

TIME SERIES ANALYSIS, 2022

ZV topics

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1. Time domain: Definition of multivariate stationary time series, properties of the autocovariance function.
Frequency domain: Spectral distribution and spectral density function of multivariate, weakly stationary processes. Condition for the existence of the spectral density matrix.
2. Relation between the autocovariance function and spectral representation of weakly stationary processes. Fourier and inverse Fourier transformations.
3. Estimating parameters of stationary time series, ergodicity for the mean and autocovariances.
Estimates of the spectral density. One- and multi-dimensional periodogram.
4. Time invariant linear filters, one-dimensional $MA(\infty)$ and $MA(q)$ processes.
One-dimensional $AR(p)$ process, stability, Youle–Walker equations.
One-dimensional $ARMA(p, q)$ processes, causality, rational spectral density.
5. Wold decomposition in one dimension, and its consequences.
Multivariate Wold decomposition, innovation subspaces.
6. Classification of one-dimensional, weakly stationary processes, types of singular processes.
Multivariate stationary time series of constant rank. Factorization of their spectral density.
7. Multivariate ARMA processes and the Yule–Walker equations.
Low-rank approximation of constant rank and regular processes.
8. One- ad h -step ahead prediction of one-dimensional, weakly stationary processes based on n past observations and on the infinite past. Prediction error, relation to the Wold decomposition.
One-step ahead prediction of multi-dimensional, weakly stationary processes based on n past observations and on the infinite past. Rank of the error covariance matrix, relation to the transfer function.
9. Kálmán’s filtering.

Books:

- Bolla, M. and Szabados, T., Multidimensional Stationary Time Series (in preparation, to be published by Taylor and Francis).

- Brockwell, P. J. and Davis, R. A., Introduction to time series and forecasting, Springer (2016).
- Deistler, M. and Scherrer, W., Modelle der Zeitreihenanalyse, Springer (2018).
- Gerencsér, L., Vágó, Zs. and Gerencsér, B., Financial time series, Pázmány Péter Catholic University (2013), ISBN 978-963-308-161-7.