freqdom (version 2.0.2)

spectral.density: Compute empirical spectral density

Description

Estimates the spectral density and cross spectral density of vector time series.

Usage

```
spectral.density(
  X,
  Y = X,
  freq = (-1000:1000/1000) * pi,
  q = max(1, floor(dim(X)[1]^(1/3))),
  weights = c("Bartlett", "trunc", "Tukey", "Parzen", "Bohman", "Daniell",
    "ParzenCogburnDavis")
)
```

Arguments

X	a vector or a vector time series given in matrix form. Each row corresponds to a timepoint.
Y	a vector or vector time series given in matrix form. Each row corresponds to a timepoint.
freq	a vector containing frequencies in $[-\pi, \pi]$ on which the spectral density should be evaluated.
q	window size for the kernel estimator, i.e. a positive integer.
weights	kernel used in the spectral smoothing. By default the Bartlett kernel is chosen.

Value

Returns an object of class `freqdom`. The list is containing the following components:

`operators`	an array. The k-th matrix in this array corresponds to the spectral density matrix evaluated at the k-th frequency listed in **`freq`**.
`freq`	returns argument vector **`freq`**.

Details

Let $[X_1, \ldots, X_T]'$ be a $T \times d_1$ matrix and $[Y_1, \ldots, Y_T]'$ be a $T \times d_2$ matrix. We stack the vectors and assume that $(X_t', Y_t')'$ is a stationary multivariate time series of dimension $d_1 + d_2$. The cross-spectral density between the two time series (X_t) and (Y_t) is defined as

$$\sum_{h \in \mathbf{Z}} \mathrm{Cov}(X_h, Y_0) e^{-ih\omega}.$$

The function **`spectral.density`** determines the empirical cross-spectral density between the two time series (X_t) and (Y_t). The estimator is of form

$$\widehat{\mathcal{F}}^{XY}(\omega) = \sum_{|h| \leq q} w(|k|/q) \widehat{C}^{XY}(h) e^{-ih\omega},$$

with $\widehat{C}^{XY}(h)$ defined in **`cov.structure`** Here w is a kernel of the specified type and q is the window size. By default the Bartlett kernel $w(x) = 1 - |x|$ is used.

See, e.g., Chapter 10 and 11 in Brockwell and Davis (1991) for details.

References

Peter J. Brockwell and Richard A. Davis *Time Series: Theory and Methods* Springer Series in Statistics, 2009