

Multivariate Control Chart to Determine Efficiency Measurements in Industrial Processes

Authors : J. J. Vargas, N. Prieto, L. A. Toro

Abstract : Control charts are commonly used to monitor processes involving either variable or attribute of quality characteristics and determining the control limits as a critical task for quality engineers to improve the processes. Nonetheless, in some applications it is necessary to include an estimation of efficiency. In this paper, the ability to define the efficiency of an industrial process was added to a control chart by means of incorporating a data envelopment analysis (DEA) approach. In depth, a Bayesian estimation was performed to calculate the posterior probability distribution of parameters as means and variance and covariance matrix. This technique allows to analyse the data set without the need of using the hypothetical large sample implied in the problem and to be treated as an approximation to the finite sample distribution. A rejection simulation method was carried out to generate random variables from the parameter functions. Each resulting vector was used by stochastic DEA model during several cycles for establishing the distribution of each efficiency measures for each DMU (decision making units). A control limit was calculated with model obtained and if a condition of a low level efficiency of DMU is presented, system efficiency is out of control. In the efficiency calculated a global optimum was reached, which ensures model reliability.

Keywords : data envelopment analysis, DEA, Multivariate control chart, rejection simulation method

Conference Title : ICCSET 2015 : International Conference on Computer Science, Engineering and Technology

Conference Location : Barcelona, Spain

Conference Dates : October 26-27, 2015