT
x[c(20,21)] <- NA
out <- missar(x,2)
```

missls	<i>missls substitutes missing values in a time series using LS approach</i>
--------	---

Description

missls substitutes missing values in a time series using LS approach

Usage

```
missls(x, p = 0, tol = 0.001, theo = 0)
```

Arguments

x vector, the time series

p integer, the order of polynom

tol tolerance that can be set; it enters via `tol*sd(x,na.rm=TRUE)`

theo (k,1)-vector, prespecified Inverse ACF, IACF (starting at lag 1)

Value

y completed time series

Examples

```
data(HEARTBEAT)
x <- HEARTBEAT
x[c(20,21)] <- NA
out <- missls(x,p=2,tol=0.001,theo=0)
```

moveav *moveav smoothes a time series by moving averages*

Description

moveav smoothes a time series by moving averages

Usage

```
moveav(y, q)
```

Arguments

y the series, a vector or a time series
q scalar, span of moving average

Value

g vector, smooth component

Examples

```
data(GDP)  
g <- moveav(GDP, 12)  
plot(GDP) ; lines(g, col="red")
```

movemed *movemed smoothes a time series by moving medians*

Description

movemed smoothes a time series by moving medians

Usage

```
movemed(y, q)
```

Arguments

y the series, a vector or a time series
q scalar, span of moving median

Value

g vector, smooth component

Examples

```
data(BIP)
g <- movemed(GDP,12)
plot(GDP) ; t <- seq(from = 1970, to = 2009.5,by=0.25) ; lines(t,g,col="red")
```

MUSKRAT	<i>Annual trade of muskrat pelts</i>
---------	--------------------------------------

Description

Annual trade of muskrat pelts

Usage

MUSKRAT

Format

MUSKRAT is a univariate time series of length 62; start 1848, frequency = 1

MUSKRAT annual trade of muskrat pelts

Source

<<https://archive.uea.ac.uk/~gj/book/data/mink.dat>>

Examples

```
data(MUSKRAT)
## maybe tsp(MUSKRAT) ; plot(MUSKRAT)
```

outidentify	<i>outidentify performs one iteration of Wei's iterative procedure to identify impact, locations and type of outliers in arma processes</i>
-------------	---

Description

outidentify performs one iteration of Wei's iterative procedure to identify impact, locations and type of outliers in arma processes

Usage

```
outidentify(x, object, alpha = 0.05, robust = FALSE)
```

Arguments

x	vector, the time series
object	output of a model fit with the function <code>arima</code> (from <code>stats</code>)
alpha	the level of the tests for deciding which value is to be considered an outlier
robust	logical, should the standard error be computed robustly?

Value

out	list with elements
outlier	matrix with time index (<code>ind</code>), type of outlier (1 = AO, 2 = IO) and value of test statistic (<code>lambda</code>)
arima.out	output of final <code>arima</code> model where the outliers are incorporated as fixed regressors

Examples

```
data(SPRUCE)
out <- arima(SPRUCE,order=c(2,0,0))
out2 <- outidentify(SPRUCE,out,alpha=0.05, robust = FALSE)
```

OXYGEN

Amount of an Oxygen isotope

Description

Amount of an Oxygen isotope

Usage

OXYGEN

Format

OXYGEN is a matrix with 164 rows and 2 columns

T Time

D DELTA18O

Source

Belecher, J., Hampton, J. S., and Tunnicliffe Wilson, T. (1994, ISSN: 1369-7412) "Parameterization of Continuous Time Autoregressive Models for Irregularly Sampled Time Series Data"

Examples

```
data(OXYGEN)
## maybe plot(OXYGEN[,1],OXYGEN[,2],type="l"); rug(OXYGEN[,1])
```

pacfmat	<i>pacfmat sequence of partial autocorrelation matrices and related statistics for a multivariate time series</i>
---------	---

Description

pacfmat sequence of partial autocorrelation matrices and related statistics for a multivariate time series

Usage

```
pacfmat(y, lag.max)
```

Arguments

y	multivariate time series
lag.max	maximum number of lag

Value

out list with components:

M	array with matrices of partial autocovariances divided by their standard error
M1	array with indicators if partial autocovariances are significantly greater (+), lower (-) than the critical value or insignificant (.)
R	array with matrices of partial autocovariances
S	matrix of diagonals of residual covariances (row-wise)
Test	test statistic
pval	p value of test

Examples

```
data(ICECREAM)
out <- pacfmat(ICECREAM,7)
```

 PAPER

Two measurements at a paper machine

Description

Two measurements at a paper machine

Usage

PAPER

Format

PAPER is a bivariate time series of length 160

H High

W Weight

Source

Janacek, G. J. & Swift, L. (1993, ISBN: 978-0139184598) "Time Series: Forecasting, Simulation, Applications"

Examples

```
data(PAPER)
## maybe tsp(PAPER) ; plot(PAPER)
```

 periodogram

periodogram determines the periodogram of a time series

Description

periodogram determines the periodogram of a time series

Usage

```
periodogram(y, nf, ACF = FALSE, type = "cov")
```

Arguments

y	(n,1) vector, the time series or an acf at lags 0,1,...,n-1
nf	scalar, the number of equally spaced frequencies
ACF	logical, FALSE, if y is ts, TRUE, if y is acf
type	c("cov","cor"), area under spectrum, can be variance or normed to 1.

Value

out (floor(nf/2)+1,2) matrix, the frequencies and the periodogram

Examples

```
data(WHORMONE)
out <- periodogram(WHORMONE, 50, ACF=FALSE, type="cov")
```

periodotest	periodotest computes the p-value of the test for a hidden periodicity
-------------	---

Description

periodotest computes the p-value of the test for a hidden periodicity

Usage

```
periodotest(y)
```

Arguments

y vector, the time series

Value

pval the p-value of the test

Examples

```
data(PIGPRICE)
y <- PIGPRICE
out <- stl(y, s.window=6)
e <- out$time.series[,3]
out <- periodotest(e)
```

perwinba perwinba *Bartlett-Priestley window for direct spectral estimation*

Description

perwinba Bartlett-Priestley window for direct spectral estimation

Usage

```
perwinba(e, n)
```

Arguments

e equal bandwidth (at most n frequencies are used for averaging)
n length of time series

Value

w weights (symmetric)

Examples

```
data(WHORMONE)  
w <- perwinba(0.1,length(WHORMONE))
```

perwinpa perwinpa *Parzen's window for direct spectral estimation*

Description

perwinpa Parzen's window for direct spectral estimation

Usage

```
perwinpa(e, n)
```

Arguments

e equal bandwidth (at most n frequencies are used for averaging)
n length of time series

Value

w weights (symmetric)

Examples

```
data(WHORMONE)
w <- perwinpa(0.1,length(WHORMONE))
```

pestep *pestep help function for missar*

Description

pestep help function for missar

Usage

```
pestep(f, xt)
```

Arguments

f	IACF, inverse ACF
xt	segment of the time series

Value

xt new version of xt

PIGPRICE *Monthly prices for pigs*

Description

Monthly prices for pigs

Usage

```
PIGPRICE
```

Format

PIGPRICE is a univariate time series of length 240; start January 1894, frequency =12

PIGPRICE Monthly prices for pigs

Source

Hanau, A. (1928) "Die Prognose der Schweinepreise"

Examples

```
data(PIGPRICE)
## maybe tsp(PIGPRICE) ; plot(PIGPRICE)
```

polymake	<i>polymake generates the coefficients of an AR process given the zeros of the characteristic polynomial. The norm of the roots must be greater than one for stationary processes.</i>
----------	--

Description

polymake generates the coefficients of an AR process given the zeros of the characteristic polynomial. The norm of the roots must be greater than one for stationary processes.

Usage

```
polymake(r)
```

Arguments

r vector, the zeros of the characteristic polynomial

Value

C coefficients (a[1],a[2],...,a[p]) of the polynomial $1 - a[1]z - a[2]z^2 - \dots - a[p]z^p$

Examples

```
C <- polymake(c(2, -1.5, 3))
```

PPDEMAND	<i>Peak power demand in Berlin</i>
----------	------------------------------------

Description

Peak power demand in Berlin

Usage

```
PPDEMAND
```

Format

PPDEMAND is a univariate time series of length 37; start 1955, frequency = 1

PPDEMAND annual peak power demand in Berlin, Megawatt

Source

Fiedler, H. (1979) "Verschiedene Verfahren zur Prognose des des Stromspitzenbedarfs in Berlin (West)"

Examples

```
data(PPDEMAND)
## maybe tsp(PPDEMAND) ; plot(PPDEMAND)
```

PRODINDEX

Production index of manufacturing industries

Description

Production index of manufacturing industries

Usage

PRODINDEX

Format

PRODINDEX is a univariate time series of length 119:

PRODINDEX Production index of manufacturing industries

Source

Statistisches Bundesamt (2009) <<https://www-genesis.destatis.de/genesis/online>>

Examples

```
data(PRODINDEX)
## maybe tsp(PRODINDEX) ; plot(PRODINDEX)
```

psifair	<i>psifair is a psi-function for robust estimation</i>
---------	--

Description

psifair is a psi-function for robust estimation

Usage

```
psifair(u)
```

Arguments

u vector

Value

out transformed vector

Examples

```
out <- psifair(c(3.3,-0.7,2.1,1.8))
```

psihuber	<i>psihuber is a psi-function for robust estimation</i>
----------	---

Description

psihuber is a psi-function for robust estimation

Usage

```
psihuber(u)
```

Arguments

u vector

Value

out transformed vector

Examples

```
out <- psihuber(c(3.3,-0.7,2.1,1.8))
```

RAINFALL	<i>Annual amount of rainfall in Los Angeles</i>
----------	---

Description

Annual amount of rainfall in Los Angeles

Usage

RAINFALL

Format

RAINFALL is a univariate time series of length 119; start 1878, frequency = 1

RAINFALL Amount of rainfall in Los Angeles

Source

LA Times (January 28. 1997)

Examples

```
data(RAINFALL)
## maybe  tsp(RAINFALL) ; plot(RAINFALL)
```

REDWINE	<i>Monthly sales of Australian red wine (1000 l)</i>
---------	--

Description

Monthly sales of Australian red wine (1000 l)

Usage

REDWINE

Format

REDWINE is a univariate time series of length 187; start January 1980, frequency =12

REDWINE Monthly sales of Australian red wine

Source

R package tsdl <<https://github.com/FinYang/tsdl>>

Examples

```
data(REDWINE)
## maybe tsp(REDWINE) ; plot(REDWINE)
```

robsplinedecomp	robsplinedecomp <i>decomposes a vector into trend, season and irregular component by robustified spline approach; a time series attribute is lost</i>
-----------------	---

Description

robsplinedecomp decomposes a vector into trend, season and irregular component by robustified spline approach; a time series attribute is lost

Usage

```
robsplinedecomp(y, d, alpha, beta, Plot = FALSE)
```

Arguments

y	the series, a vector or a time series
d	seasonal period
alpha	smoothing parameter for trend component (the larger alpha is, the smoother will the smooth component g be)
beta	smoothing parameter for seasonal component
Plot	logical, should a plot be produced?

Value

out list with the elements trend, season, residual

Examples

```
data(GDP)
out <- robsplinedecomp(GDP,4,2,10,Plot=FALSE)
```

RS	<i>RS rescaled adjusted range statistic</i>
----	---

Description

RS rescaled adjusted range statistic

Usage

$RS(x, k)$

Arguments

x	univariate time series
k	length of the segments for which the statistic is computed. Starting with $t=1$, the segments do not overlap.

Value

(1,3)-matrix, 1. column: k, second column: starting time of segment, third column: value of RS statistic.

Examples

```
data(TREMOR)
R <- RS(TREMOR, 10)
```

SALES	<i>Monthly sales of a company</i>
-------	-----------------------------------

Description

Monthly sales of a company

Usage

SALES

Format

SALES is a univariate time series of length 77:

y monthly sales of a company

Source

Newton, H. J. (1988, ISBN: 978-0534091989): "TIMESLAB: A time series analysis laboraty"

Examples

```
data(SALES)
## maybe tsp(SALES) ; plot(SALES)
```

SCHAUINSLAND

CO2-Concentration obtained in Schauinsland, Germany

Description

CO2-Concentration obtained in Schauinsland, Germany

Usage

SCHAUINSLAND

Format

SCHAUINSLAND is a univariate time series of length 72:

SCHAUINSLAND CO2-Concentration obtained in Schauinsland

Source

<<http://cdiac.ornl.gov/trends/co2/uba/uba-sc.html>>

Examples

```
data(SCHAUINSLAND)
## maybe tsp(SCHAUINSLAND) ; plot(SCHAUINSLAND)
```

simpledecomp

simpledecomp decomposes a vector into trend, season and irregular component by linear regression approach

Description

simpledecomp decomposes a vector into trend, season and irregular component by linear regression approach

Usage

```
simpledecomp(y, trend = 0, season = 0, Plot = FALSE)
```

Arguments

y	the series, a vector or a time series
trend	order of trend polynomial
season	period of seasonal component
Plot	logical, should a plot be produced?

Value

out: (n,3) matrix

1. column	smooth component
2. column	seasonal component
3. column	irregular component

Examples

```
data(GDP)
out <- simpledecomp(GDP, trend=3, season=4, Plot=FALSE)
```

smoothls smoothls *smooths a time series by Whittaker graduation. The function depends on the package Matrix.*

Description

smoothls smooths a time series by Whittaker graduation. The function depends on the package Matrix.

Usage

```
smoothls(y, beta = 0)
```

Arguments

y	the series, a vector or a time series
beta	smoothing parameter ≥ 0 (the larger beta is, the smoother will be)

Value

g vector, smooth component

Examples

```
data(GDP)
g <- smoothls(GDP, 12)

plot(GDP)
t <- seq(from = tsp(GDP)[1], to = tsp(GDP)[2], by=1/tsp(GDP)[3]) ; lines(t, g, col="red")
```

smoothrb	<i>smoothrb smoothes a time series robustly by using Huber's psi-function. The initialisation uses a moving median.</i>
----------	---

Description

smoothrb smoothes a time series robustly by using Huber's psi-function. The initialisation uses a moving median.

Usage

```
smoothrb(y, beta = 0, q = NA)
```

Arguments

y	the series, a vector or a time series
beta	smoothing parameter (The larger beta is, the smoother will the smooth component g be.)
q	length of running median which is used to get initial values

Value

g vector, the smooth component

Examples

```
data(GDP)
g <- smoothrb(GDP,8,q=8)

plot(GDP) ; t <- seq(from = 1970, to = 2009.5,by=0.25) ; lines(t,g,col="red")
```

specest	<i>specest direct spectral estimation of series y using periodogram window win</i>
---------	--

Description

specest direct spectral estimation of series y using periodogram window win

Usage

```
specest(y, nf, e, win = c("perwinba", "perwinpa"), conf = 0, type = "cov")
```

Arguments

y	(n,1) vector, the ts
nf	number of equally spaced frequencies
e	equal bandwidth
win	string, name of periodogram window (possible: "perwinba", "perwinpa")
conf	scalar, the level for confidence intervals
type	c("cov","cor"), area under spectrum is variance or is normed to 1.

Value

est (nf+1,2)- or (nf+1,4)-matrix:

column 1:	frequencies 0, 1/n, 2/n, ..., m/n
column 2:	the estimated spectrum
column 3+4:	the confidence bounds

Examples

```
data(WHORMONE)
est <- specest(WHORMONE,50,0.05,win = c("perwinba","perwinpa"),conf=0,type="cov")
```

specplot	<i>specplot plot of spectral estimate</i>
----------	---

Description

specplot plot of spectral estimate

Usage

```
specplot(s, Log = FALSE)
```

Arguments

s	(n,2) or (n,4) matrix, output of specest
Log,	logical, if TRUE, the logs of the spectral estimates are shown

Examples

```
data(WHORMONE)
est <- specest(WHORMONE,50,0.05,win = c("perwinba","perwinpa"),conf=0,type="cov")
specplot(est,Log=FALSE)
```

splinedecomp	splinedecomp <i>decomposes a time series into trend, season and irregular component by spline approach.</i>
--------------	---

Description

splinedecomp decomposes a time series into trend, season and irregular component by spline approach.

Usage

```
splinedecomp(x, d, alpha, beta, Plot = FALSE)
```

Arguments

x	the series, a vector or a time series
d	seasonal period
alpha	smoothing parameter for trend component (The larger alpha is, the smoother will the smooth component g be.)
beta	smoothing parameter for seasonal component
Plot	logical, should a plot be produced?

Value

out (n,3) matrix:

1. column	smooth component
2. column	seasonal component
3. column	irregular component

Examples

```
data(GDP)
out <- splinedecomp(GDP,4,2,4,Plot=FALSE)
```

SPRUCE	<i>Annual logging of spruce wood.</i>
--------	---------------------------------------

Description

Annual logging of spruce wood.

Usage

SPRUCE

Format

SPRUCE is a univariate time series of length 42:

SPRUCE Annual logging of spruce wood

Examples

```
data(SPRUCE)
## maybe tsp(SPRUCE) ; plot(SPRUCE)
```

statcheck	<i>statcheck determines the means, standard deviations and acf's of segments of a time series and plots the acf's for the segments.</i>
-----------	---

Description

statcheck determines the means, standard deviations and acf's of segments of a time series and plots the acf's for the segments.

Usage

```
statcheck(y, d)
```

Arguments

y	the series, a vector or a time series
d	scalar, number of segments

Value

out list with components:

ms	matrix with means and standard deviations of the segments
ac	matrix with acf's, the first column: acf of the series, the others: acf's of the segments

Examples

```
data(LYNX)
sympplot(LYNX)
```

taper	taper <i>taper modification of a time series</i>
-------	--

Description

taper taper modification of a time series

Usage

```
taper(y, part)
```

Arguments

y	the time series
part	scalar, $0 \leq \text{part} \leq 0.5$, part of modification (at each end of y)

Value

tp tapered time series

Examples

```
data(WHORMONE)
out <-taper(WHORMONE,0.3)

plot(WHORMON)
lines(out,col="red")
```

TAXES	<i>Monthly community taxes in Germany (billions EURO)</i>
-------	---

Description

Monthly community taxes in Germany (billions EURO)

Usage

```
TAXES
```

Format

TAXES is a univariate time series of length 246; start January 1999, frequency = 12

TAXES monthly community taxes in Germany

Source

<<https://www-genesis.destatis.de/genesis/online?operation=previous&levelindex=1&step=1&titel=Tabellenaufbau&levelid=>

Examples

```
data(TAXES)
## maybe tsp(TAXES) ; plot(TAXES)
```

TREERING

Mean thickness of annual tree rings

Description

Mean thickness of annual tree rings

Usage

TREERING

Format

TREERING is a multivariate time series of length 66 with 3 variables:

THICK mean thickness of annual tree rings

TEMP mean temperature of the year

RAIN amount of rain of the year

Source

<<https://lrr.arizona.edu/>>

Examples

```
data(TREERING)
## maybe tsp(TREERING) ; plot(TREERING)
```

TREMOR	<i>Measurements of physiological tremor</i>
--------	---

Description

Measurements of physiological tremor

Usage

TREMOR

Format

TREMOR is a univariate time series of length 400.

TREMOR Tremor

Examples

```
data(TREMOR)
## maybe tsp(TREMOR) ; plot(TREMOR)
```

tsmat	<i>tsmat constructs a $(n-p+1,p)$ matrix from a time series where the first column is the shortened series $y[p], \dots, y[n]$, the second is $y[p-1], \dots, y[n-1]$, etc.</i>
-------	--

Description

tsmat constructs a $(n-p+1,p)$ matrix from a time series where the first column is the shortened series $y[p], \dots, y[n]$, the second is $y[p-1], \dots, y[n-1]$, etc.

Usage

tsmat(y, p)

Arguments

y	the series, a vector or a time series of length n
p	desired number of columns

Value

mat $(n-p+1,p)$ matrix

Examples

```
out <- tsmat(c(1:20),4)
```

USAPOP	<i>Population of USA</i>
--------	--------------------------

Description

Population of USA

Usage

USAPOP

Format

USAPOP is a univariate time series of length 39; start 1630, frequency = 0.1

USAPOP Population of USA

Source

[<https://www.worldometers.info/world-population/us-population/>](https://www.worldometers.info/world-population/us-population/)

Examples

```
data(USAPOP)
## maybe tsp(USAPOP) ; plot(USAPOP)
```

vartable	<i>vartable determines table of variate differences</i>
----------	---

Description

vartable determines table of variate differences

Usage

vartable(y, season)

Arguments

y	the series, a vector or a time series
season	scalar, period of seasonal component

Value

d matrix with ratios of variances for differend numbers of simple and seasonal differencing

Examples

```
data(GDP)
out <- vartable(GDP,4)
```

 WHORMONE

Concentration of growth hormone of a bull

Description

Concentration of growth hormone of a bull

Usage

```
WHORMONE
```

Format

WHORMONE is a univariate time series of length 97:

WHORMONE Concentration of growth hormone of a bull

Source

Newton, H. J. (1988, ISBN: 978-0534091989): "TIMESLAB: A time series analysis laboraty"

Examples

```
data(WHORMONE)
## maybe tsp(WHORMONE) ; plot(WHORMONE)
```

 wntest

wntest graphical test for white noise for a time series or a series of regression residuals

Description

wntest graphical test for white noise for a time series or a series of regression residuals

Usage

```
wntest(e, a, k = 0)
```

Arguments

e	vector, the time series ($k = 0$) or residuals ($k > 0$)
a	scalar, level of significance
k	scalar ≥ 0 , number of regressors used to compute e as residuals

Value

tp vector, value of test statistic and p-value

Examples

```
data(WHORMONE)
out <- wntest(WHORMONE, 0.05, 0)
```


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