ENHANCED EXPONENTIALLY WEIGHTED MOVING AVERAGE (EWMA) 
CONTROL CHART PERFORMANCE WITH AUTOCORRELATION

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To my beloved mother and late father
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Alhamdulillah biniimatihi tatimmus salihati. In the name of Allah, The most Merciful. The Most Gracious. Verily, all praise is for Allah, we praise Him and we seek His assistance and we ask for His forgiveness. And we seek refuge in Allah from the evils of ourselves and from the evils of our actions.

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ABSTRACT

This research introduces an enhanced exponentially weighted moving average (EWMA) control chart which is effective in detecting small and unnoticed shifts in monitoring process mean for autocorrelated data. The control chart is based on extension or modification of EWMA control chart statistic. The proposed control chart is named the new EWMA (NEWMA) and is applied to simulated autocorrelated data for different autocorrelation levels (low, moderate and large) to study the performance of the chart. The run rules schemes were introduced to enhance the performance of the NEWMA chart namely; three out of three and three out of four schemes and three out of four is the best among the schemes. The NEWMA chart performs for observations that are autocorrelated. The NEWMA control chart has been tested on 100,000 simulations and it is found that it is quick in detecting process shift and able to identify the out of control points as it occurs. The performance of the technique has been evaluated using the average run length (ARL) and compared with modified exponentially weighted moving average (MEWMA) and classical exponentially weighted moving average (CEWMA) control charts and found that the NEWMA chart is faster in detecting shift. The NEWMA chart was applied to the KLSE Share index data, water quality data and Malaysian labour force data which are autocorrelated in nature and found to be effective in detecting the shifts.
Kajian ini memperkenalkan carta kawalan purata bergerak eksponen (EWMA) yang berkesan dalam mengesan anjakan kecil dan tidak disedari yang berlaku dalam pemantauan min proses dalam data berautokorelasi. Carta ini dibina berdasarkan statistik carta kawalan EWMA lanjutan. Carta EWMA baharu ini diaplikasikan kepada data simulasi berautokorelasi bagi paras autokorelasi berlainan (rendah, sederhana dan tinggi) untuk melihat keupayaan carta ini. Petua penentuan proses luar kawalan juga diperkenalkan dalam menggunakan carta baru ini, iaitu tiga daripada tiga dan tiga daripada empat. Carta baru ini didapati berupaya meneliti proses yang berautokorelasi. Carta baru ini diuji ke atas 100,000 data simulasi yang berautokorelasi dan didapati ia pantas dalam mengenalpasti anjakan min proses. Keupayaan carta ini diukur daripada purata panjang larian (ARL) dan dibandingkan dengan carta kawalan purata bergerak eksponen terubahsuai (MEWMA) dan carta kawalan purata bergerak klasik (CEWMA). Carta kawalan baru ini didapati adalah yang terpantas dalam mengenalpasti anjakan min proses. Carta baru ini diaplikasikan kepada data indeks saham KLSE, data kualiti air dan data buruh Malaysia yang diketahui berautokorelasi dan didapati ia adalah efektif dalam mengenalpasti anjakan min.