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PROGRAMMING OF INTEGRATED MEASURING IN FLEXIBLE TURNING SYSTEM

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Abstract – The presented paper describes the model of integrated computer-aided measuring and a special system for in-process measuring on flexible manufacturing turning system. The system was implemented in practical use on flexible turning system.

Keywords: FMS programming, in-process measuring.

1. INTRODUCTION

During the past years the demand for new products on the market has increased. The time of designing, and in particulars, the time of manufacturing of products have been shortened.

A higher degree of automation requires higher investments. In order to assure economy of introduction and operation of automated flexible systems, it is necessary to increase their productivity and/or utilisation. Attempts are being made to reach that by integrating and automating the manipulation of tools and workplaces, measuring and checking in the system and integrating the necessary additional operations in the system(degreasing and washing of products, preserving, packing, etc.) The efficiency is even higher, if the flexible automatic manufacturing system is linked to the system of computer - integrated manufacturing where automated information flow is ensured between the CAD, CAPP, CAMM and CAQ systems and the business systems in factory.

2. DESCRIPTION OF FMS

A part of CIM production is the self operated manufacturing system, which can be relatively in a simple way adapted to the manufacture of various products from the family of geometrically and technologically similar parts. This is a flexible manufacturing system which is computer controlled and can operate independently for certain time. It consists of CNC controlled machine tools, automated transport of workpieces, computer-integrated measuring of the product in the working space of manufacture, or on special measuring device, automated internal handling of products and cutting tools and system of computerised monitoring of operation.

3. COMPUTER - AIDED QUALITY CONTROL

Computer - aided quality control is only one part of Total Quality Management system (TQM). The main scope of CAQ system is inspection and measuring of parts in manufacturing systems with measuring devices and measuring machines. Quality assurance was in the past done by manual and statistical methods. This was very time consuming and accuracy was low. If the parts inspection takes place outside the machine tools it could cause the bottle necks and delays in production.

Introducing of NC machine tools in manufacturing system was followed by a great change in set-up and preparatory functions of production system. This change was transmitted also to the field of parts measuring and inspection. The products become more and more sophisticated with advanced design and shapes and with higher level of accuracy. Time for inspection and measuring in such type of production can be up to 30% or even 100% of machining time. This means, that the machine tools must be stopped, during the inspection of parts and the result is decrease of productivity. This was the reasons for introducing the numerical controlled measuring machines.

3. PROGRAMMING OF MEASURING

Recently, several systems of automatic programming have been developed in order to reach a higher extent of utilisation of measuring machine. The systems NCMES (Numerically Controlled Measuring and Evaluation, developed in Aachen, Germany) and SCAI-CNC (Software per Control Automation Inspector, developed in Italy) are the most perfect of them. The two systems have a certain degree of automation of programming of sensor positioning with any number of measuring points. The principle of programming is creation of input programme in the problem-oriented symbolic programme language.

The input program consists of:
- general commands,
- geometrical commands for part description,
- technological commands,
- instructions for moving the measuring head and
- instructions for evaluation of measuring data.

In order to assure efficient and user friendly programming, the following must be taken into accounts:

- each programme module must operate separately, i.e. e., independently of others but in a co-ordinated way,
- the programme system must ensure the central control and monitoring.
- for programming of the individual units the use of commercially available programme systems (e. g. EXAPT, CNC, DLOG, UNIGRAPHICS, NCMES, ANVIL 500, CADMES, ROBEX etc.) must be ensured,
- the system must ensure graphic support for programming.
- the system must also have graphic simulation of operation of the entire flexible turning cell and must allow incorporation of simulation programmes for the individual activities (e. g. simulation of tool motion, real graphic representation of the cutting tool etc.).

The structure of the developed programme system ensures preparation of control programmes for the entire flexible turning cell. The programme system consists of three parts:
- NC system for programming the turning unit NDM-16,
- system for preparation of control programmes and data for automation of components,
- system for computer simulation of functioning of flexible turning cell.

In the second part of the programme system the pre-setting sheet for measuring unit is prepared.

4. PREPARATION OF MEASURING SYSTEM

The measuring system consists of measuring device and measuring control. The measuring device ensures execution of geometrical inspection of the product, while the measuring controls show the dimension and calculate the required tool correction (Fig. 1). The control programme consists from common values and data for individual measuring controls.

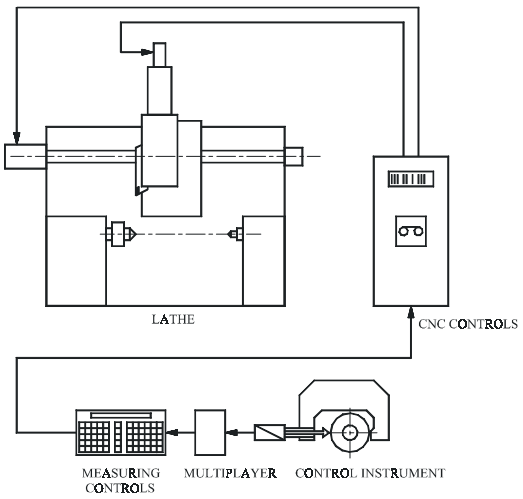

Fig. 1. Connection of measuring control unit with lathe control

5. CONCLUSIONS

The program system for complex programming of the flexible turning cell, including measuring programming, presented in the paper, has proved to be successful. By means of program package the programming is more simple and clear. Graphic simulation of control program and parameters has ensured shortening of the time required for preparation of the turning cell. Some errors in control programs and parameters can be revealed in time and then possible damages to the machine tool can be prevented. The program system is open-ended and can be complemented and extended simply. It is possible to incorporate monitoring of opening and closing the door, monitoring of entry of the robot manipulator into the lathe machining space (the jaws must be in the left hand position), reading of specific program parameters etc. Specially developed graphical simulation system ensures higher efficiency and reliability of programming. The computer language Turbo-C has proved to be suitable for writing of programs for graphic simulation.

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