شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

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التوثيق الالكتروني والميكروفيلم

بعض الوثائق الاصلية تالفة

بالرسالة صفحات

لم ترد بالاصل

Banha University
Faculty of commerce
Statistics, Mathematics
and Insurance Department

Statistical Study of Multivariate Quality Control Procedures and Its Applications

By

Hanaa Mohamed Shehata

Supervised By

Prof. Abd ELftah Mohamed Ahmed Kndeal
Professor of Statistics and Dean
Faculty of Commerce, Banha University

Dr. Mohamed Swelam EL-Said
Dr. of Statistic
Faculty of Commerce, Banha University

2007

This Thesis is submitted in partial fulfillment of Requirements for Degree of Master in Applied Statistics at the Faculty Commerce, Banha University.

كلية التجارة

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This research considers an application of multivariate quality control chart, Hotelling's T^2 chart, generalized variances chart and MEWMA chart.

It is shown that each of T^2 chart and MEWMA chart are used to determine whether or not the process mean vector for two or more variables is in-control, generalized variances chart is used to determine whether or not the joint process variability for two or more variables is in-control.

MEWMA and T^2 charts allow us to simultaneously monitor whether two or more related variables are in control. Generalized variances chart allow us to simultaneously monitor whether the joint variability of two or more related variables is in control. In addition T^2-generalized variances chart allow us to track the process level and process variation simultaneously.

It is shown that multivariate quality control chart do not indicate which variables cause the out-of-control signal so that the interpretation of the out-of-control signal are addressed specially by decomposition of T^2 to determine which variable(s) are caused the out-of-control signal.

This research effort explores designing the multivariate quality control charts, multivariate control charts for process variability and methods that address which variable(s) caused the out-of-control signal.

Industry fertilizers is an important one of the chemical industries in Egypt, so that this work concerns the fertilizers industries quality control, especially urea fertilizer with application on Delta fertilizers and chemical industries which is considered on of the leading companies in the field of fertilizers production in Middle east with application of multivariate quality control procedures to achieve best one procedure for multivariate quality control.

This application shows that the company should use the multivariate quality control chart to determine whether or not the process is in-control because the production have several correlated variables, and the used of separate control charts is misleading because the variables jointly affect the process. The used of separate univariate control charts in multivariate situation lead to a type I error and the probability of a point correctly plotting in-control are not equal to their expected values.

Table of contents

Nomenclature

ARL	=	Average Run Length of a control chart
Ci	=	The cumulative sum up to and including the i^{th} sample
CUSUM	=	Cumulative SUM
CV	=	Critical Values
EWMA	=	Exponential Weighted Moving Average
FIT	=	Finite inter section tests
HDS	=	Historical data set
LCL	=	Lower control limit
MC1	=	Multivariate Cusum scheme 1 developed by Pignatiello and kasunic (1985)
MC2	=	Multivariate Cusum scheme 2 developed by Pignatiello and Runger (1990)
MCUSUM	=	Multivariate Cumulative SUM
MEWMA	=	Multivariate Exponential Weighted Moving Average
MYT	=	Mason, Tracy and young decomposition
OOC	=	Out-Of-Control
PCA	=	Principal component analysis
SPC	=	Statistical Process Control
T^2	=	Hotelling's control chart
UCL	=	Upper Control Limit
C^+	=	Upper one-sided CUSUMS
C^-	=	Lower one-sided CUSUMS
N^+	=	The number of consecutive periods the CUSUM C_i^+ have been nonzero.

N^-	=	The number of consecutive periods the CUSUM C_i^- have been nonzero.
α	=	The probability of type I error
θ	=	The direction of the shift
λ	=	The noncentrality parameter
χ^2	=	Chi-square control chart

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