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Predictive model to evaluation quality of the manufacturing process using Matlab tools

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Abstract

Quality of production is very important part of successful company. Through the variability of production can be generated the products, which not achieve requirements of quality. For company it means loss. Prediction of evaluation of the achievement level of quality of production process is possible way how can be eliminated losses of the company.In the presented contribution is shown the possibility of using tools of software product Matlab to create a predictive model for evaluating the quality of the production process. There are described the tools that enable the creation an appropriate model. In this model were used the basic tools of statistical process control and their graphic representation in the form of diagram.

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1. Introduction

The manufacturing processes of productive forces effect on each other to create a product. Each product has a certain dimension which is highly important for it. This means that if the size is out of the tolerance limits, the product is classified as non-compliant, as a waste [1]. As a result, companies have losses and therefore they put increased emphasis on compliance with these requirements.

The concepts of statistical process control (SPC) were initially developed by Dr. W. E. Shewhart, and were expanded upon by Dr. W.E. Deming, who introduced SPC to Japanese industry after WWII. After early successful adoption by Japanese firms, SPC has now been incorporated by organizations around the world as a primary tool to improve product quality by reducing process variation.Dr. W.E. Shewhart recognized that there are two major causes of variation in a process: *common causes* and *special causes*. Common causes of variation result from natural factors in the process and occur at random. Variation due to common causes cannot be changed except through fundamental change in the process itself [2]. The variations mean that it is impossible to produce two completely identical products.

A capable process is such a process where almost all the measurements fall inside the specification limits. This can be represented by the plot below [3]:

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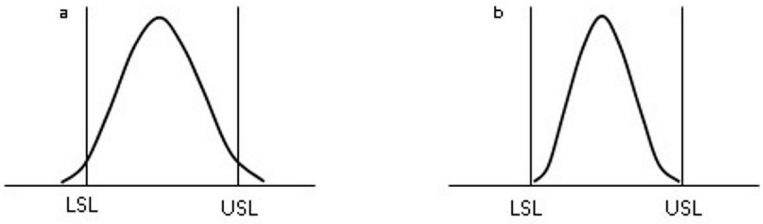

Fig. 1.(a) Traditional process; (b) Capable process.

In order to avoid losses manufacturing companies began use the tools to monitor and improve the quality of the production process. For one of the basic tools is statistical process control - SPC. Within connection graphical representation with numerical values of indices is described achieved level of quality and so brings the necessary information.

Control charts typically display the limits that statistical variability can explain as normal. It graphical represents how a process changes over time. This graph is based upon the Central Limit Theorem which tells us, in effect, that the samples will follow a normal distribution regardless of the shape of the parent distribution.If the process is performing within considered limits, it is said to be in control; if not, it is out of control. Data are plotted in time order. A control chart has a central line for the average, an upper line for the upper control limit (*UCL*) and a lower line for the lower control limit (*LCL*) [4].

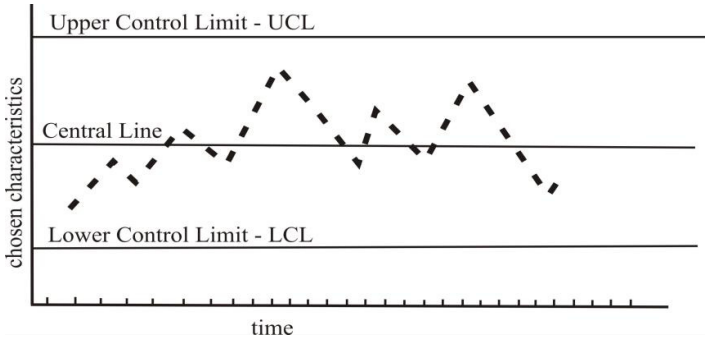

Fig. 2. Description of Shewhart graph

In practice, specification limits *USL* and *LSL* are usually established by engineers and are not a function of the capabilities of the process. Control limits represent "what the process can do," and specification limits represent "what we want the process to do" [5]. By comparing current data to these lines, you can draw conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation). Points outside of these control limits can indicate that the process is not operating as consistently as possible and some assignable cause has resulted in a change in the process. Similarly, runs of points on one side of the average line should also be interpreted as a signal of some change in the process. When such indicates exist, action should be taken to identify and eliminate them [6].

The disadvantage of traditional evaluation is that the evaluation is carried out after a process. The aim is therefore to find ways to secure the pre-production process evaluation of the in-time. Then should be possible intervene to in the process in cases of finding irregularities. With continuous monitoring and process analysis we can move to an appropriate "just-in-time" manner.

The paper assumes automatic data acquisition and use of MATLAB software options for visualization and measurement data. At the beginning we can predict through visualization what will be the level of production quality, or even, if is necessary to intervene in the event of adverse developments in the state.

Nomenclature

SPC	statistical process control	C_{pk}	indicator of current capability of process
USL	upper specification limit	C_p	process capability index
LSL	lower specification limit	*K*	index of capability
$\bar{x}$	arithmetic mean of the measured values	σ	standard deviation of process
UCL	upper control limit		
CL	central line		
LCL	lower control limit		

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