

Optimize

Use SPC to Make Better Parts

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Statistical process control (SPC) is a tool for monitoring and controlling manufacturing processes. Dr. W. Edwards Deming claimed that the majority of variation in a process is due to operator over-adjustment. SPC gives operators a tool to determine when a statistically significant change has taken place in the process or when a seemingly significant change is due to chance causes.

SPC involves:

- Determining the critical process parameters that need to be monitored.
- Setting up an initial control chart and confirming that the process is in-control.
- Collecting and plotting future data on the chart and interpreting the chart to determine if the process has gone out of control.

There are a number of reasons why companies use SPC. Often an internal champion initiates the use of control charts and other SPC techniques to reduce variation and to improve manufacturing processes. Sometimes companies implement SPC to satisfy customer requirements or to meet certification requirements. SPC itself will not make improvements. However, SPC will give the operator a tool to identify when a special cause of variation has entered the process so that the special cause can be eliminated. With this tool, constant adjustment of the process is eliminated. In addition, SPC can be helpful in identifying opportunities for improvement that can lead to reduced variation and processes that are better aimed at their target.

MeasurLink® is a data collection and real-time SPC suite from Mitutoyo America Corp. (Aurora, IL). The software is designed to detect and display patterns and provide additional statistical information. Many patterns can be detected on SPC charts, including:

- Cycles
- Trends
- Mixtures
- Grouping of measurements
- Gradual change in level
- Sudden shift in level
- Instability (abnormally large fluctuations)
- Stratification (abnormally small fluctuations)
- Interactions (two or more variables acting together)
- Systematic variation

Entering Data

In order to use an SPC system, data needs to be entered into the software. Consider, for example, handheld metrology tools.

Mitutoyo America Corp. offers a wireless data transfer system to support SPC, which eliminates the need for long, cumbersome data cables. "Our digital tools have an option for data transfer, using our U-Wave system with our own Digitmatic protocol," explains Pat Harkness, national sales manager for Mitutoyo. Each receiver can transfer data from up to 100 gages from 70 feet away, making it an ideal

for both small and large shops to monitor their processes.

To make things easy for shop-floor personnel, Mitutoyo's SPC software, MeasurLink®, reduces error by prompting personnel on which device to use, as well as how to perform measurements. This is helpful when there's a number of devices to choose from including *calipers*, *micrometers*, *bore gages*, *snap gages* and *depth gages*.

With a CAD model of the workpiece, the operator sets up a program that is read and interpreted, and then provides instructions on how to take measurements and which tool to use, eliminating operator errors.

Types of Data

Data used in SPC can be divided into two broad categories: variable and attribute. Variable data is normally a dimensional or quantitative measurement, such as the thickness of a part or the diameter of a hole. Variable data are easily collected using industry standard measuring tools, such as micrometers, calipers, bore gages and CMMs.

Attribute data is a yes/no or go/no-go form of data. An example of yes/no attribute data is a refrigerator inspection looking for dents or scratches (or how many dents or scratches). The refrigerator either has a dent or scratch, or it doesn't. An example of go/no-go attribute data is the use of a go/no-go gage to check the diameter of a hole. The hole is either within tolerance, or it isn't.

Using variable data is preferred over attribute data since it gives more information about the product/process. In the case of the hole diameter, knowing the hole size a machine/process is producing gives the operator a marker for tool wear. The operator can then replace or adjust the tool before the hole diameter goes out of specification.

Make good parts

To ensure manufacturers make good parts, SPC starts at the point of manufacture. When manufacturing a part and checking features critical to quality, it is important to collect the data immediately and as physically close as possible to the point of manufacture. When recording and charting data, the operator is going to see that things such as assignable cause and corrective action. The only time you have good understanding of these is at the point of manufacture. A week later, no one remembers.

SPC systems provide records of when things are going right—the data that's in control and in tolerance—and when things go wrong—the assignable cause and corrective action. That's important in using data for statistical projections. Statistical predictions can only be made on stable processes.

Statistics is all about numbers, however, sometimes looking at the numbers is not as easy to interpret as a graphical representation of those same numbers. As the saying goes, a picture is worth a thousand words, or in this case, a picture is worth thousands and thousands of numbers. SPC systems allow you to do both, allowing a quick check of a process, as well as the ability to drill down as necessary for more information when necessary.

For example, you want to do a comparison between the tolerance limits and the control limits. If you have control limits that are well within the tolerance limits, great. You want to look at statistics to validate what you see in the graph, but the graphs tend to give you big-picture information on the overall process.

All the while, manufacturers are trying to maintain a process, make sure it is stable over time and

continues to be so in the future.

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