ABSTRACT

Automation of process planning is developing via administrative support, the group technology supported variant systems and the generative system possibly supported by the use of artificial intelligence in expert systems. Problems not yet completely solved are CAD-process planning integration, extraction of logic or heuristic process planning rules, composing of plans by inference mechanisms and interfaces with production control systems.

1. Introduction

In 1984 a proposal for a major new project was presented to its sponsors by CAM-I. The project was referred to as "IMPACT" and it concerned probably the most advanced proposal for Integrated Manufacturing Planning and Control Technology at that time [1]. Budgetwise it may also have been the largest Automated Process Planning project as the required funds were estimated at somewhere between $20-30 million. (Although the project has not yet started). The basic philosophy is still useful for achieving the final goal: automation of Process Planning (Fig. 1). The figure indicates how a computer-based product model has to be made for the Process Planning logic approach, in order to recognise its features and the related dimensional, engineering and technological data. After determination of the operational sequences and the selection of machines the required NC-programs can be generated as well as Process- and Pictorial plans. A connection that has not been indicated is the interface with Supervisory Control Systems governing production in the (partly) automated factory.

At the same time fig. 1 indicates the majority of the problem areas in the development of automated Process Planning Systems. They will result in truly

*CAM-I: "Computer Aided Manufacturing-International" a "not for profit"-organisation, managing industry-sponsored research projects. Arlington, Texas, USA.
Automated Process Planning Systems not being available before 5-10 years from now. Totally integrated systems may take as long as 10-15 years.

The problem areas involve:
- the availability of a CAD-product model that is "digestible" for the Process Planning approach. An important task here is the classification of technological product features.
- the use of a hard- and software system that can handle Process planners experience and logic rules in an economic and user-friendly way.
- the set up of data bases of logic and heuristic rules for Process Planning. They may be company-specific, machineshop-specific (and may be even Plannersmood-specific).
- the interfaces between the various CAD-systems and Process Planning and between Process Planning and Production Control Systems.

These areas will be dealt with in this paper, along with:
- Short overview of Process Planning and the developments until now.
- Some developments taking place in the field of Process Planning.
- Future research topics and encountered problems.

2. Process planning

Process Planning is generally defined as the function within a manufacturing facility that specifies the process and information required to manufacture a part or assembly. Process plans in the machining environment may specify:
- Type of operation to be performed.
- Sequence of operations.
- Machine selection.
- Set-ups and sequence required.
- Tools and fixtures.
- Technological data.
- Calculation of machining times and costs.
- Raw materials required.

as well as other specific information.

Fig. 2 gives an example of a Process Plan. In the information-flow chain, Process Planning can be located between the design and the manufacturing function. So in principle PP is an information transforming activity: Input is an engineering part-drawing and possibly some engineering specifications regarding for instance treatments or inspection procedures. Output is a process-plan that prescribes the manufacturing method as indicated above. (Fig. 3). The Input of data from the drawing into the Process Planning