Organization of mechatronic system maintenance and repair

Organizácia opráv a údržby mechatronických systémov

Yuri V. TURYGIN (RU), Mária TÓTHOVÁ (SR), Pavol BOŽEK (SR)

ABSTRACT

Maintenance and repair adaptive strategies play an important role in supporting the operational efficiency of mechatronic systems. Thereby, further application of computer aids and generation of automated control system for maintenance and repair works at production enterprises is expected.

KEYWORDS

maintenance and repair works, automatic control system, mathematic support and software, reference data

INTRODUCTION

Maintenance of mechatronic system operational efficiency is a complex and urgent task. As for the advanced mechatronic systems (including machining centers, paper-making machines and many others), the timely and qualitative maintenance is essentially important during their operation. Development and application of adaptive strategies for maintanance and repair of enterprise engineering systems implies wide application of computing facilities and creation of automatic control system for maintenance and repair works. The main goal of automatic control system for equipment repairing is improvement of organization and functioning of the enterprise repair services and service companies, and activities on increasing the manufacturing effectiveness. The guiding principle of creating the automatic control system for equipment repair, which is the component of the computer integrated manufacturing (CIM) system, is the approach that provides creation of CIM system as a single complex, covering all aspects of economic organizing and industrial engineering activities of the enterprise repair service.

Automatic control

Providing the engineering enterprise with the advanced automatic equipment and increasing the requirements to its reliability and effectiveness establish new tasks for the repair plant management. Dynamic regulation of repair service activity and scientific forecasting in the field of application and reproduction of manufacturing equipment by its technical state estimation are of greater and greater importance within control matters. In this connection the automatic control system for repair activity becomes thereupon the necessary element of the whole manufacturing process. System analysis of repair control at enterprises allowed determining the following main models and structures of repair control functions:

- formal structure (subdivision structure of repair service department, hierarchy and number of employees in each subdivision);
- hierarchic structure;
- structure of functions, including the structure and hierarchy of control functions;
- information structure, determining the network of data flows between subdivisions and employees of the department;
- structure of technical facilities (structure and technical characteristics of the whole

engineering office equipment, including hardware CIM and diagnostics systems).

Sets of tasks for repair automatic control system

The advanced repair automatic control system (RACS) must solve the following sets of tasks:

- generation and maintenance of the system reference base;
- estimation and account of repair schedule fulfillment;
- dynamic control of repair works;
- maintenance control;
- diagnostics of equipment and its component technical state;
- management of repair service staff;
- control of repair material support (preparation);
- estimation and account of repair expenses for specific types of equipment;
- control of repair service warehouses;
- control of mechanical-repair department if it is present in the enterprise structure.

On the basis of analyzing the operation process and leading production experience the requirements have been stated to the sets of tasks, solved within repair CIM systems.

Calculation and account of performing the schedule of preventive repair works (PRW). According to the accepted system of maintenance and repair (SMR), for each item of the equipment or production line the performance of various (current, medium, overhaul) preventive repair works is provided. Based on this information the annual and monthly schedules of PRW are designed. The annual schedule of equipment PRW is the main document to analyze all technical and economical indices of the repair service and to ground the production program of the enterprise. Information and reference base of the set should provide the acquisition of initial data to generate the individual repair schedules for each item of the equipment. The account of actually performed works is the basis of refinement and addition of the information and reference base.

Dynamic control of the equipment repair provides first of all the refinement of repair schedules and size based on the report data on performing the repair activity during the previous period, definition of the work size during unplanned stops. In order to increase the efficiency of repair control, it is reasonable to apply repair flow charts which comprise the information, necessary to prepare and perform works at the specific equipment, labor costs and workers' skills to perform repair operations. Information of the flow charts is applied to generate the tasks for repair workers to perform the works and to process the data of their performing.

Maintenance control. This set implies the development and control of performing the schedule of lubricating and other preventive measures to determine the consumed amount of lubricants. The information and reference base of the set is generated based on the equipment ratings.

Diagnosing the technical state of the equipment and its components is the constituent part of the maintenance. However, the importance, separate character of such works, necessity and reasonability of keeping the information and reference base allows to single out the solution of the task of evaluating the equipment technical state into a separate set. When there is the computer-aided system of diagnosing the technical state of separate types of the equipment, these systems are the component parts of the repair CIM. The considered set of tasks allows automatizing the development of the diagnostics frequency, data processing and analysis with giving the solution according to evaluation results of the technical state of the equipment and its components.

Labor force control. The set of tasks implies the calculation of the amount of workers to perform each repair, defined by the annual and monthly schedules, definition of workers' skills depending on the performed works, foundation of attracting the contractors to the repair works. Material support (preparation) of the repair. Timeliness of preparing the components

and parts to be replaced during the repair allows to reduce the idle time of the production equipment. In this connection it is reasonable to automatize the estimation of the demand in spare parts within the specific repair, generation of orders to manufacture and buy spare parts, definition of the demand in other materials to perform the repair works.
Estimation and account of repair expenses. The set of tasks must provide the preparation of the financial estimation documentation for each type of the repair, account of actual expenses for the repair and their analysis, which provides increasing the efficiency of the repair service operation.
In general case, each set must provide the execution of the following functions: generation and maintenance of the reference base; estimation and planning of works to be executed; account of performed works and state analysis.

CONCLUSION

Solving the enumerated sets of tasks within CIM systems reduces the work content of calculations, increases the responsiveness of repair control and operation quality of paper-making equipment. The greatest efficiency of CIM systems is achieved by participation of direct executives in the process of preparing and making decisions. Such an interaction of executives and CIM system is possible when delegating the solution of a certain number of repair control tasks directly to the working place of the mechatronic system operator.

ABSTRAKT

Adaptívna stratégia údržby a opravy hrajú významnú úlohu v podpore prevádzkovej efektivity mechatronických systémov. Preto sa očakáva ďalšie uplatňovanie počítačových a automatizovaných systémov riadenia. Implementujú sa do procesu údržby a opravárenských prác vo výrobných podnikov.

KĽÚČOVÉ SLOVÁ

údržba a opravy, automatický riadiaci systém, matematická podpora a softvér, referenčné dáta.

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CONTACT

Prof. Yury V. Turygin, DSC.
Kalashnikov Izhevsk State Technical University,
Studencheskaya str., 7, 426069,
Izhevsk, Russia,
e-mail: turygin_uw@mail.ru

RNDr. Mária Tóthová, PhD.
Slovenská technická univerzita v Trnave,
Materiálovotechnologická fakulta,
Ústav aplikovanej informatiky, automatizácie a matematiky,
Hajdóczyho 1
917 24 Trnava
e-mail: maria.tothova@stuba.sk

Assoc. Prof. Pavol Božek, PhD.
Slovak University of Technology,
Faculty of Materials Science and Technology,
Institute of Applied Informatics, Automation and Mathematics,
Hajdóczyho 1,
917 24 Trnava, Slovakia
e-mail: pavol.bozek@stuba.sk

Recenzoval(a): doc. Ing. Vladimír Popelka, CSc.