GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ)
ISSN (E): 2347-6915
Vol. 12, Issue 3, March (2024)

CONTROL PROGRAMS FOR CNC MACHINES

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ABSTRACT

The article deals with CAM - numerical control and systems that provide the possibility of automated creation of control programs for CNC machines (computer numerical control).

Keywords: production automation, computer systems, CAM, control program, processing of complex surfaces, CAM module, cloud services.

INTRODUCTION

Production automation is defined by technologies consisting of the use of computer systems to plan, manage and control production operations through direct or indirect relationship with production resources [1]. CAM - numerical program control and systems that provide the possibility of automated creation of control programs for CNC (numerical control) machines. Such qualities of CAM-systems as the ability to generate complex tool paths, high speed of creating control programs, the possibility of postprocessing for almost all existing CNC systems have opened up many opportunities in areas related to the processing of complex surfaces.

The main goal of developers of modern CAM-systems is not to increase the functionality of the software product, but the simplicity of its applicability, for the user interface, automation of the processes of preparation of control programs. In CAM-systems their CAD-component is important. The programmer needs such functions as extending surfaces, "sewing" holes and pockets that are not to be machined at this stage, building various contours to limit or refine tool paths, combining or splitting surfaces, creating a model of the workpiece, and so on. The availability of such capabilities allows the CNC programmer to prepare a model for creating correct control programs without turning to designers [2]. One of the sides of this direction is cloud technologies, implemented, if not in a comprehensive PLM-system, then at least in CAM-modules. Cloud services allow to create a UE9 (control program) of not complicated machining for almost all common CNC systems. However, the most promising direction of such technologies today is the creation of open databases, from which CAM-systems will be able to apply, for the creation of the control program, such data as cutting modes, data about the tool itself in the form of 3D models, which can be used for verification and much more. Predominantly the filling of such databases will fall on the shoulders of the tool and tooling manufacturers, and users, in the process of their use, will be able to modernize them and offer their own solutions. Another possible area of application of cloud technologies is the promising areas of KBM and FBM. With their help the CAM-system gets an opportunity not only to recognize structural elements of the model, but also to automatically create different variants of processing of these elements, assign the appropriate processing technology, etc. The role of "clouds" in this case is the creation of interacting databases. With the use of KBM modules, the user will only need to set the "zeros" of the part, assign the type of machining (milling,

turning, etc.), start the automatic recognition of elements and select the appropriate machining variant from the proposed ones, and then start postprocessing of the PM.

The development of CAM systems in terms of trajectories and machining strategies also has a promising direction in high-speed cutting. High-speed machining (HSM) is theoretically based on the so-called Solomon curves, which are graphs of the change in tool load in the process of increasing cutting speed, feed and other characteristics. Experimentally it was found that in a certain range of ultra-high machining speeds the tool loads are significantly reduced, allowing the cutting process to continue without sharp fluctuations of machining parameters. In addition to high spindle speeds and high minute feeds, the application of VSO requires special tools and it is desirable to carry out experimental machining to adjust the cutting modes. The importance of the CAM system in the application of WSO is quite significant, because there is a need to obtain such trajectories that would provide constant loads on the tool, minimizing their fluctuations, minimizing the number of tool cuts into the workpiece, etc. CCA solutions are gradually appearing in multi-axis machining as well. In addition to the correctness of the trajectories, the user is interested in whether a machine with specific kinematics, using specific fixtures, can machine a workpiece according to a given control program. Often, especially when machining a part in multiple setups, the programmer has to machine with different tooling, which must be reflected in the part setup cards. In such cases, some CAM systems allow the user to create 3D models of the tooling, place them on the part right at the time of part creation, and generate a machine program that requires the machine to bypass the specified tooling. However, this is not always enough.

The main directions and principles of SAM-systems development: creation of cloud resources using knowledge bases; creation of cloud services allowing to select tools and machining modes; further promotion of FBM and KBM in multi-axis machining

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