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NUMERICAL CONTROL CENTER

ROK/82/031/A/01/37

THE REPUBLIC OF KOREA

Final report : NC POSTPROCESSORS

by

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Post: DP/ROK/82/031/11-53/31.9.B

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I. ACKNOWLEDGEMENTS

I would like to express my thanks and appreciation to the management and staff of the Korea Institute of Machinery and Metals (KIMM) as well as the NC-Center research group for its active cooperation, interest and support in efforts to achieve mission's purposes.

I am especially grateful to Dr. Sam-Jin Park, the project Director, for his genuine commitment to my work within the project.

II. INTRODUCTION

Postprocessors are crucial and necessary elements in any successful introduction of the CAD/CAM technology to the shop floor level. It has been a part of the NC technology for years. The scope of the mission goals has been outlined according to:

1. Project Document, ROK/82/031/A/01/37
2. Job Description, DP/ROK/82/031/11-53/31.9.B

and after discussions with the KIMM staff members.

III. OBJECTIVES

Train the assigned group of engineers at the NC Center on:

- postprocessor design
- cutter location data structure in advanced part progvamming systems.
- geometrical data base structure in the extended APT-like systems and other CAD/CAM systems.

IV. SEMINARS AND WORKSHOPS

Seminars and workshops have been chosen as the most efficient way to carry out the work in given circumstances. Six research-engineer group appriopriated to postprocessor designing has had a significant experience in engineering application software. Therefore, the task could be ambitiously extended to a practical design of the postprocessor modules for milling machines and lathes. Usually it takes several months to accomplish such a task.

All seminars have been carried out in first four weeks.

These are the topics of the seminars:

1. Structure of the APT-like systems
2. Postprocessor as an important component of the system
3. Typical postprocessor applications
4. Analysis of the available CAD/CAM oriented software
5. Advanced NC part programming as necessary step toward design and manufacture integration

6. Specialized subsystems for design and manufacture of products with double-curved surfaces. (e.g. TV tube, car body, ship, aircraft, turbine blades, dies and moulds, etc)
7. Typical postprocessor structure
   - NC lathes
   - NC milling machines
8. Practical approach to postprocessor writing
   - analysis of a control system
   - programming manual for an NC machine tool
9. Postprocessor modules
10. Analysis of the ANVIL-4000 system.

The postprocessor is a computer program which is needed for every machine control unit (MCU) and machine tool (MT) configuration, but general modules can be built to serve for various configurations.

The postprocessor generates as output either the punched tape or information which can be directly applied to prepare the tape by using some standard peripheral equipment; such equipment is available at the KIMM.

In addition to the APT system, there are many other programming systems that have been developed by computer companies or by machine tool manufacturers. Some of the more common ones are COMPACT II, ADAPT, EXAPT, POUT-APT, AUTOSPOT, AUTOPROMPT, SPLIT. None of these systems is available at the Institute, but there is ANVIL-4000,the CAD/CAM system supplied by MCS, CA, USA.

This system is oriented more toward graphics and design than to manufacturing. Nevertheless, the output is structured according to APT CLDATA and general APT postprocessor modules can by modified to fit the ANVIL-4000 system.

The general modules have been designed in order to fit to the SINUMERIC 3M, CNC system and to milling machines, machining centers and lathes.

There is a good computer installation at the KIMM; VAX11/780 and VAX11/750 are available.

During workshops about 51 postprocessor subroutines have been developed(written in FORTRAN 77 language).

The subroutines for input check the input data for reliability and print list of the information and auxiliary elements for subsequent processing.

The subroutines for motion perform all instructions concerned with the tool movement(geometrical and dynamic aspects).

The subroutines for machine tool functions compare available preparatory and miscellaneous functions of a specific NC configuration with the required functions which are accepted from the input.

The subroutines for control convert the data into a format appriopriate to be accepted by the specific MCU.

In addition to these subroutines, the special subroutines for monitoring the machining process has been developed. It is very useful for the machining process optimization.

The postprocessor developed is being extensively tested in NC Center and it is expected that in two mouths it can be introduced to shop floor testing.

The attached "Appendix 1" gives the idea what has been done during postprocessor workshops. The complete listing of source program (132 pages) has been submitted to Dr. Sam-Jin Park, the Project Director in the Korea Institute of Machinery and Metals, Changwon Station.

V. FINDINGS AND CONCLUSIONS

1. There is a general lack of manufacturing and designing background among engineers working on CAD/CAM software. It may occur to be crucial for factory implementation of the software, because the advanced engineering software is closely related to the area of applications. The CAD/CAM projects need not only persons with computer science knowledge, but in the first place persons with a deep knowledge of application areas together with the requisite capability in systems analysis and programming.

2. In the frame of CAD/CAM, special attention must be given to the NC manufacturing. There are at least several types of modern sophisticated NC machines and CNC systems produced in the Republic of Korea, but the adquate CAD/CAM software supporting these hardware products has not been developed. For full utilization of the CAM technology the training process must reach a relatively large percentage of plant's staff. The following functional groups should be included: design engineering, planning, tooling, production, quality control, and, in the first place, the managerial level.

VI. DATES

Briefing in the UNIDO, Vienna	29-30 January, 1986
Briefing in the UNIDO Office, Seoul	3 February, 1986
Arrival to Changwon City	3 February, 1986
Last working day at duty post	20 March, 1986
Debriefing in the UNIDO Office, Seoul	21 March, 1986
Debriefing in the UNIDO, Vienna	26-27 March, 1986