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Selection of cutting conditions and tool flow in flexible manufacturing system

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Abstract

Modern production requires minimum costs and maximum productivity of cutting processes. By using the simultaneous engineering, it is possible to include the processes of optimization of cutting conditions and tool flow already in the integrated preparation of the product and processes and in the parallel program of all activities. This paper presents the experience gained in concrete researches in industry.

Keywords: Optimization; Cutting condition; Databases; Tools; Cutting tool flow; Simultaneous engineering; Tool management

1. Rational method of production at the turn of the century

Simultaneous engineering is the strategy of the future. These insights appeared at the end of 1980s when there was no symposium or congress without euphoric forecasts. Today, after almost 10 years have passed, it is possible to make a balance of successes and failures [1].

The simultaneous engineering (SE) represents an integral method and a parallel time progress of the product and processes. In putting the simultaneous engineering into practice, the following targets are aimed at:

- to shorten the time-to-market from the idea up to the beginning of sale;
- to reduce the costs of the product development and manufacture;
- to improve the product quality in the sense of total quality management.

The principle of modern work in industry is shown in Fig. 1. The role of the production management has completely changed in comparison with the hitherto principles of work.

In the area of cutting technologies great changes have occurred. The manufacturing accuracy, technologically reachable, and the flexibility of production facilities as the key function of industrial production have increased [2].

Of course, one of the important factors of production is the organization of the tool supply. In our researches, we found that some companies invest much into new machines and their information support, whereas they deal very little with optimization of cutting condition and tool flow in flexible production.

2. Optimization processes of machining are not perfect in practice

In the questionnaire submitted to a maker of diesel engine components, we found that the main objective was to replace conventional machines by modern machines ensuring complete machining. The second phase of optimization refers to the area of cutting conditions and tool management.

In joint cooperation and particularly thanks to understanding the SE, we managed to secure a project and to introduce the basic function areas of the tool management. First, by a network matrix we established the function and object dependences of the tool management with other activities in the company (purchase, disposition, storing, transport, maintenance, etc.). Fig. 2 shows comparison of conventional method of machining of standard components with the method of complete machining.

3. Basic function areas of tool supply

When trying to reach the target that the tools must fulfil their function, i.e. cutting, it is necessary to follow up the entire quantity of tools as shown in Fig. 3. In our practical

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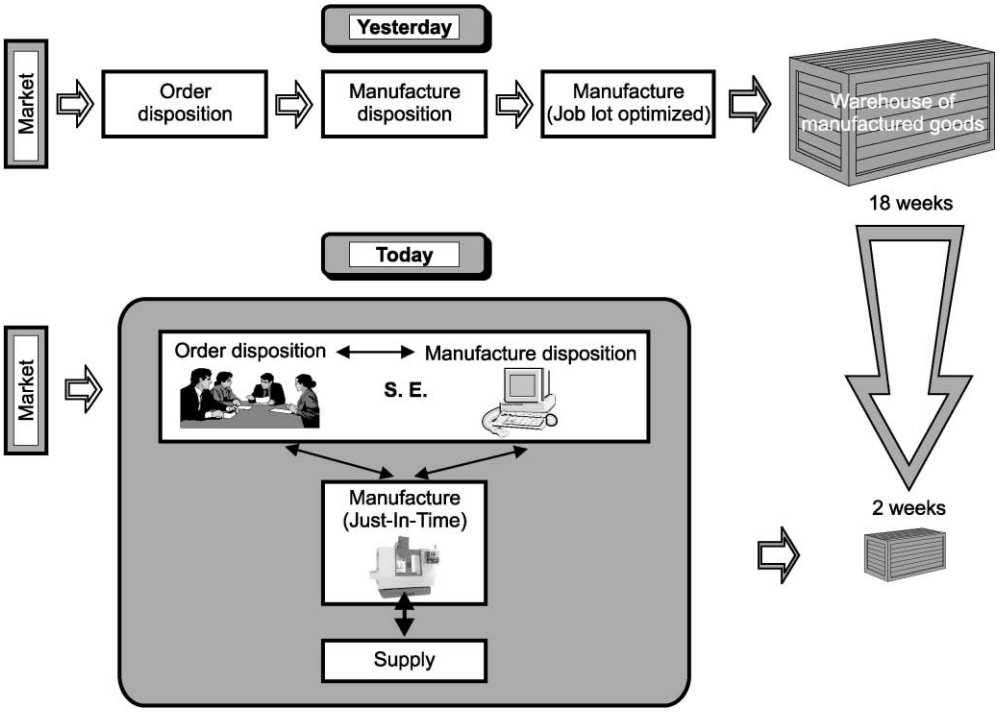

Fig. 1. Principle of work of modern production management.

example, we undertook the distribution for three main function areas: selection, purchase and use of tools. The selection of tools must be defined in the work process of simultaneous engineering. Many problems can be removed in time.

In particular, it is important to have as few specially designed tools as possible, since they are very expensive, and as many standard tools as possible. Definition of production capacities and planning of machining by NC

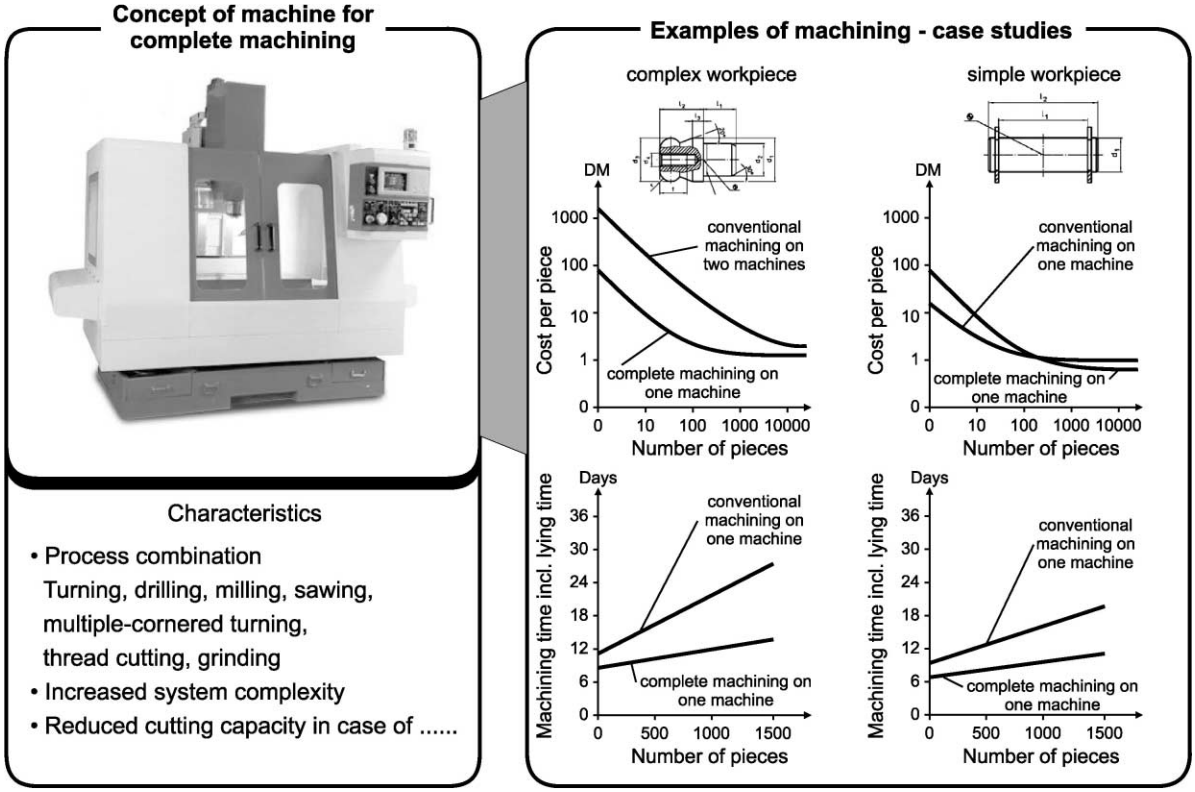

Fig. 2. Comparison of conventional method of machining of standard components with the method of complete machining.