Assignment 3

Date: 2007/01/10

Content:

Use Matlab’s Wavelet Toolbox to detect the trend in nonstationary processes and identify the signal components. The block diagram is shown below. **Important: Assume that you have no idea about the trend of the original process.**

(A) Additive type process

Nonstationary process:

(a) Gaussian white process plus 1\textsuperscript{st} order polynomial
(b) Gaussian white process plus sinusoidal wave

Wavelet analysis:

Select appropriate type of wavelets and appropriate levels in decomposition and reconstruct the signal.

Denoising and retaining residue:

Check the stationarity of components in discrete wavelet decomposition, remove the stationary components, and then export the residue process which contains the trend.

Trend detection:

(i) Calculate the cross-correlation function of residue process and original nonstationary data to check the existence of nonstationary component.
(ii) Calculate the autocorrelation function of possible trends such as polynomial type, sinusoidal type…
(iii) Compare the results in (i) (ii) then check the slope and peak value of above function to identify the trend.
(B) Multiplicative type process

Nonstationary process:

(a) Gaussian white process multiplied by 1\textsuperscript{st} order polynomial
(b) Cyclostationary process
   (Gaussian white process multiplied by sinusoidal wave)

Absolute:
Compute the absolute value.

Complex Wavelet analysis:
Select appropriate type of wavelets and appropriate levels in decomposition and reconstruct the signal.

Trend detection:
Observe the modulus and angle of $Ca,b$ coefficients then identify the polynomial component and frequency of sinusoidal component, respectively.

Presentation:
- 15 min / person

Reference: