World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:10, No:01, 2016

The Moment of the Optimal Average Length of the Multivariate Exponentially Weighted Moving Average Control Chart for Equally Correlated Variables

Authors : Edokpa Idemudia Waziri, Salisu S. Umar

Abstract : The Hotellng's T^2 is a well-known statistic for detecting a shift in the mean vector of a multivariate normal distribution. Control charts based on T have been widely used in statistical process control for monitoring a multivariate process. Although it is a powerful tool, the T statistic is deficient when the shift to be detected in the mean vector of a multivariate process is small and consistent. The Multivariate Exponentially Weighted Moving Average (MEWMA) control chart is one of the control statistics used to overcome the drawback of the Hotellng's T statistic. In this paper, the probability distribution of the Average Run Length (ARL) of the MEWMA control chart when the quality characteristics exhibit substantial cross correlation and when the process is in-control and out-of-control was derived using the Markov Chain algorithm. The derivation of the probability functions and the moments of the run length distribution were also obtained and they were consistent with some existing results for the in-control and out-of-control situation. By simulation process, the procedure identified a class of ARL for the MEWMA control when the process is in-control and out-of-control. From our study, it was observed that the MEWMA scheme is quite adequate for detecting a small shift and a good way to improve the quality of goods and services in a multivariate situation. It was also observed that as the in-control average run length ARL0¬ or the number of variables (p) increases, the optimum value of the ARL0pt increases asymptotically and as the magnitude of the shift σ increases, the optimal ARLopt decreases. Finally, we use the example from the literature to illustrate our method and demonstrate its efficiency.

Keywords : average run length, markov chain, multivariate exponentially weighted moving average, optimal smoothing parameter
Conference Title : ICPS 2016 : International Conference on Probability and Statistics
Conference Location : Paris, France
Conference Dates : January 21-22, 2016