

A Methodology to Interpret Multivariate T Squared Control Chart Signals

Teodoro R. García León*

Industrial Engineering School, University of Carabobo, Valencia, Venezuela
tgarcia@uc.edu.ve

Maura L. Vásquez

Statistics school, Central University of Venezuela, Caracas, Venezuela
mauralvasquez@gmail.com

Guillermo Ramírez

Statistics school, Central University of Venezuela, Caracas, Venezuela
Guillermo.ramirez.ucv@gmail.com

Carolina Pérez

Industrial Engineering School, University of Carabobo, Valencia, Venezuela
carolinaguatavita@gmail.com

Multivariate control charts based on the use of Hotelling T squared Statistic are a very useful tool to be applied on Statistical Production Process Control, where a simultaneous monitoring of quality variables of terminated products should occur. The main advantage of these charts is that they are based on an optimum statistical test that allows detecting changes on the process mean vector for multivariate samples of any size. However, once the alarm signal is detected, additional interpreting criteria should be established in order to determine which variables are producing these changes. This paper proposes a methodology based on the GH Biplot Factorization of Hawkins' Z scale, which results into a multivariate graphic tool that represents the alarm signal, where the identification of the source of the signal detected by the T squared Statistic is possible. Therefore, this paper establishes a criterion to select the GH Biplot plane where the signal is best represented. It also suggests the sample statistic to evaluate the significance of the signal projection on the studentized partial residuals (SPR) of each variable on the selected plane. This proposal has been validated in an environment of simulated scenarios and proven through its application on regular and real problems in Venezuelan industry. Its application has been effective to detect changes in the process mean vector; being those changes the outliers or on one variable. In addition, as the sample size becomes greater it is more effective to detect changes. On the other hand if the change increases it is easier to detect.

Key Words: Alarm signal, studentized partial residuals, GH Biplot, plane selections.