Transactions of the VŠB – Technical University of Ostrava, Mechanical Series
No. 1, 2011, vol. LVII
article No. 1841

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THE SYSTEM OF AUTOMATIC CONTROL OF COMPLEXITY WORK EVALUATION IN ASSEMBLY

SYSTÉM AUTOMATICKÉHO RIADENIA HODNOTENIA ZLOŽITOSTI PRÁCE PRI MONTÁŽI

Abstract

The article is about a task of creating of an automated system for the evaluation of the complexity and the prediction of labour input of fitting and assembly operations, which used for manufacturing of machine-building item.

Abstrakt

Článek se zabývá vytvořením automatizovaného systému pro hodnocení složitosti a predikce práce ve výrobě na vstupu, montáži a při montážních operacích, které používá ve strojírenské výrobě.

1 INTRODUCTION

As a rule, products of engineering plants are complex items. For their design engineering and manufacturing, a large volume of design documentation is required. In order to raise their competitiveness, the plants constantly expand the spectrum of products, which naturally leads to an increase in the volume of preproduction.

In this connection, solving the problem of making-up the product range of an engineering plant is rather complicated and at the same time, it is currently central. An adequate evaluation of labour input and production costs that are necessary for manufacturing an item is one of the main requirements for efficient and effective planning the production activity of an engineering plant.

In specialists' opinion, the operations referring to machining and fitting-assembly operations are the most labour-consuming in machine-building because they are performed manually 60-80 % and require significant inputs of manual labour and high level of proficiency from workers. Increased labour input of fitting-assembly operations appreciably increases the general labour input in machinery manufacturing and substantially impairs economic indicators of the plant operation, which is caused by an increase in the in-process storage of expensive completed parts and elements. This, in its turn, increases the cost of the work-in-progress inventory and decreases the efficiency of the working capital use.

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2 DEVELOPMENT OF AN AUTOMATED SYSTEM

Thus, the quality improvement and the increase of labour productivity of fitting-assembly operations are very important for the enhancement of the efficiency of an engineering plant. In this connection, the evaluation of the labour input of fitting-assembly operations at early stages of the life cycle of a machine-building item including the step of decision-making on its manufacturing is one of the currently central problems. The task of prediction of the labour input in machining a machinery part is resolved based on the use of the constructive-technological complexity [5].

Since the design documentation package has been developed, the determination of the labour input of the fitting-assembly operations for a certain production type is carried out based on the differentiated or extended norms. The prediction of the labour input and production costs for a machine-building item at early stages of its life cycle in the absence of the developed design documentation is very often difficult due to the absence of respective methods or their insufficient development.

The necessity to improve the efficiency of the engineering and manufacture of new items requires that up-to-date automated systems for the technological preparation of the production process will be introduced. At present, active work in this sphere has resulted in the creation of automated systems or program modules, one of the functions of which is resolving the task of norm setting and cost fixing [3, 6].

The analysis shows that at present, the automated systems used in the industry provide the standardization for the fitting-assembly operations in accordance with the technological process developed. The evaluation of such operations in the absence of the design documentation developed is carried out at a plant with the help of the methods that are based of the analogy method. It leads to the subjectivity of evaluations obtained, the accuracy of which significantly depends on the qualification of a specialist, who carries out an evaluation. Thus, it is necessary to develop a method for prediction of the labour input of the fitting-assembly operations needed for manufacturing a machine-building item, which should be based on the analysis of the design documentation package for this particular item [4]. The constructive-technological complexity factor of a machine-building item is offered as the basis for developing the method.

The objects of the present research are the development of a method to determine the probable labour input of fitting-assembly operations, which will take into account the factors influencing the complexity and labour input of operations, and the creation of an automated system based on the method offered that will allow determining the probable labour input of fitting-assembly operations.

In order to reach the above object, it is necessary to resolve the following problems:

The investigation of the influence of the constructive-technological complexity of items on the effectiveness of fitting-assembly operations;

The development of a method for the formation of the constructive-technological complexity factor for fitting-assembly operations;

The investigation of the factors that influence the constructive-technological complexity and labour input of fitting-assembly operations; the obtaining of their numerical evaluations;

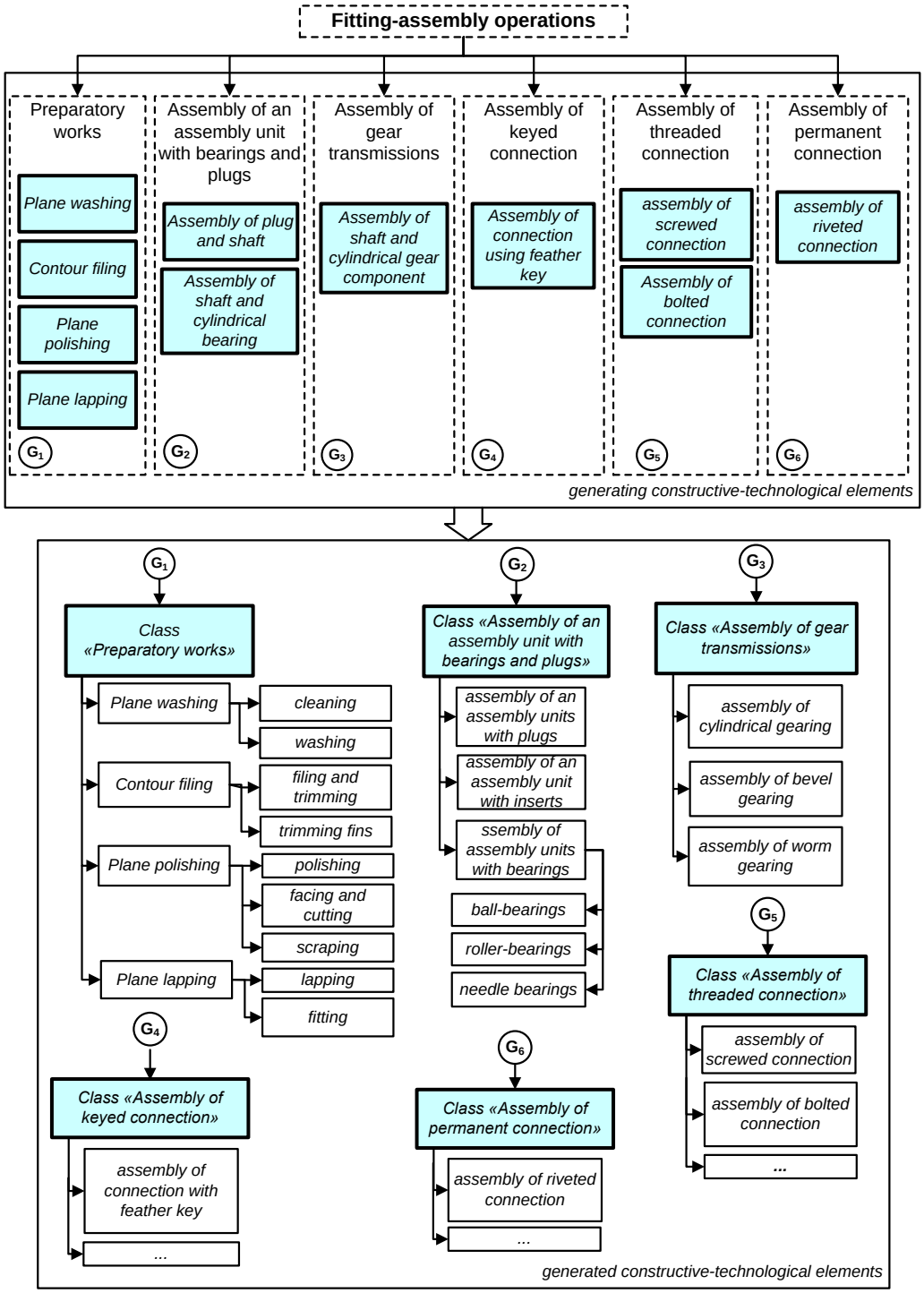

Fig. 1 Classifier of fitting-assembly operations.

The development of a method for the determination of the probable labour input of fitting-assembly operations;

The development of algorithms for the determination of the probable labour input of fitting-assembly operations;

The development of an automated system for the determination of the probable labour input of fitting-assembly operations;

The approbation of the method and the automated system developed under the manufacture conditions.

In accordance with a general model for the formation of the constructive-technological complexity that is used as the main element in the formation of an information model for a particular fitting-assembly operation, an elementary operation is singled out and the type of an aggregate function is determined, which takes into account the structure and the volume of carried-out elementary operations and their parameters [1, 2]. The elementary operations are combined into separate classes. In each class, generating elements providing the formation of generated elements are singled out. (Fig. 1).

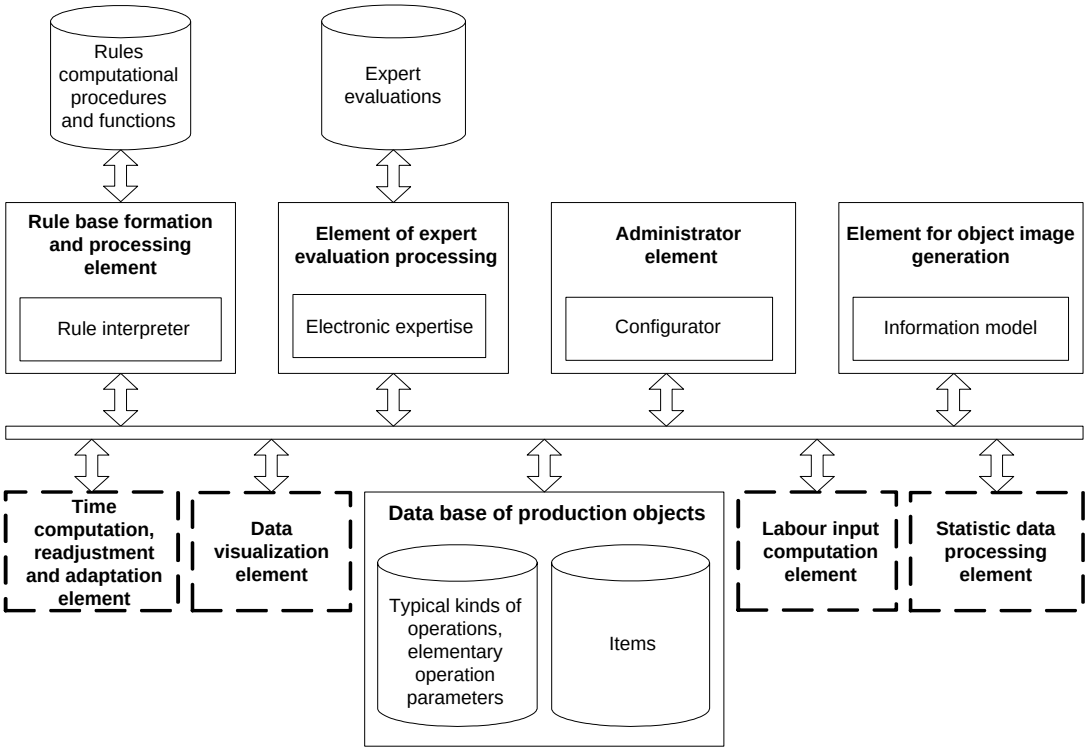

Fig. 2 The automated system structure.

3 CONCLUSION

At present, the formation of generating elements for the classes of elementary operations and the numerical evaluation of their parameters are carried out. The formation algorithms for the information model of fitting-assembly operations are developed based on the singled-out elementary operations. Based on the model, the evaluation algorithms for the constructive-technological complexity and laubour-input of an operation are also being developed. Based on the obtained results, the designing of the structure (Fig. 2) and the specifying of the modules are conducted for the developed automated system for the evaluation of the complexity and for the prediction of labour input of fitting-assembly operations.

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