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ANALYSIS OF ROLLING PROCESS DESIGN MODELS

Abstract: *The article deals with the traditional principles of design, technical and economic indicators and the introduction of technological design of rolling. The article shows the mode of technological design of rolling, the maximum efficiency of automation of design and construction works, methods of using the mathematical apparatus of the theory of operation research and methods of informal analysis.*

Key words: *rolling, automation, model, computer technologies, design, system approach.*

Language: *English*

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Introduction

In the automation of design design, significant difficulties arise at the stage of formalization of design tasks. In many cases, it is possible to obtain mathematical models that allow the use of only approximate algorithms for solving [1].

The study shows [1-2] that the use of innovative solutions often leads to an excessive rise in the cost of rolling production or real production conditions limit the capabilities of the technologist.

Therefore, having specific knowledge in the field of designing the technological design of rolling, you need to apply them in a specific situation, i.e. own methods of choosing the optimal variant of the technological process [3].

At the modern level, computer technologies and the created mathematical apparatus are able to replace in some cases production experiments and quickly answer the question of what each of the technical solutions gives.

The success of technological design design depends on how deeply the developer understands the process, what arsenal of special technical means and fundamental knowledge he possesses.

When automating technological design, it is necessary to take into account the nature and relationship of a large number of factors that affect the construction of technological design and determine the economic efficiency of manufacturing products and their quality.

At present, along with the development of methods for solving various technological problems of rolling, more and more attention is paid to the

problems of methodology for the design of technological design.

First of all, this is due to the fact that the complication of technological design and the goals facing them, their transformation into complex technical systems comes into conflict with the traditional design principles, which are usually carried out according to the scheme (Fig. 1).

According to this scheme, based on the tasks (goals) of the process, according to the arrangement of the developer, several alternative options for the implementation of technological design are selected.

Technological design options are compared in terms of technical and economic indicators. When comparing on several indicators, the choice of the preferred option for technological design is not strictly justified. After choosing one of the options for it, the development of complete technical documentation, equipment, assessment, etc. is carried out.

This approach to design is explained by the fact that the preparation and implementation time for technological design of rolling is significantly extended.

Today's search, which is carried out by trial and error in a rolling mill, is very expensive.

Compared to the traditional design scheme, system analysis makes it possible to optimize the process by stages of its design.

A significant step in improving the design of technological design of rolling was the creation of statistical models of these processes. The use of statistical models allows you to raise the level of designing processes similar or close to existing ones (modeling) [4]. The principles of constructing an optimal solution adopted in the system approach require one of the criteria as an optimality criterion to evaluate technological design or to set a priori a method for reducing several criteria to one generalized one.

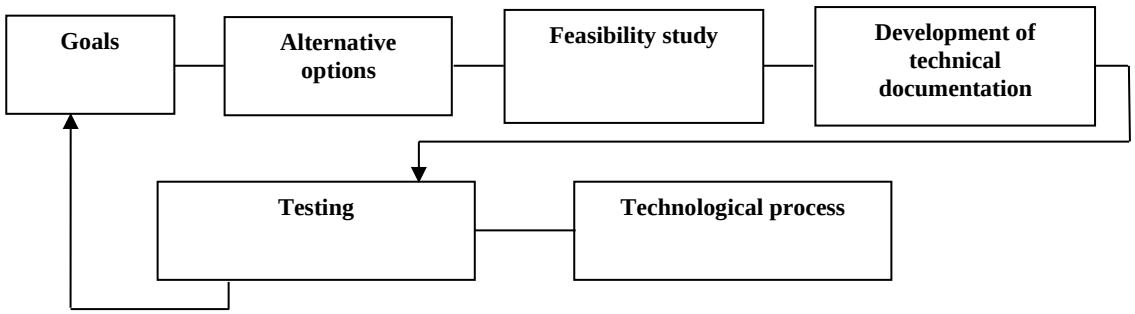

Fig. 1. Scheme of traditional technological design of rolling

To ensure the maximum efficiency of the automation of design and engineering work, it is necessary to introduce a scientific design methodology. The main such design is system analysis, which allows you to combine the system outcome with multi-objective optimization, i.e. synthesize formal and informal research methods (Fig. 2)

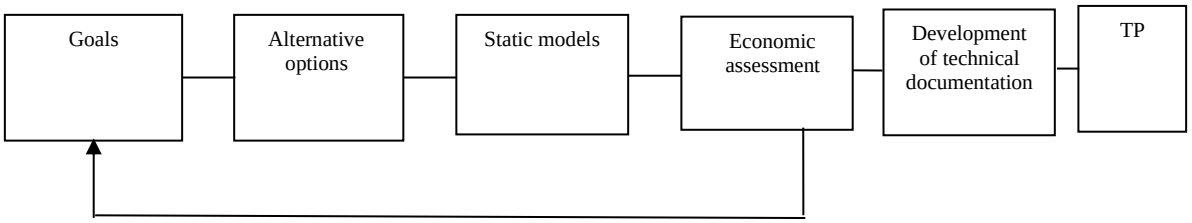

Fig. 2. Scheme of technological design of rolling in the framework of system analysis

Systems analysis is a systematic discipline that develops ways to study a variety of complex systems or situations with unclear goals (criteria).

Such studies are necessary to determine scientifically based programs of action, taking into account not only objective, but also subjective information. The systematic approach uses the mathematical apparatus of the theory of operation research and methods of informal analysis [5].

The main task of the system analysis is to help the researcher develop a unified criterion for assessing an acceptable solution based on the analysis of many disparate factors of indicators characterizing the system and the various solutions associated with them. The formulation of the goals of creating a technological process creates the possibility of choosing related criteria, with the help of which it is possible to quantitatively compare the relative advantages of the options.

The above is achieved by sequentially splitting the goal until indicators (private goals, subgoals) are obtained, which can be estimated either by a

dimensional value (for example, by spending money), or using points (for example, from 0 to 1 for degree of process automation) [6].

The variable parameters that determine the mode of technological design of rolling can be the type of stands, the geometric dimensions of the rolled and rolled stock, the power of the electric motor, the material of the rolls, etc. This approach to technological design is called systemic (Fig. 3).

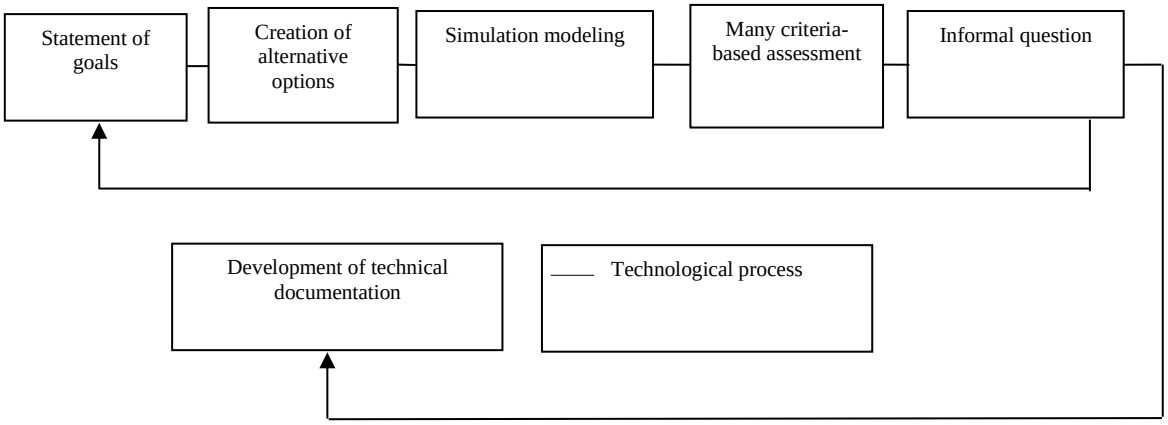

Fig. 3. Scheme of technological design of rolling from the position of a systematic approach

The general goal of the synthesis of a technological process is to compile an extensive set of hypothetical methods for its implementation, developed in sufficient detail for their assessment in the light of the chosen goals [7].

The first step in synthesizing a process is collecting known alternatives from all possible sources. However, it is very difficult to meet the requirements for the maximum completeness of the set of alternatives based on intuition alone. Therefore, in design, methods of directed synthesis, both ordered and disordered, are widely used, leading to optimal design [8].

Recent advances in computer technology have created a new direction in the study of complex processes - simulation [9].

When developing a process model, its internal (exogenous) characteristics and external (exogenous) factors influencing it are linked.

There are models that, on the one hand, are optimization models, i.e. within the framework of which the problems of mathematical programming are solved, and on the other hand - by imitation, i.e. within the framework of these goals, simulation experiments are carried out [10-11].

The main purpose of the analysis of simulation models is to obtain the most desirable values of the decisive variables.

At the stage of assessing possible solutions, the researcher tries to classify possible solutions according to the degree of preference. At the stage of setting the task, indicators are determined, with the help of which they establish the degree of achievement of the goal, in this or another version of the solution.

In most cases, it is impossible to simultaneously obtain ideal values for different indicators, because they often correspond to the need to achieve conflicting goals. So, the requirement of the maximum value of some operating characteristic of the system is not met with a minimum of loss of time and minimum financial costs. In addition, the ideal situation is achieved due to the impossibility of taking into account the influence of some factors.

Conclusion.

As a result of the analysis of the traditional design of rolling in the form of a developed technological rolling scheme from the standpoint of a systematic approach, the rolling efficiency increases 2-3 times.

To select a solution with specific values of variables, it is necessary to transform the vector description of the system with many indicators into a scalar one, i.e. build an objective function.

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