

## Abstract

Product quality can be explained through relationship between explained and explanatory variable(s). This relationship is called profile which might be linear or nonlinear depending on the situation. Linear profile is the most commonly used profile because of its simplicity and use. Linear profile has been used by many researchers with fixed explanatory variable with simple random sampling denoted by  $EWMA_{(SRS)}-3$ . This control chart is used in simple linear profiles to detect the small shifts in intercept, slope and error variance separately. The condition of fixed explanatory variable does not hold in many cases so random explanatory variable is being used through different ranked set sampling techniques with proposed  $EWMA_{(R)}-3$  charts. In this article  $EWMA_{(RSS)}-3$ ,  $EWMA_{(ERSS)}-3$ ,  $EWMA_{(MRSS)}-3$ ,  $EWMA_{(DRSS)}-3$ ,  $EWMA_{(DERSS)}-3$  and  $EWMA_{(DMRSS)}-3$  control charts are used for ranked set sampling (RSS), extreme ranked set sampling (ERSS), median ranked set sampling (MRSS), double ranked set sampling (DRSS), double extreme ranked set sampling (DERSS) and double median ranked set sampling (DMRSS) respectively, generally denoted by  $EWMA_{(R)}-3$ . Sample is collected through these sampling techniques to enhance the performance of ordinary  $EWMA-3$  control chart. Average run length (ARL), Standard deviation run length (SDRL) and median run length (MDRL) have been used as performance measures to evaluate to performance of  $EWMA_{(R)}-3$  as compare to ordinary  $EWMA_{(SRS)}-3$ . The charting performance of  $EWMA_{(SRS)}-3$  has been improved by using  $EWMA_{(RSS)}-3$ ,  $EWMA_{(ERSS)}-3$  and  $EWMA_{(MRSS)}-3$  with random explanatory variable. The results of different performance measures showed that  $EWMA_{(DRSS)}-3$ ,  $EWMA_{(DERSS)}-3$  and  $EWMA_{(DMRSS)}-3$  have even better charting performance over  $EWMA_{(RSS)}-3$ ,  $EWMA_{(ERSS)}-3$  and  $EWMA_{(MRSS)}-3$ . Specifically  $EWMA_{(DMRSS)}-3$  performed efficiently for both separate and combined shifts in intercept and slope.