

International Conference on
COMPUTER INTEGRATED MANUFACTURING
Internationale Konferenz über
RECHNERINTEGRIERTE FERTIGUNGSSYSTEME
Zakopane, March 24-27 1992

Michał ANDRZEJEWSKI
Jan UNIEJEWSKI
Kazimierz WIECZOROWSKI

The Institute of Mechanical Engineering Technology
Poznań Technical University, Poznań, Poland

THE PROCEDURES OF AUTOMATIC PROCESS PLANNING OF TURNING

Summary. The paper presents specification of steps and functions, which are realized in automatic process planning system. The starting-point is description of a shape of a shaft. The computer aided process planning contains the choice of operations, structure of cuts and instrumentation in dependence of the input information. The points, where the man-computer dialogue occurs, are forced by process planning system and kind of the process engineer influence on the process planning.

1. Steps in process planning and realized functions

The specification of steps and functions, which are realized by computer in process planning, shows the computer operation sequence, points of man-computer dialogue stated by process planning system and kind of the process engineer influence on the process planning [1,2].

The procedure of process planning realization consists of ten steps:

Step 1: Conditions of the manufacturing process:

- Information generating for condition setting,
- Composition of the condition card-index.

Step 2: Recording & formal control of the drawing:

- Information generating for part coding,
- Formal control of the draft recording by the process engineer,
- Error identification of the draft recording,
- Result generating of the draft coding,
- Card-index composition of the drafts,
- Composition of the working manufacturing card-index.

Step 3: Planning of the manufacturing process structure:

- Calling of the process structure planning subroutine,
- Planning of the process structure,
- Process structure generating,
- Process structure generating after changes made by process engineer,
- Structure planning result memorization in the working manufacturing card-index.

Step 4: Operation planning:

- Dialogue planning of the operation structure (positioning, cuts),
- Calculating of the dimensions between operations,
- Type dimension selection of the fixtures,
- Operation generating after its planning,
- Operation generating after changes made by process engineer,
- Process generating with operation descriptions,
- Process generating after changes made by process engineer,
- Memorization of the operation planning results in working manufacturing card-index.

Step 5: Selection of the technological means:

- Planning of machines and installations by dialogue with process engineer,
- Generating of the technological means,
- Generating of the technological means after changes made by process engineer,
- Memorization of the results in working manufacturing card-index.

Step 6: Blank planning:

- Blank dimensioning,

- Blank dimensions generating,
- Blank dimensions generating after changes made by process engineer,
- Calculating of the expenditure quota of the material,
- Memorization of the blank planning results in working manufacturing card-index.

Step 7: Selection of cutting parameters:

- Planning of cutting parameters,
- Generating of cutting parameters,
- Generating of cutting parameters after changes made by process engineer,
- Process generating with cutting parameters,
- Memorization of cutting parameter planning results in working manufacturing card-index.

Step 8: Control planning:

- Planning of methods and means of manufacturing process control basing on man-computer dialogue,
- Generating of means and methods of control,
- Generating of means and methods of control after changes made by process engineer,
- Memorization of control planning results in working manufacturing card-index.

Step 9: Work time planning:

- Generating of the information by the process engineer, in order to complete the input data,
- Work time generating,
- Work time generating after changes made by process engineer,
- Memorization of planning results in working manufacturing card-index.

Step 10: Printout of the manufacturing documentation;

- Generating of called up manufacturing process,
- Passing of the manufacturing process from the working manufacturing card-index to manufacturing card-index,
- Generating of questions about printout of the documentation,
- Printout of the documentation.

The specification of automatic process planning procedures shows the main problems in process planning. The modular system structure supported on manufacturing data banks makes possible the detailed process analyze and verification according to instrumentation choice, control and accuracy. Interactions occur between

the planning system modules . The existing modules (planning procedures) connections with data banks, should be completed with actual manufacturing data. The planning procedures, connected in system, are the set of standard activities of the process engineer. In dependence of the kind and complexity of manufacturing process and of taken criteria, the proper sequence of modules realization and recurrent loops of algorithms, which correct executed options, are selected.

2. Input data of the process planning system

The starting-point to manufacturing process planning is description of a shape of a shaft with relieves, chamfers, rounded edges, threads, splineways, splines, axial holes and the kind of material, heat treatment and conditions of the process realizing - stock of machines.

Data base of the computer aided process planning system CAP consist of files.

1/ Information data:

- manufacturing method base,
- base of instrumentation,
- base of workpieces with constructional and manufacturing data,
- base of blanks with type, shape, accuracy, heat treatment data,
- base of machines with constructional and functional data,
- base of tools for machining and control.

2/ Procedural data.

3/ System software:

- input data programs.
- file maintenance programs,
- direct input-output programs,
- data search programs.
- output data programs.

4/ Application software:

- programs for the choice of blank,
- programs for the choice of manufacturing route with necessary operations,
- programs for planning of operations (cuts),
- programs for choice of instrumentation
- time estimating programs.

3. Manufacturing process planning

Manufacturing process planning contains the choice of operations, structure of cuts in dependence from the type of blank, heat treatment, choice of machines, fixing, tools: kind of tools, tool materials, dimensions; cutting speed, feed, number of cuts. Program should realize machining allowances planning, giving to the process engineer blank dimensions to accept.

Automatic choice of fixtures and measuring instruments also belongs to the system. Program is finished by documentation printout. It's conception bases on identification and quantification of the project decisions for unified manufacturing process [3].

These automatic planned manufacturing operations are the base for further works to extend on the other parts of manufacturing system, for example instrumentation planning, economical analyze and optimal choice of the manufacturing system.

REFERENCES

- [1] Projektowanie struktury procesu technologicznego i algorytmów, CPBP 02.04, temat 03.04-01, ITBM Politechnika Poznańska, Poznań 1988.
- [2] Andrzejewski M., Gawlak G., Wieczorowski K.: Kryteria decyzyjne w komputerowo wspomaganym projektowaniu procesów technologicznych, Komputerowe wspomaganie konstruowania obrabiarek i procesów obróbki skrawaniem CAD-CAM-CIM, Prace Naukowe ITBM Politechnika Wroclawska nr 36, Wroclaw 1988.
- [3] Oprogramowanie i testowanie systemu komputerowo wspomaganego projektowania technologii, CPBP 02.04, temat 03.04-01, ITBM Politechnika Poznańska, Poznań 1990.

DIE PROZEDUREN VON DER AUTOMATISCHEN DREHENTECHNOLOGIEPROJEKTIEREN

Zusammenfassung

In der Arbeit ist der Übersicht von den Schritten und Funktionen im System von der automatischen Technologieprojektierung vorgestellt. Einem Ausgangspunkt ist die Welleformenbeschreibung. Diese Komputerunterstützte Technologieprojektierung enthält die

Operations- und Vorrichtungsausrüstungsauswahl im Abhängigkeit von Eingangsdaten. Die Man-Komputer Dialogplätze sind bei der Planungssystem und bei Projektanteinwirkungen erzwingen.

PROCEDURY AUTOMATYCZNEGO PROJEKTOWANIA TECHNOLOGII TOCZENIA

Streszczenie

W pracy przedstawiono zestawienie kroków projektowych i funkcji realizowanych w systemie automatycznego projektowania technologii. Punktem wyjścia jest zgłoszenie dowolnego kształtu wałka. Projektowana w opisany sposób technologia jest komputerowo wspomaganym wyborem operacji, treści zabiegów i oprzyrządowania w zależności od zgłaszanych danych wejściowych.

Miejsca dialogu wymuszane są przez system projektowania, a także rodzaj oddziaływania projektanta na przebieg procesu projektowania.

Wpłynęło do redakcji w styczniu 1992 r.

Recenzent: Jan Darlewski