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Process Planning by Applying Data Mining Approaches

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Abstract. There are huge amount of data which need to analysis and extract valuable knowledge. The extracted knowledge is useful for developing or planning for creating products, communication, supplying or monitoring the results or etc. Currently one of the main requirements is related to assessment of product quality. Data mining techniques are useful for program planning process based on the extracted knowledge, product producing or assessment for developing the quality of products with the help of data mining techniques. In this article, we attempt to cover the various applications of data mining techniques for process planning purpose.

Keywords: Data Mining, Data Production, Processing Parameters, Knowledge Discovery.

1. INTRODUCTION

New and smart technologies contact with some applications to help produce or supply independent products. The concept of a smart component are, intelligent things that are supplies physically cyber potentially or decentralized product program planning [1, 2].

Communication with other centralized technologies or sensors make an increase in the quality of products. Therefore, some challenges regarding the producing knowledge or control methods are exist. Further finding appropriate resources or process parameters can be lead us to produce optimal production. This planned process provide a system which is depend on the knowledge of experts. In the last decade, most of the research studies are organized to declare the feature of expert systems and propose an standard for the available data [3].

Knowledge discovery is based on extracting valuable or useful information from huge amount of data. For this purpose, some methods including statistics, learning machine or data modeling are useful [5]. Fayyad and colleagues [4] proposed a model with five steps for data mining. These 5 steps were: data collection, data preprocessing, transmission, or applying data mining techniques and interpretation.

Nowadays, product planning or controlling are the major research areas. The reason is, these operations need to know more details about data structure or information suppliers. However, the lack of concepts for data assessment cause barriers for developing smart things [6].

This investigation proposes an approach to assets data production systematically to program process planning based on the extracted knowledge from production concept.

- Decomposition and analysis of data production by applying new approaches or applying assessment process are the first step.
- In the second step, data collection, assessment methods with the help of data mining techniques are necessary to describe data.

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2. THE CONCEPT OF KNOWLEDGE-BASED PLANNING PROCESS IN PRODUCTION GENTELLIGENTLY

The idea of gentelligent production for a first time proposed by the center research collaborative (CRC). The number of sample set was 653. The target physical component related to the extracted information is developed.

Smart data production allows to companies search authority and after confirming that, processing of data and production starts and finally history of production saves for future usages. This cycle is continually has been repeated in all life of the products [7].

In this background, one concept to program planning process has been found based on knowledge with using information of single product's development (as it is shown in Figure 1).

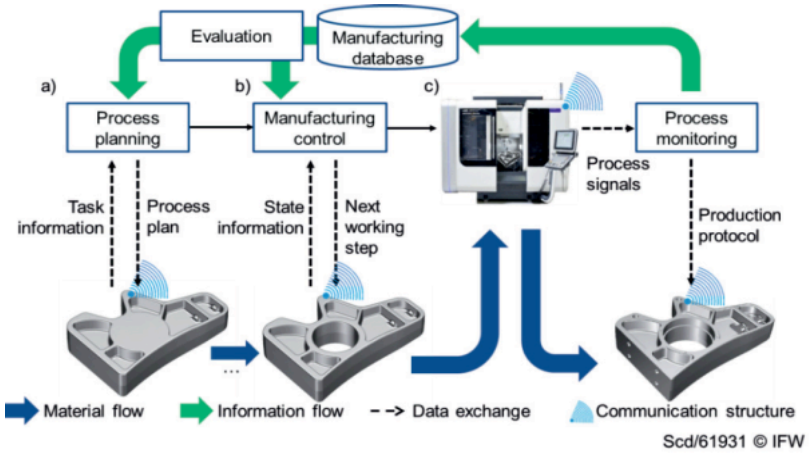

Figure 1. Knowledge-Based Production Planning Gentelligent

From Figure 1, it is revealed that: there are three phases for knowledge based production planning including:

- *Process Planning:* is based on data construction and tool selection tasks (figure 1 (a)).
- *Selecting Modern Production information*: The basic idea behind of this step of processes is concerned on modern information about production and selection of control systems(figure 1 (b))
- *Processing the signals:* in this step, the signals are processed by one system monitoring process (figure 1 (c)).

Finally, one production protocol save total life cycle of products.

3. DECOMPOSITION, ANALYSIS AND CATEGORIZATION OF MANUFACTURING DATA

The target goal of concept production gentelligent is, maximizing the products along with improving planning processes and control. Data production contains static and dynamic information [8, 9]. The input data for process planning includes: information about products, processes and resources. Figure 2 shows the sources of static and dynamic information about production. Dynamic data are such as data of business production and static data from environment and spectrum production.

However, currently the lack of infrastructure information and trust methods for assessment, there are no information about collection of continues program planning process.

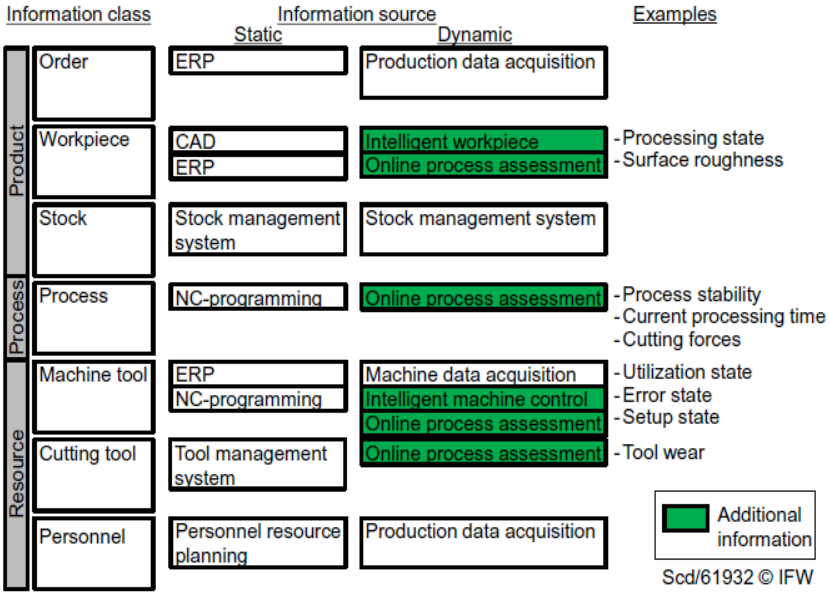

Figure 2. Analysis of Production Data

There are methods for online assessment process with higher level of details, real-time information.

4. EVALUATION PROCESSES

For selecting the proper information for specific program knowledge-based planning process and method for processing assessment or online development of data, is the main purpose of this section. The normal or strategic process assessment for specific product process is necessary. One new method for data collection is proposed in the next section which is based on reconstruction of deviation tools.

4.1. Data Collection

Components sensory equipped by a modern machine tool to process real-time data. Modern machine tool is able to monitor business internal signals or production processes [10] (Figure 3) Force apply by one tool could be have resolution true of 10 n with rate sample of 500 Hz. Processing information of one process or system monitoring device present at a result and can to diagnosis failure cutting and or instability process [11]. Furthermore, forces cutting can be used for reconstruction process and terms pieces work.

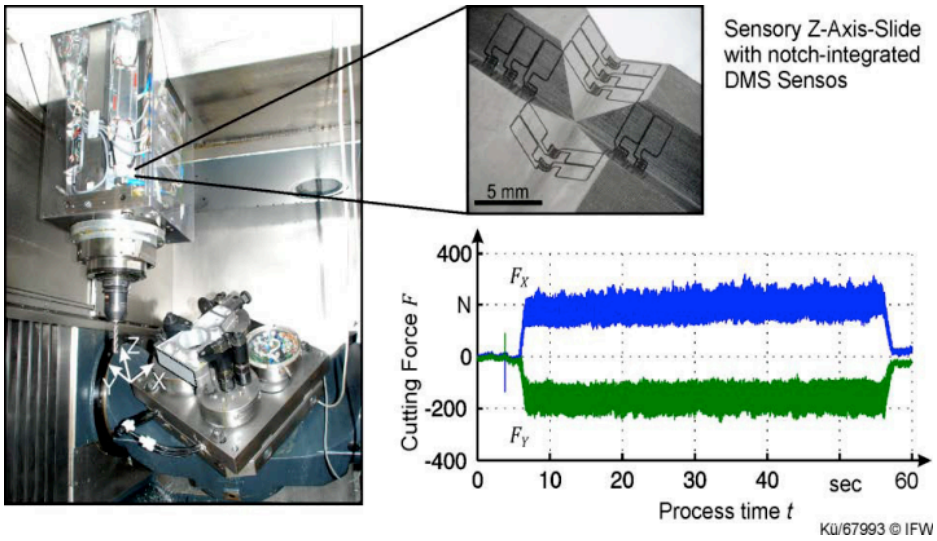

Figure 3. Components Machine for Sensory Development.

4.2. Reconstruction Deviation Tool And Coarseness Level On Basis Forces Cutting

Map vector is one level mill at path feed by specifications coarseness motion. In addition, on influence parameters process one process mill, coarseness level motion to intensity by vibrations and deviation tool under influence used [12].

To check effect of deviation tool at coarseness level at mill, determination online deviation tool case need. Further, forces cutting from tool machine gentelligent (figure 3) for identification parameters deviation present and to purpose determination effect coarseness surface at piece used occur. The basis extraction features signal characteristic from forces cutting, an amount reference derived by that effect deviation on top result forces cutting described. The purpose identification parameters deviation tool (the ρ and angle phase λ) accurately, question optimized building numerical way up. Question optimized building with identification parameters deviation unknown on basis parameters process and features signal data by from forces cutting data. for identification parameters deviation, parameters determination by should change until difference between property signal characteristic and property reference calculation numerical to at least reach. For determination fast parameters deviation, algorithm elder-mead simplex-algorithm at question optimized building to work slave out. The algorithm identification deviation development results to tools different and conditions process widespread experiment. As a result, accuracy identification deviation to statistics specified. the algorithm development results a carefully μ 3 ± for the deviation ρ and 3 ± degree to angle phase deviation λ offer the [13]. To check effect deviation tool at coarseness level piece work machine, equation simple to calculation coarseness level motion able number of implementations. Therefore, move edge cutting to analytical calculation by a. route move edge cutting with tool deflection with radius edge cutting r_i calculation under influence is placed.

$$s_i = \begin{bmatrix} R_i.\cos(\varphi - \Phi_i) \\ R_i.\sin(\varphi - \Phi_i) \end{bmatrix} \quad (1)$$

$$R_i = \sqrt{R_0^2.2R_{0\rho}.\cos(\lambda - \phi_i)\,.\rho^2}, \quad (2)$$

$$with\ \phi_i = \frac{2.\pi.(i-1)}{n}, for\ i = 1 \ldots n \quad (3)$$

It is r $_0$ radius tool nominal, ρ is amount deviation tool, λ angle phase deviation and φ $_i$ angle location edge cutting. Radius edge cutting from path edge cutting s $_i$ under influence placed. Specifications level piece work machine by intersection Boolean from path edge cutting s and several costal piece work wp production is:

$$WP_i = WP_i \cap \bar{S}_i \,, for\; i = 1..n \tag{4}$$

Wp (z) shape piece work at level height specific z to title one several description of the side. The purpose assessment coarseness level presents on basis tool deviation and identification. Functions at inside of one model process implementation is shown in figure. 4.

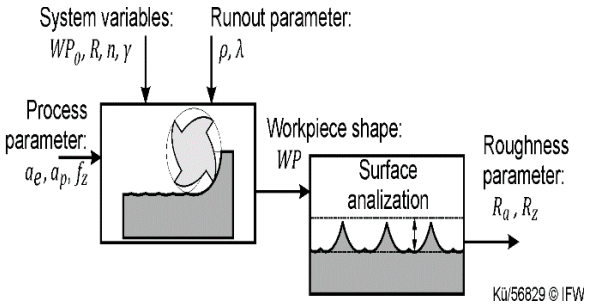

Figure 4. The Process Model for Assessing the Coarser Level.

Wp work on basis process and variables system and on basis parameters deviation specified from production process. several costal piece work characteristic coarseness level motion from one level it combines the mill. The purpose calculation parameters coarseness specifications level usually use by one function decomposition and analysis level development data by one approach based model development and one shape level detailed from piece work cars offer that can check parameters coarseness on top deep interactions.

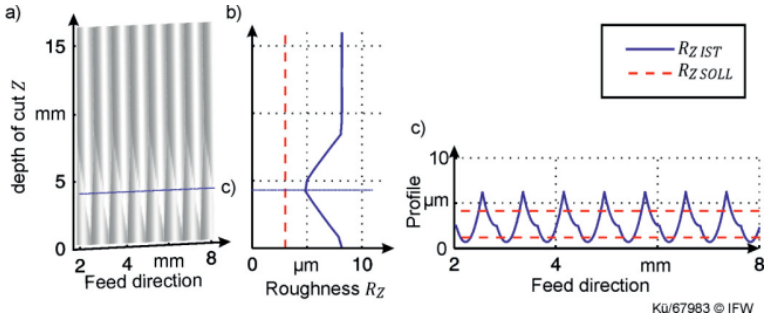

Figure 5a. Shape Level Reconstruction and (b) Reconstruction Coarseness on Top Depth Cutting; (c) View Level Reconstruction.

Three level for model processing can be offer (figure 5 (a)). The attention to error tools deviation, coarseness level motion can on top depth section (fig. 5 b) differs is. figure 5 (c) specifications coarseness level one line cantor specific from surface that, to calculation coarseness level motion by parameters coarseness r $_{z,}$ r $_{a,}$ (cf. din 4768) r $_{max}$ use. As a result, parameters coarseness from piece work machine can form parallel process machining reconstruction by knowledge base length process production.

5. OUR PROPOSED APPROACH TO ASSESS DATA PRODUCTION TO PLAN PROCESSES

5.1. Data Structure

For creating a process plan for assessment of productions based on the data suppliers, documentary data is used. The model of systematic assessment tools is shown in the following Figure 6.

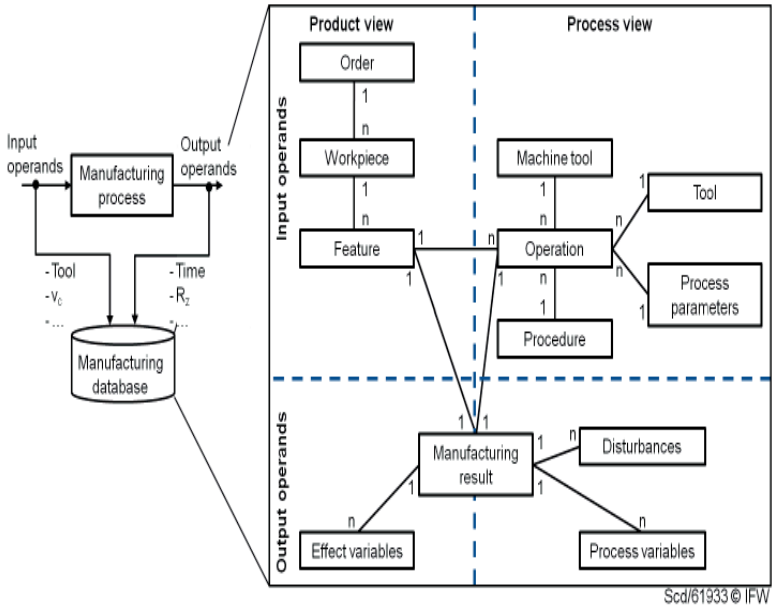

Figure 6. Knowledge Based Information Model

Structural based model produce a set of the inputs, outputs and operations. Further, the standard for creating of models and named as “feature”. For defining one object, it is requires that, the object’s title must be clear. Therefore, the extracted knowledge must be not depend on specific operations. Therefore, it leads to discover production information from collected data.

5.2. Method Assessment

For knowledge assessment, it is necessary to make program planning process. Further, apply data mining methods for data development. It is also possible to have a chain of replacements [14]. We need to define more features and conditions [Figure 7]. Moreover, all the collected data are searched respective their specification or realization.

Then, all data collection respective that specifications realization are searched. The results this phase identification compounds possible from tools machine and tools cutting that with view and count all categories at past (figure. 7, step 2). Data Collection should in relation to similarity decomposition and analysis (to title example from view cutting parameters, forces process and etc.). Therefore, decomposition and analysis of clusters with applying k-means algorithm [15]. Result of this phase is shown in Figure 7, Step 3.

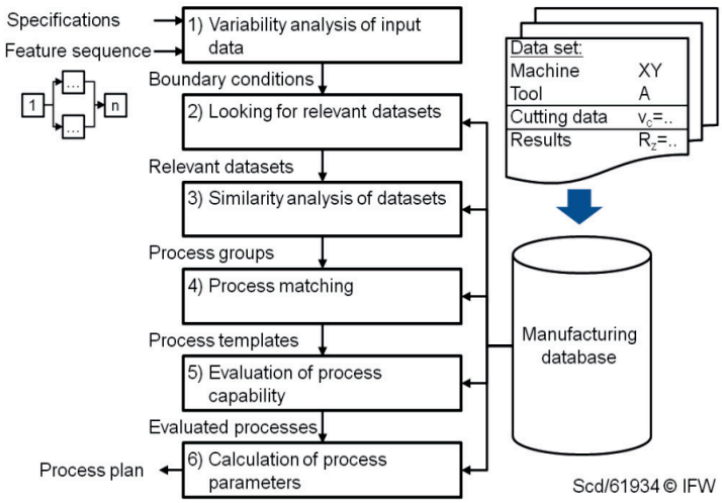

Figure 7. Method Assessment.

$$C_{pCK} = \frac{min(UTL - \tilde{x}_{Cluster}; \tilde{x}_{Cluster} - LTL)}{3 \cdot S_{Cluster}} \quad (5)$$

Index $_c$ pck ability cluster to characteristic tolerance x with attention to limit tolerance top (utl), limit tolerance down (ltl) and spread amount characteristic at cluster computing not get it. The basis index $_c$ pck identification options for process optimized to one work production of specific possible is (figure 7, step 5). In latest stage, parameter process appropriate to each action possible calculated from average values cluster is set (figure 7, step 6).

6. APPLIED PROGRAM

For evaluating or testing one product, it is necessary to test simply its performance. For this step, we need to collect training or set data. Our experimental results includes 10.000 records and we made sample set (the number of samples equal to 100) with applying simple random sampling method.

Table 1, shows the results of sample data.

The material (g-alsi7mg wa), coarseness level with tolerance of <3 mm with helping cost machining <1 mm meters, and width cutting a $_e$ to mill specifies the side.

Table 1. Operations Superseded Recommended for Process Planning.

Operation ID	30	20	3	37	4
Process	Milling	Milling	Milling	Milling	Milling
Machine tool	No. 2	No. 1	No. 1	No. 2	No. 1
Tool radius [mm]	4	2	15	5	6
Cutting speed v_c [m/min]	210.00	190.00	185.00	210.00	200.00
Feed rate v_f [m/min]	3.44	5.26	6.00	2.89	1.79
Cutting depth a_p [mm]	4.30	2.20	0.66	3.50	2.70
Material removal rate Q_w [mm^3/s]	246.37	193.02	65.89	168.51	80.75

It is revealed from Table 1 that, five operations are used for method assessment purposes. The main goal is, to select one proper operation to plane process. This operation must be able to satisfy the expected results and production quality. Figure 8 shows the expected level of assessment based on applying clustering methods with the rate of material elimination.

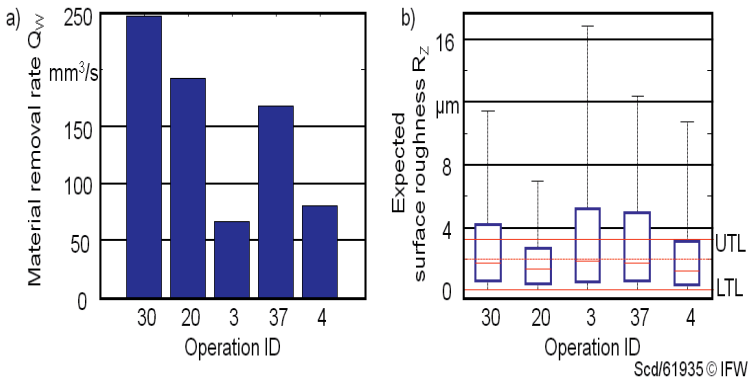

Figure 8. The Recommended Operations to Process planning: (a) Calculation of the Rate of Eliminated Materials. (b) Roughness of the Expected Level.

The assessment method, decision support and selection of appropriate operations for optimizing program process or improving the quality of products are main factors. In our study, operation number 30 provides more efficient results.

7. CONCLUSION

Business intelligent is an important factor for increasing flexibility and efficiency of products. Process planning is an approach to collect manufacturing data and use data mining techniques for creating of valuable assessments for the products. Intelligent online assessment is useful for detecting the quality of production. Assessment explanation method can be apply to operate program planning process of productions. In this way, there are some restrictions for applying appropriate planning methods.

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