



**The Hong Kong University of Science and Technology**

**Department of Mathematics**

**PhD THESIS EXAMINATION**

**Univariate and Multivariate ARMA models with Heteroscedastic Noises**

*By*

**Miss Bibi CAI**

**ABSTRACT**

This thesis studies two topics. The first one investigates the autoregressive and moving average (ARMA) model with time-functional variance (TFV) noises, called the ARMA-TFV model. The consistency and asymptotic normality of its least squares estimator (LSE) are established. Based on the theory, the Wald tests and portmanteau tests are constructed for variable selection and model checking, respectively. It should be mentioned that the process generated from the ARMA-TFV model is not stationary, and the technique in this thesis is nonstandard and may provide insights for future research in this area. The second one studies the quasi-maximum likelihood estimator (QMLE) for the vector ARMA-GARCH (VARMA-GARCH) model. The self-weighted QMLE is showed to be consistent and asymptotically normal under a fractional moment condition. Using the iterative method, the asymptotic normality of local QMLE is also established for the VARMA model with GARCH (finite variance) and IGARCH errors. We construct the Wald tests and portmanteau tests for variable selection and model checking using these two estimators. Simulation results are carried out to access the performance of our methods, and real illustrating examples are given.

**Date : 5 August 2024, Monday**

**Time : 3:00 pm**

**Venue : Room 5510 (Lifts 25-26)**

**Thesis Examination Committee:**

- Chairman** : Prof. Xinghua ZHENG, ISOM/HKUST
- Thesis Supervisor** : Prof. Shiqing LING, MATH/HKUST
- Member** : Prof. Can YANG, MATH/HKUST
- Member** : Prof. Dong XIA, MATH/HKUST
- Member** : Prof. Mike K.P. SO, ISOM/HKUST
- External Examiner** : Prof. Guodong LI, The University of Hong Kong

*(Open to all faculty and students)*

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).