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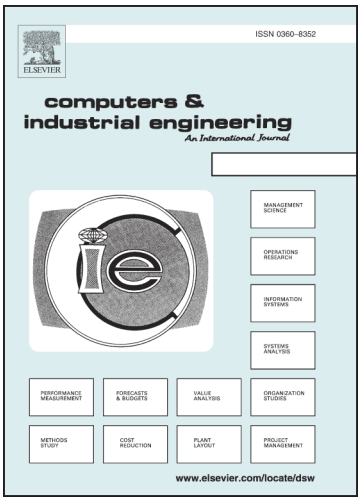

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SIMULTANEOUS MONITORING OF LINEAR PROFILE PARAMETERS UNDER PROGRESSIVE SETUP

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Abstract

In many manufacturing or service processes, we come across different quality characteristics that govern the process behavior. These characteristics are categorized as the main quality characteristics (study variables) and the supporting or explanatory characteristics. There is always a possibility that some of the explanatory variables offer a relationship with the study variable which is known as profiles. The monitoring of study variable which is linearly associated with an explanatory variable is termed as simple linear profiles. In this study, we intend to design an efficient memory type structure based on progressive mean for the simultaneous monitoring of linear profile parameters. The performance of proposed scheme (PM_3) and its counterparts (i.e. EWMA_3 chart, Hotelling T^2 chart, EWMA/R chart and Shewhart_3 chart) are evaluated using some useful performance measures such as average run length (ARL), relative average run length (RARL), sequential relative average run length (SRARL), extra quadratic loss (EQL) and sequential extra quadratic loss (SEQL). In the presence of shifts in linear profile parameters, the findings depict that PM_3 has better detection ability as compared to counterpart charts. A case study related to Queen size problem is also discussed to highlight the importance of newly proposed control chart.

Keywords: Error variance; Intercept; Simple linear profiles; Progressive mean; Slope.

1. Introduction

In this modern era, new technology is consistently coming forth all around us, especially in the domain of consumer behavior. With the passage of time, customers are seemly more tech-smart and want products as per their needs with high quality and low cost. Nowadays, many companies upping efforts to satisfy such desires of customer's. In general, every process has some cause of variations namely natural and un-natural variations. Natural variations are the inherent part of the process and cannot be completely eradicated while un-natural variations occur due to some assignable factors that affect the performance of any process. Control chart is a key tool among seven magnificent tools of statistical process control, mainly used to differentiate the afore-mentioned variations in any process.

In many manufacturing processes, control charts are used to monitor a single quality characteristic (qualitative or quantitative) but in some processes, the quality characteristic has association (linear or non-linear) with other ancillary variable(s) in the process. To monitor such quality characteristic which has a linear relationship with another explanatory variable is termed as simple linear profiles. In general, three parameters are considered to express the state of