Modelling and coherent forecasting of zero-inflated count time series

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Abstract: In this article, a new kind of stationary zero-inflated Pegram's operator based integer-valued time series process of order $p$ with Poisson marginal or ZIPPAR$(p)$ process is constructed for modelling count time series consisting a large number of zeros compared to standard Poisson time series processes. Several properties like stationarity, ergodicity are examined. Estimates of the model parameters are studied using three methods of estimation, namely Yule–Walker, conditional least squares and maximum likelihood estimation. Also $h$-step ahead coherent forecasting distributions of the proposed process for $p = 1, 2$ are derived. Real data set is used to examine and illustrate the proposed process with some simulation studies.

Key words: zero-inflated Poisson, Pegram's operator, coherent forecasting

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1 Introduction

During the last three decades there has been growing interest in modelling low count time series data. Such cases are different from the standard Box-Jenkins ARMA$(p, q)$ process, and as a result it cannot be used as an approximate solution in a situation having count data with excessive zeros. The low count time series data arises in many practical fields like epidemiology, social science, clinical study and so on. Al-Osh and Alzaid (1987) and McKenzie (1988) made some pioneering attempts based on binomial thinning operator (the operator was proposed by Steutel and Van Harn (1979)) for modelling count time series. Those models are well known as integer-valued AR(1) (or INAR(1)) process with different margins like Poisson, geometric, negative binomial and so on. Later several extensions like integer-valued autoregressive (INAR$(p)$), integer-valued moving average (INMA$(q)$) and integer-valued ARMA (INARMA$(p,q)$) processes were developed and applied by several

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