QC Report

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For Quality Control and Process Improvement Professionals

Stochos and the Evolution of a Great SPC Tool

Stochos first published Custom/QC (CQC) for Statistical Process Control in the early 1980's. Its capabilities were very much in line with the discrete part manufacturing SPC philosophy of the time. That is to say, the Descriptive Statistics portion used to quantify the current quality level included the customary tools such as: histogram, Pareto chart, average, standard deviation, skewness and kurtosis with a dash of percentage of product likely to meet customer specification. The Process Improvement module included the standard X, Xbar, Range and Standard Deviation charts for variables data and p, np, c and u charts for attributes data.

As people started using Custom/QC in their plants, we began to get data sets submitted from the continuous process industries for suggestions as to what approaches should be used. At this point, Stochos began to add features that clearly set CQC apart from the ever-growing number of competitors in the SPC software field.

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The first step was the addition to the histogram reporting screen to include estimates of what the standard deviation of the data would have been IF the process were in-control. Comparisons of this "capability" standard deviation to the actual ("performance") standard deviation gave CQC users a heads up relative to the stability of the process which generated the data. This in turn allowed them to report accurately as to whether their relative quality measures (e.g. Cp, Cpk) were capability measures or simply performance measures. It should be noted that this distinction is considered to be of little consequence to those using SPC analysis for public relations (my customer said I had to "have SPC"- sort of like having the measles - they go away in a couple of weeks) rather than for real process improvement activities.

The second step was to add control charts which are appropriate for the cases where the state of the process must be evaluated with each new data point as it occurs. The most commonly used chart for this purpose is the X - Moving Range chart (sometimes referred to as an I/R chart). Charts such as CuSum and EWMA will often yield better information about the status of the process.

CQC introduced a new version of the EWMA chart which makes it comparable to the CuSum chart and still capitalizes on the intuitive advantages of the EWMA.

The next step was to add regression, analysis of variance and means (chosen because of its control chart look and feel relative to significance of variables), key variable identification (to determine which control variables should be included in the experimental design), auto and cross correlation, time series modeling and true multivariate methods (T-square and Chi-square). These additions were a necessity for the continuous processes from the start of SPC but are now becoming important to the discrete process as they become more fully automated.

The time series modelling function available in CQC enables the users to build a model of the expected effect of the complex control system on the output and then make appropriate use of the proper control charts.

In This Issue:

Alliance Announcement
Abomitable Snowjob:Cpk
SPC Training
Process Optimization Exhibit
SPC Software Review

The distinction between "capability" and "performance" standard deviations led us to develop a similar concept for the dispersion matrix which is an integral part of the T-square control chart. This makes the CQC T-square chart more efficient in detecting unusual process events in the multivariate world.

The increased use of the T-square chart led, in turn, to the development of an auxiliary ("Bonferroni") chart to help stand the out-of-control points on the T-square chart.

So, as the world turns and new concepts are developed or older concepts become revitalized, Stochos will continue to add to the usefulness of Custom/QC. On the horizon are such things as multivariate relative quality measures and principal components.

Stochos uses "Chocolate Chip Cookie?" Exhibit

- To Demonstrate ProActive Process Optimization

Stochos used a modified, automated toaster oven to demonstrate seamless integration of software and hardware components that provide **Process Optimization and Control.** The aroma of baked cookies drew large numbers of people to the Stochos/Nematron exhibits, making the "Baking Factory" a great success in educating manufacturing professionals on the concepts of ProActive Process Optimization.

As cookies and toast complete their baking cycle, a visual sensor detects the lightness and darkness of the product being completed. To further effect the process, a muffin fan is faced into the oven from various distances. The fan represents uncontrollable variables in a process. The Stochos ProActive Process Improvement (PPI) system sends signals to the controllers to adjust the temperature and/or rotational speed within the oven to continuously optimize the product. In this case, produce the perfect cookie or toast in the presence of cooling winds (non-controllable variables).

Utilization of the Stochos/Nematron alliance products in a plant environment can result in lower costs and higher yields. Other benefits include decreased waste, reduced customer complaints, ISO management and the elimination of paperwork.

For more information on the Baking factory, visit **www.stochos.com** or to request information on Stochos Solutions email: **Sales@Stochos.com**

Feb.19-21 Basic & Feb. 21-23 Advanced Statistical Process Control Training

Course Description: This course has two components: a two and ½ day basic overview and a two and ½ day advanced topics. The basic course deals with such standard tools as histograms, Xbar and R charts, process capability studies and sampling plans. The advanced topics deal with statistical process control in automated industries: Key variable identification, regression, correlation, principal components, autocorrelation, discriminant analysis and evolutionary operation (EVOP). The course will cover the basic concepts of statistical analysis and their application to practical problems in process control.

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News Release: Stochos Forms Alliance with Nematron

Nematron Corporation (Amex: NMN) and Stochos Inc. have announced a partnership to provide integrated PC-based control, Statistical Process Control (SPC), Quality and Manufacturing Execution solutions to manufacturing and process industries. Nematron and Stochos will work together to implement automation solutions that help manufacturers reduce costs, improve quality, and provide better connectivity between the factory floor and corporate information systems.

Nematron's President, Matthew Galvez commented, "The real value of our PC-based control solutions is in the integration with other plant systems. That makes a partnership with Stochos, who has been providing industrial solutions since 1968, a natural fit."

Don Holmes, President of Stochos, added, "The partnership with Nematron furnishes Stochos with a great connection to the plant control system. This combination of products and skills, coupled with Stochos' experience in linking to plant legacy systems, makes a completely integrated factory system a reality - not just wishful thinking."

Nematron Corporation has been setting the standard in PC-based control since the birth of the industry. Nematron is the only company that designs and manufactures a complete and proven PC-based control solution. Their web site is http://www.nematron.com Stochos, Inc., is a leading supplier of high quality software systems that focus on improvement of the manufacturing process. Visit Stochos on the web at http://www.stochos.com

The Abomitable Snowjob:Cpk
Time For A Decent Burial!

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www.stochos.com/dons_resume.htm

One widely used relative measure of quality is the Cpk. I will not repeat its definition in this discussion. It is misunderstood as widely as it is used. This note is addressed to those folks who place any confidence in the Cpk as a clean measure of quality.

The arguments in its favor seem to run along the lines of several similar arguments given below.

Argument #1: "It certainly worked in the one case I tried. Therefore it must be valid."

Argument #1's Similar Argument:
2 + 2 = 4 which gives the same result as 2*2. Therefore to multiply two numbers you need only to add them. This is obviously incorrect - so the argument is invalid.

Argument #2: "It certainly worked for the thirteen examples I tried. Therefore it must be valid."

Argument #2's Similar Argument:
J. Wilson (1741-1793) stated that n is a prime number if and only if,

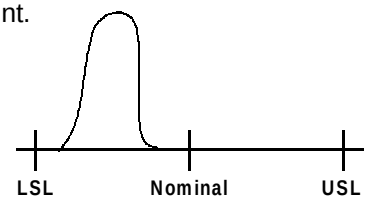
Q = 1 + 2*3*4*...*(n-1) is divisible by n.

Example: for n = 6, Q = 121 which is not divisible by 6 so 6 is not a prime number. for n = 7, Q = 721 which is divisible by 7 so 7 is a prime number.

This worked fine for many small values of n but failed when n became 101. (See Volume 1 of The World of Mathematics page 506 for more details.)

Thus the rule breaks at n = 101 and an argument based on many successes fails.

So it would seem that one should only have to show one case where the value of Cpk is excellent yet the quality level is clearly terrible to prove the invalidity of the CpK as a measure of quality. The following example clearly results in a beautiful Cpk. But, the customer got not one item that was anywhere close to the target value - which is a clear indication of poor quality. This example requires only a sketch, no math, to make the point.



But the nails in the coffin grow more numerous. The Cpk, as is shown in the diagram above, is a confounded measure: the quality of the process width (Cp) is mixed up with the quality of the process center (Cn). If this is not considered to be a serious confusion, then we offer another great statistical measure to be pondered: the "stavage". This measure is defined below.

Stavage = Standard Deviation + Average

Notice how the stavage simplifies your task of relating the results of your quality improvement efforts: you need only talk about one number as a description of process output as opposed to two, three or maybe even four.

If you don't buy the stavage, how can you buy the Cpk?

Kill it and bury it as quickly as possible. Lest you think there is no viable alternative, use two values: Cp for process width and Cn for process center. You should already be used to using standard deviation for width and average for center. Use of Cp and Cn is a natural and understandable and non-confounded alternative!

The Cpk is an abomitable snowjob. The Cpk should be allowed to die a quiet but sure death.