S4 Transfer Function models

Statement

Description

Three datasets are available:

-Time series with no seasonality:

- NonSeasonal_TF.dat

- Time series with single seasonality:

- Seasonal_TF_1.dat
- Seasonal_TF_2.dat

Tasks

Put in practice the LTF identification procedure using the above time series:

1) Transform the series for stabilizing the variance

2) Fit a multiple regression model of the form:

$$y[t] = c + \alpha_0 x[t] + \alpha_1 x[t-1] + \alpha_2 x[t-2] + \ldots + \alpha_k x[t-k] + v[t]$$

with a large (8-10) *k* and a low order AR model for the noise.

3) If the regression errors are not stationary, then differentiate *y* and *x*. Fit the model with the differentiated series (or include a unit root in the noise model).

4) If the regression errors are stationary, identify the transfer function by selecting appropriate values for *b, r* and *s:*

- The value of *b* is selected as the number of samples it takes for the output to respond to the input.
- The value of *r* (order of $\delta(L)$) determines the pattern of decay in the impulse response weights.
- The value of *s* (order of $\omega(L)$) determines where the pattern of decay in the impulse response weights begins.

5) Identify an ARMA model for the regression errors *n[t].*

6) Fit the complete model with the identified TF and ARMA model.

7) Analyze the residual *e[t]* using the general procedure.