

The ARIMA/VARIMA Time Series Workshop

Presenter: Dr. Ky M. Vu (AuLac Technologies Inc.)

1 Workshop Summary

This workshop is a result of more than twenty years of interest in and research of the presenter on the topic of the ARIMA time series. The ARIMA and its vector counterpart VARIMA time series have vast applications in many different fields of science and technologies. A sufficient knowledge in the theory of the ARIMA time series gives a control engineer essential skills in designing discrete controllers for linear feedback control systems. The minimum variance of the controlled variable ARMA time series with a constraint on the variance of the control variable gives him a linear quadratic gaussian controller. The flat spectrum of the controlled variable ARMA time series gives him the least sensitive H_∞ controller. Model predictive control requires prediction of a future value of the controlled variable ARMA time series. The workshop gives formulae for the moments, spectra and prediction theory, necessary to design these stochastic controllers.

2 Workshop Schedule (1pm-5pm)

- Basic background (60 min.).
 - The random variable, probability and statistics.
 - The expectation operator, moments and cumulants.
 - The discrete time series: periodic and aperiodic (ARIMA).
 - The periodic time series.
 - The ARIMA time series.
 - The model and modeling of an ARIMA/VARIMA time series.
- Break (10 min.).
- Analyses: Moments and spectra (80 min.).
 - The Autocovariance (crosscovariance) generating function and the autocovariances (crosscovariances).
 - The Autospectrum and the Cross-spectra.
 - System norms.

- Break (10 min.).
- Applications: Forecast, prediction, controller design and digital filter spectra (80 min.).
 - Forecasts: Forecasts of an ARMA and a VARMA Time Series.
 - Prediction and Kalman filter theory.
 - Discrete Stochastic Control Theory: The Box-Jenkins model and its controllers.
 - Digital Filter spectra: Low-pass, high-pass, band-pass and all-pass filters.

3 Biography of Presenter

Dr. Ky M. Vu was born in the kingdom AuLac (Vietnam) and educated in Canada. He got his B.A.Sc. at the University of Ottawa, his M.Eng. at MacMaster University and his PhD. at the University of British Columbia (1997). His research interests are in the theories of Control, Matrix and Statistics. He has written numerous papers published in IEE Proceedings Control Theory and Applications, International Journal of Control, International Journal of System Sciences, Applied Mathematics and Computation and many control conference proceedings. He is a regularly invited paper reviewer for the Canadian IASTED Control and Applications conferences and the British IET Journal in control. He also has published two textbooks "Optimal Discrete Control Theory: The Rational Function Structure Model" (ISBN 978-0-9783996-0-3) and "The ARIMA and VARIMA Time Series: Their Modelings, Analyses and Applications" (ISBN 978-0-9783996-1-0).