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Identifying Poorly Performing Processes

Process capability indices, in partnership with control charts on critical process variables, help you identify processes that are performing poorly.

Remember that stability is evaluated using control charts.

Capability is evaluated based on the ability to meet customer specifications.

A capable process must be stable, but a stable process might not be capable.

The best processes are both stable and capable.

The worst process is one that is not stable and not capable.

This type of graph is called a process performance graph.

Let's look at the process performance graph for an example with 20 variables. The P_{pk} is plotted on the Y axis.

The stability index is plotted on the X axis. The stability index is a measure of the stability of the process.

It is the ratio of the overall (long-term) standard deviation, or sigma, to the within-subgroup (short-term) sigma. For a stable process, the overall and within estimates of the standard deviation are about the same, and the stability index is close to 1. An unstable process has a large overall standard deviation relative to the within estimate. In this case, the stability index will be larger than 1.

A similar measure, the stability ratio, can also be used.

For our example, all of the variables are stable, so there are no points in the yellow or red boxes.

Some of the variables are capable and stable.

But many of the variables are stable but incapable.

A process performance graph can provide insights into the types of problems you need to address to improve the performance of your process.

If the process is unstable, you need to identify the special causes and address them.

If the process is not capable, then there is too much variability or the process is off target, or both.

You've learned that C_p measures the potential capability and that C_{pk} measures actual capability.

If there is a difference between C_p and C_{pk} (or P_p and P_{pk}), the process is off target.

The target index is a measure of how far off target a process is. The target index measures the number of standard deviations the mean is from the target. If the target index is 1, then the mean is 1 standard deviation from the target.

Here we see the target index, along with many other performance measures, for 20 variables, sorted by target index.

It's easy to see that some of the processes are shifted more than 1 standard deviation from the target, and one process is nearly 2.5 standard deviations from the target!

Let's look at the variable NPN5. The process is shifted 1.77 standard deviations from the target. This is reflected in the low P_{pk} and C_{pk} values for this process. The C_p value is close to 1, indicating that the process spread is wider than the spec limits. But this isn't the biggest problem.

Clearly, action must be taken to shift this process to the target.

In this video, you learned about the stability index and the target index.

These measures, along with the capability indices that you've learned in this lesson, provide insights into the problems you need to address to improve performance.

Do you need to stabilize the process?

Do you need to bring the process to target?

Or do you need to reduce the common cause variation in your process?

Note that some of the common cause variation might be due to measurement error. As you learn in the next lesson, a measurement system analysis can be used to study sources of variation in a measurement system.

For more information about the stability index, the stability ratio, and the target index, see the Read About It for this module.

In the next video, you see how to identify poorly performing processes in JMP using the goal plot, the process performance graph, and the target index.

Then you hear from an industry expert about the importance of these metrics in managing and controlling process variation.

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