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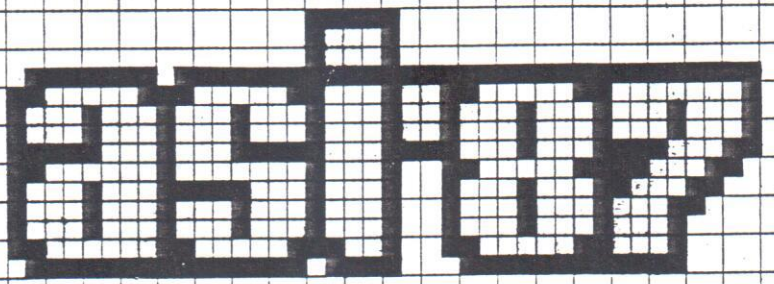

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BASIC FUNCTIONS OF A GENERALIZED POSTPROCESSOR IN A MECHANICAL CAD/CAM SYSTEM

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THE POSTPROCESSOR IN THE MECHANICAL CAD/CAM SYSTEM

Since first announced in 1957 as part of the APT (Automatic Programming Tools) CAM system, up to now, the postprocessor is the last level of NC (Numerical Control) part programme generation. The input data is stored in the so called CL-file (Cutter location file), which contains information concerning the processing conditions (feedrates, spindle speed and etc.) and tool motion sequences. The CL-file is generated from the previous level of the CAM software using part and workpiece geometry data, technology requirements, available cutting tools and etc.

Different CAM and CAD/CAM manufcturers use their own formats in generating the CL-file. This causes great disadvantage in further postprocessing - the CAM user is forced to use a postprocessor compatible with the desired CL-file. Due to this an APT CL-file format standard was established. Nowadays most world-wide used CAM and CAD/CAM systems generate the standard APT CL-file (ANVIL 4000, ANVIL 5000 from MCS, EUCLID from MATRA DATAVISION and etc).

As output, the postprocessor generates a NC part programme for a particular NC or CNC (Computer Numerical Controlled) machine tool. This means, that all the tehnological conditions of the part processing must

coincide with the machine tool capabilities i.e. the feedrates and spindle speeds are within the limits, the number of tools needed to process the part is not more than the tool magazine capacity, the cutting power is less than the power of the machine tool. Also the NC part programme has to be generated in a format, compatible with the CPU unit and it has to contain statements recognizable by the CPU system.

In the early days, due to accoplishment of these requirments, different postprocessors were developed for different machine tools. This approach has the advantage of the fact, that the postprocessor very precisely generates an NC part programme according to the machine tool and its CPU. But in this case, the CAM user had to have as many postprocessors in the CAM system as different NC or CNC machine tools he has. Usualy these postprocessors were developed by the CAM manufacturer. So if the user puts a new NC or CNC machine tool to work, he is forced to ask the CAM manufacturer to write a new postprocessor, or to maintain a staff, capable of doing so.

To overcome these disadvantages, in the middle of 70's and begining of the 80's some CAM manufacturers developped the first generaliazed postprocessors. With such a software, the CAM user was given the possibility to define his own postprocessor. The process of defining a new postprocessor was usualy involved in filling tables containg data, necessary for generating a NC part programme for a particular NC or CNC machine tool. These tables are later saved on a media and are known as postprocessor files.

Nowadays, after almost 30 years of worldwide experience in CAM, NC and CNC and the latest developments in CAD/CAM, FMS (Flexible Manufacturing Systems) and CAE

(Computer-Aided Engeneering), the generaliazed postprocessor must perform much more functions than only generating NC part programmes and postprocessor files.

BASIC FUNCTIONS OF A GENERALIZED POSTPROCESSOR

Certainly, the most common function which a postprocessor must perform is generating a correct NC part programme, compatible with the particular NC or CNC machine tool. At this point there are two problems to discuss. First of all, this is the form of the input data i.e. the CL-file. Most worldwide used CAM and CAD/CAM systems - ANVIL 4000, ANVIL 5000, EUCLID, EXAPT, I-DEAS and etc. generate the standard APT CL-file format, or other standardized formats i.e. COMPACT and etc. So it is advisable to use as input data these CL-file formats. A good solution is including preprocessors for different standard CL-file formats. This approach allows linking the postprocessor to every CAD/CAM system, which generates standard CL-file format. The second problem concerns the NC functions which the postprocessor must generate. Nowadays most CNC systems offer a large variety of functions, which simplify the manual NC programming such as canned cycles, offset tool path calculation, NC subprogrammes, MACRO programming and etc. No matter of that, a generalized postprocessor must generate the common standard NC functions. This way NC part programme compatibility is perfomed with the only shortcoming, that the NC part programme is larger than the other, written using the exotic capabilities of the particular CNC unit.

Next two functions arrise from the user's and manufacturing point of view. It it very useful, if one can choose "right at the moment" the CL-file, which must be processed and the postprocessor with which it is to be processed. There are many reasons and events in the

manufacturing process which determine such requirements. So we call these two functions catalogs. A generalized postprocessor must maintain a CL-file and a postprocessor's catalogs with which the user can flexibly determine CL-files for processing and the related postprocessors.

The last function of a generaliazed postprocessor is generating a new postprocessor. The session of postprocessor generation should be simple and understandable for the NC or CNC users. It must be built around the latest developments in user interface software tools (simple operator's environment, online help, default values, ability to move forward and backward in session's sequence and etc.) and yet generating a precise enough postprocessor. After the end of a session, the new postprocessor must be available for generating NC part programmes.

All these functions should be performed by different modules of a software, written on a high level programming language, standartized and supported by a large variety of hardware. This allows a proper software configuration, complying better with the user's requirments and compatibility with user's available hardware.

EFFORTS IN GENERALIAZED POSTPROCESSOR SOFTWARE DEVELOPMENTS

An interesting development is the UCC APT POSTPROCESSOR of the University Computing Company called UNCMO1. As input it uses the standard APT CL-file and generates a NC part programme with the information for a particular NC or CNC machine tool. To perform different functions, the user must start different programmes, i.e. to generate a NC part programme a module called UNCMO1 is used; to generate a new postprocessor, a programme called OPTMO1 - option file generator must be utilized and etc.

In an interactive environment, answering a number of questions, a postprocessor file is generated, and it can be further used to process CL-files. UNCMO1 is available for UNIVAC, VAX and IBM computers.

Other developments use similar approaches. Examples are PAFEC's DOGS NC, FANUC's FAPT software, TC-APT, EXAPT CAM system, FIDES's EUKLID. These postprocessors use mainly their own CL-file format.

This year the FMS and CNC Technology Research Lab in collaboration with the CAD/CAM centre in the Higher Institute of Mechanical and Electrical Engeneering "V.I. Lenin" announced the generalized postprocessor named POSTGEN 1.0. As input it uses the standard APT CL-file. POSTGEN 1.0 generates NC part programmes for contour and pocket milling, flame cutting, EDN processing and nibelling with CNC machines. It also incorporates catalogs of CL-files and postprocessors. Their selection is made during the current postprocessing session. An easy-to-use and user-friendly interactive postprocessor generator performs the last function of the generalized postprocessor. Using this module three postprocessors for three different machine tools - the millig centre MSO32 1th FANUC 6M CNC, MSO32 with ZIT5OOM CNC and MAHO CNC milling machine are generated up to now. POSTGEN 1.0 is installed on IBM PC/XT, IBM PC/AT, PRAWEC 16 personal computers and IZOT 1055 C supermini computer, but it can be installed on every computer, which has an ANSI 3.9/78 FORTRAN 77 compiler and a terminal, which supports the ANSI display ESC sequence codes.

CONCLUSIONS

Finally, based on the experience of the generalized postprocessors being used, and the practice with the self-developped POSTGEN 1.0, we can define the four basic functions, which such a software must perform:

- generate NC part programme, using a standard CL-file, for a particular NC or CNC machine tool, using a postprocessor for it
- catalog of the available CL-files and possibility of dynamic CL-file selection
- catalog of the available postprocessors and possibility of dynamic postprocessor selection
- module for postprocessor generation with a high level of automation.

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