

S.m.8. JESSY JOHN, C.—ARMA Modelling of time series based on rational approximation of spectral density function—1987— Dr. R.N. Pillai

A new technique for ARMA (p,q) model selection using rational approximation of spectral density function is presented in this thesis. The thesis is divided into seven chapters.

In the first chapter a brief historical survey of stationary time series and summary of the new technique is given. Yule (1927) introduced the notion of autoregressive models. He was followed by Wold (1954). The works of Akaike, H. (1962) for fitting autoregressive models, Brown R.C. (1962) for fitting models by exponential smoothing, Box G.E.P. and Jenkins, G.M. (1970) for ARMA (p,q) model fitting, McIntire, D.D. (1977) for ARMA (p,q) model identification of time series and other recent developments in the area are discussed. The second half of this chapter contains the summary of the new model identification technique presented in this thesis.

Notations and definitions are given in chapter two. Stationary time series, autocorrelations and partial auto-correlations of a stationary time series, difference operator, ARMA (p,q) models, ARIMA (p,d,q) models, etc. are defined. Different forms of the spectral density functions of a stationary time series are discussed.

The third chapter explains the new model identification technique. A unique ARMA (p,q) model representing a given stationary time series is obtained. Rational approximations of functions are discussed first. The theory of rational approximation due to Chebyshev (1962), is applied here. Applying this theory a unique rational approximation of the spectral density function is obtained.

An algorithm is developed to solve the nonlinear equations based on iteration. These $p+q+1$ parameters uniquely determine the ARMA (p,q) model for a given stationary time series.

In the first part of chapter four, the new model building procedure is tested using theoretical autocorrelations for ten different ARMA (p,q) models. It is found that the error between the theoretical values of the parameters and the estimated values of the parameters are very small proving the efficiency of the new technique for ARMA model estimation. In the second part of chapter four the new technique is applied to analyse simulated series and in the third part it is applied to original time series data. It is found that the new model identification procedure is highly suitable.

The fifth chapter gives some results in connection with the new ARMA model building technique. It is shown that the relation between the autocorrelations and the parameters in ARMA (p,q) model are same as that given by Box and Jenkins. Multivariate extension of the procedure is taken up for two variables.

Comparison of the new method for ARMA (p,q) model identification with some prominent methods like Box-Jenkins method, McIntire's method are given in chapter six. It shows that this new technique gives a unique ARMA (p,q) model for a given stationary time series, whereas the other method gives different models for the same series.

In the concluding chapter, a brief discussion on the new technique for identifying ARMA (p,q) model representing a stationary time series is given.