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ENGINEERING AND PRODUCTION MANAGEMENT OF THE PATTERN MANUFACTURING OPERATION

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ABSTRACT
In addition to product design, decisions taken in process planning determine the right quality conditions for manufacture. Systemic process planning is therefore essential in order to achieve a resilient product from design to production. There is no efficient system integration with current working practises for process planning and quality assurance. As a result, firms spend inordinate amount of effort on quality management. This study proposes a new model-based strategy for integrated quality assurance and process planning. The model offered makes quality management from design to manufacture more efficient and holistic. New communication possibilities for process design to intent and present in a more organised and complete manner of critical quality assurance information.

Keywords: Pattern manufacturing; Process planning; Process design; Process Rationale; Quality assurance

1. Introduction

Process planning that undoubtedly involves deciding how the designer's idea should be turned into a real product. A strong manufacturing process, which produces quality components at competitive costs, is the ultimate objective of process planning. The quality of products does not depend just on checking and downstream production inspection activities. Decisions in product design and process planning provide the conditions for the correct quality of production. All processes and operations of manufacture must be optimally designed. Each process step shall contribute to ensuring the proper product quality throughout the entire process chain.

1.1Industrial engineering design

The planning of the process obviously goes beyond the sentence;it comprises creativeness, the synthesis of ideas or solutions and an analysis that determines whether particular notions are evaluated. For example, analytical activities have been thoroughly studied to compare and evaluate many possibilities. A number of thousand documents were produced on process planning but few examined the creative component of process planning[1]. At a paper on the model-based interactive knowledge of process planning in production engineering master levels, there is an enormous gap between how a novice and an expert workswhen the beginner is estimated, the expert not only examines rules and facts (like a computer following a programme), but also recognises how this target can be achieved swiftly[2].

Process design highlights this process planning in order to refer to the actions, whose results are the process plan. The creative aspect of process design is subjective and relies on the knowledge, expertise and creativity of the process planner. Almost endless solutions can be generated for the same set of requirements, as the process planner must be able to swiftly give up or remove bad ideas in order to create new ideas etc. The results, i.e. the process plan, normally appear in many document types [3]. In general, these documents just state what to do and deny the major purpose of the production process. The reasons behind the decisions are not disguised from others, because reasons for designing the processes are not clearly and explicitly given, however in recent study on process planning the reason for process design has not been extensively examined[4]in process evaluation and quality control activity it would be helpful to correctly express the objective of designing process plans and the reasons behind decision [2]

1.2Quality assurance in industrialengineering

For robust products and effective process design, quality assurance of production is as vital. The objective of quality control is to guarantee that processes and products meet the specifications established. In the course of the manufacturing process, quality control has typically developed from the inspection of manufactured goods to an integrated approach. There should not be any underestimation of reciprocal relationships between quality, production planning or maintenance control. They suggest quality of production as a new paradigm extending beyond standard six-sigma methods. The worldwide objective of quality manufacturing will include innovative and integrated quality, production logistics, maintenance design, monitoring processes and current technology [5].

1.3Management and analysis risks in industrial engineering`

Manufacturing engineers now employ several process planning and quality assurance "CAx applications. CAM is widely utilised for the planning of CNC machine tools primarily for the creation and verification of tool paths. Other software kinds are employed for quality assurance. The PLM software can be categorised as PTC, Dassault Systems, Siemens PLM and ARAS solutions or CAQ software as Q-DAS, Babtec, Boehme-Weihs, IQS". "Software applications can also support quality assurance activities, such as process failing mode and effect analysis (PFMEA), measuring system analysis and controlling plans etc. A common option also involves building on desktop apps like MS Office (Word, Excel etc.). They share the difficulty of efficient information integration between process planning and quality assurance, regardless of the category of software. The Advanced Product Quality Preparation and Control Plan (APQP) reference manual highlights careful planning at an early stage. It was initially released in 1994 and in 2008 it was published by Chrysler Corporation, Ford Motor Company, and General Motors

Corporation"[6]

The relevance of the ideas laid down in the APQP manual is beyond dispute. However, papers such as a PFMEA need to bear the load of creating and managing APQP. They are also developed almost exclusively through a document-centric methodology. A primary objective of process planning is the definition of a process with a predictable conclusion. Decision-making during process planning thus makes an essential contribution to the establishment, because PFMEA should be a comprehensive process planning operation, of the production conditions for final product quality risk assessment activities[7]"However, due to the lack of effective integration of process planning and quality assurance, the entire use of vital information in the process plan cannot be done. The manner a process planner builds the process plan largely depends on the process planner's capacity to recognise and deal with potential problems beforehand. Experienced process planners can avert manufacturing difficulties by proactively designing the production process. The information on a process plan is vital in quality assurance activities such as; process step, process sequence, production resources, etc. as PFMEA. However, the interface between tools for process planning, such as CAPP/CAM and quality assurance applications, is extremely limited, if any". As a result, producer companies are not exploiting important data generated when working with quality assurance in process planning. In addition, the quality assurance procedures currently result in wasteful waste of manufacturing engineering skills, not using important information produced during process planning. Because process planners often generate the requisite quality assurance documentation, their skill is inefficiently exploited in the re-creation of material already created for process planning. The emphasis should be on enhancing production to provide client value instead of documentation**.**

1.3Patternmanufacturing process planning

A method based on pattern manufacturing offers huge promises yet process planning and quality assurances are currently unconnected. Pattern process planning is a method that focuses on using digital models to create, present and use product, process and resource informationcompetent process planners make use of information from computer software through communication modelling, creation, visualisation, and modelling. A number and computer model that specifies what needs to be handled and how the product should be handled through operational sequence, procedures, initial inventory, process formats, manufacturing resources, etc. The resulting process planning Cohesive information is an important element in pattern manufacturing process planning.[8], machining functions and processes cannot be defined in the digital model as only geometric measurements and tolerances (GD&T)also, PFMEA elements can be represented such as failure modes, failure impacts, fault occurrence, etc. in a digitalised modela relationship between product specifications and process design characteristics, including GD&T for specific functionalities, data surfaces, etc. can also be seen as the core concept of the APQP[9].

2.Research Methodologies

In design and manufacture, risk assessment is vital. In particular, in this new version of ISO 9001, structured risk assessment was highlighted as crucial to ensuring that the production system consistently meets requirements and demands of engineering design, and PPAP (Production Part Approval Process) was set up by the Automotive Industry Action Group (AIAG) to implement automotive supply firms[10]Quality assurance procedures and tools including PFMEA are coordinated under ISO/TS 16949[11]

PFMEA is seen as a key quality assurance activity by car suppliers and is a step by step technology for assessing the risks of a failure in the production process. "The aim is to identify potential faults, the severity of the faults and the impact on them. In order to generate a method termed criticism, it is usual of failure modes in a PFMEA to be prioritised, integrating the severity, frequency of occurrence and detective potential. The RPN is one approach to statistically determine the criticality. It is a means of determining the seriousness of the failure types to prioritise countermeasures"[12]"The PFMEA result depends heavily on the group. An expert moderator can have a substantial effect on the result and its quality assurance validity. The PFMEA team analysed the production process at multiple meetings over the whole period and tried to gradually identify ways for the production process to fail from the first to the last production activity. It can often be a very large sheet for a PFMEA document."

3. Results

The research presented here is based on several years of process information modelling carried out with the support of the international organisation for standardisation, Technical Committee 184 and Sub commercial Cooperation 4, Swedish national research programmes Scania and Volvo. PFMEA has been promoted as an incentive to car and other quality assurance efforts, but present, largely sheet-based techniques have been ineffective[2]. In our case studies organisations, the PFMEA experiences are similar, namely that their efforts have shown a low PFMEA result. They feel that the actual PFMEA technique is hard to compare with each other, i.e. the findings of one PFMEA to another are hard to adapt and reuse. The findings are not mutually compatible. It is also difficult to identify and control product and production process similarities through the sheet-based method[13]

In the process planning, useful data are not being utilised by present work processes and instruments for quality assurance. In quality assurance operations such as PFMEA, where information already created from the design process must be re-created, the expertise of information production engineers is not utilised inefficiently. We propose in this work a new model-based approach to the design and management of production processes. With today's work with PFMEA, the proposed approach can eliminate most of the previous deficiencies. The necessity for interoperability across the many CAx applications in product production and for the interdisciplinary and multi-organizational work highlighted in APQP and the need to interact in supply chains all provide strong motives in support of a system-neutral data representativeness.[14]"As an important technology to permit model-built process planning, the International Standard, ISO 10303 STEP (STEP) has been identified. The standard is a key system-neutral solution for the representation of industrial data. Using the ISO 10303-11 (EXPRESS) common info modelling STEP Application Protocols (AP) as ISO 10303-238 Interpreted application model for STEP NC and recently established ISO 10302-242 Application interpreted model for computerised numerical monitoring. 3D model-based engineering management (STEP AP242) can be integrated into a variety of international manufacturing engineering standards, like the ISO 13399 cutting tool representation and ISO 13584 PLib for sharing information. EXPRESS allows you to share the same techniques of execution with others using the EXPRESS language. In addition to the capacity to represent items and product geometry, features and GD&T, production resources may all be represented, such as machine equipment, cutting tools, fixtures and more. STEP allows the inclusion in production processes and in-process shape-models of engineering concept with components of form and motion".[15]. "STEP may also reflect PFMEA principles such as failure modes, severity of the failure, fault effect, failure detection possibility, etc. Feature is a major idea in process planning based on a model. A feature is a significant or notable component or feature of *anything*, an excellent or distinguished attribute that attracts notice. The original meaning is related to form or the action to produce, shape or shape anything in a desired form. The original meaning is Latin factory. However, the setting dictates what is typical, excellent or unusual. For example, sometimes a design feature with a production feature may be similar, but not necessarily. The question relates to the interpretation of the shape from a production point of view; how can it be produced and what type of process does it suit? In design terms the interpretation relates to the question much better; which function fulfils this form and how can its geometry be modelled? However, they can also have process-related functions, as well as characteristics. For example, in clamping a face feature or the surface of a hole characteristic may serve as a data feature. For setup planning such data can be used"[13].

The purpose of a process planning choice can (but often not) be openly communicated and transmitted. The process design purpose indicates how the process planner evaluated ensuring that the product worked as described by the process design[16]. In this context, modes of failure are really found or imagined techniques in which the manufacturing process cannot manufacture goods according to the manufacturing specifications or as one of the organisations' experienced process designers said during our case study. From this perspective, modes of failure could be regarded as a probable obstacle to which preventive measures should somehow be avoided, overcome or removed. The shared sheet technique is not sufficient to describe properly or more accurately the relationship between the product, the production process and the process logic. We have chosen to define processes, product and process functions, justification for the procedures and the connections with failure scenarios.

Formal representations of engineering requirements are characteristics of model-based process planning. Features fulfil the functional demands of the product. GD&T communicates needs for engineering and production. The GD&T defined thereby helps to safeguard functional needs. If there are the tolerances supplied for a product and its attributes, the product shall work as intended. When data are inspected and machined on a feature, the data have a clear context for structured expertise building. "If a failure occurs, the fault and the event that triggered the failure might be linked to a particular feature. An essential contribution to the development of a digitally reproduced knowledge base in support of product design and production processes is the type of contextualised feedback data addressed. The model-based approach, as illustrated in Fig 3.1, provides an organised management of concepts such as rational process, product and process functions and process design in connection with characteristics, production process phases, manufacturing resources, etc."

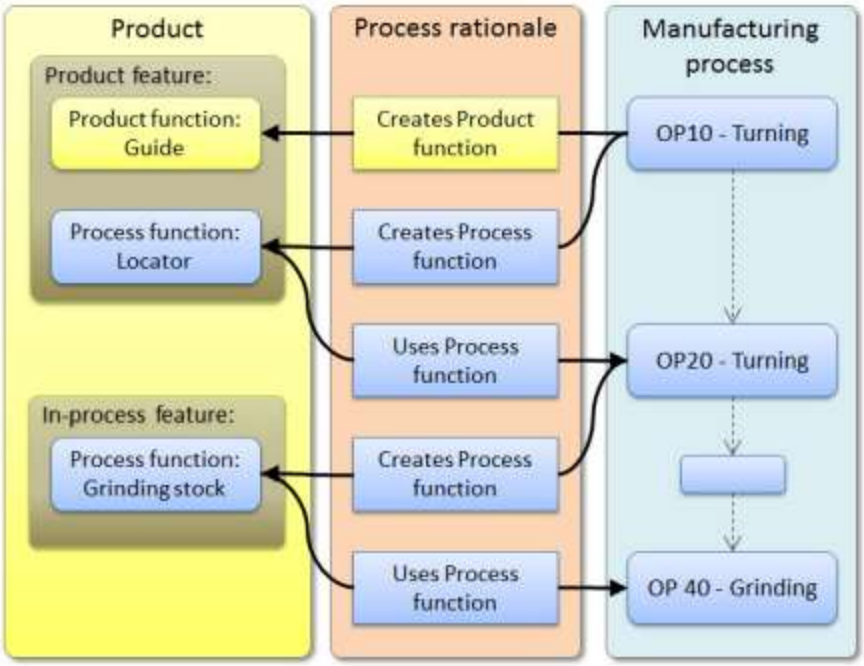

Figure 3.1 "Model-based process rationale representation integrating product and manufacturing process"[17]

The aim of the process design is the projected manufacturing capacity to be delivered in the predicted production environment by the scheduled process. The process rationale states the goal of creating a process feature, a product feature or both, for example, with a certain production process step. In turn, the aim of a production process step could be a precondition for a further production process step that does not need to be carried out one after the next in direct order. If a production process is unsuccessful, one or more succeeding manufacturing phases will be at danger of failure. "Step **OP 10 – Turning** in Fig.3.1 for example gives a product and a process function. The process function developed is employed as a location for the clamping surface in the production step OP 20 – Turning. In this production phase, the goal is to generate a sufficiently substantial stock for grinding. Grinding, **OP 40 — Grinding**is not done in the above-mentioned production process.

Fault modes are recognised as potential obstructions in the current method, resulting in loss of a product function or process function. The last step of the **OP 40 – Grinding** process, for example, could fail due to a lack of appropriate stock for a successful grinning process if the production process step **OP 20 - Turning** does not supply enough resources for the grinding process." The suggested pattern solution allows process planning to be incorporated into quality assurance programmes where data generated during process planning are once again used without reintegration into quality guarantees. Production resources, processes of fabrication, failures and the effect of failure are modelled in the context of features.

4. Conclusion

The given pattern strategy for integrated process planning and quality assurance will improve the efficiency and feature of manufacturing operations. The model-based method for modelling the impacts of failure, failure and failure includes both characteristics of the product and process and prevention. This gives additional options in a more integrated environment to present multiple failure modes and to provide thorough information. For example, Change Point Management is a workable application. When things are moved into workshops, lines or cells, operators will be able to be aware of the specially critical nature of the production process and therefore know how necessary it is to ensure that products are specific to customers and to pay them additional attention. AP242 STEP and NC STEP New quality assurance methodologies that employ valuable information previously developed during production design and planning can be used with necessary expansion activities to assist quality assurance. The major representation of information is possible for model-driven process planning and quality control. Therefore, this research aims to diminish the value of previously submitted re-entry information via the proposed model-based technique. This work makes a significant contribution to the establishment of ISO 10303 STEP and other related digital information management standards for high-end production.

References

[1] L. Alting and H. Zhang, "Computer aided process planning: the state-of-the-art survey," *Int. J. Prod. Res.*, vol. 27, no. 4, pp. 553–585, 1989.

[2] M. Lundgren, M. Hedlind, and T. Kjellberg, "Model driven manufacturing process design and managing quality," *Procedia CIRP*, vol. 50, pp. 299–304, 2016.

[3] S. C. Park, "Knowledge capturing methodology in process planning," *Comput. Des.*, vol. 35, no. 12, pp. 1109–1117, 2003.

[4] M. A. Price *et al.*, "Maintaining design intent for aircraft manufacture," *CIRP Ann.*, vol. 62, no. 1, pp. 99–102, 2013.

[5] M. Colledani *et al.*, "Design and management of manufacturing systems for production quality," *Cirp Ann.*, vol. 63, no. 2, pp. 773–796, 2014.

[6] C. LLC., F. M. Company., and G. M. Corporation., *Potential failure mode and effects analysis (FMEA) : reference manual.* [Southfield, Mich.]: Chrysler LLC : Ford Motor Company : General Motors Corporation, 2008.

[7] M. Bagge, "Process planning for precision manufacturing: An approach based on methodological studies." KTH Royal Institute of Technology, 2014.

[8] A. von Euler-Chelpin, "Information modelling for the manufacturing system life cycle." KTH, 2008.

[9] L. A. Mihail, "Organisational process mapping for ISO/TS 16949: 2009 certification of industrial quality management systems," *Bull. Transilv. Univ. Brasov. Eng. Sci. Ser. I*, vol. 2, p. 89, 2009.

[10] L. M. Fonseca, "ISO 9001 quality management systems through the lens of organizational culture," *Calitatea*, vol. 16, no. 148, p. 54, 2015.

[11] L. A. Mihail, "Applying Quality Tools for Managing the Production of Automotive Parts," in *Applied Mechanics and Materials*, 2015, vol. 809, pp. 1299–1304.

[12] "s are obtainable from AHAG at + I-248-358-30," no. July 1995, 2000.

[13] M. Stampfer, "Automated setup and fixture planning system for box-shaped parts," *Int. J. Adv. Manuf. Technol.*, vol. 45, no. 5, pp. 540–552, 2009.

[14] H. A. ElMaraghy, "Evolution and future perspectives of CAPP," *CIRP Ann.*, vol. 42, no. 2, pp. 739–751, 1993.

[15] D. Kiritsis, "A review of knowledge-based expert systems for process planning. Methods and problems," *Int. J. Adv. Manuf. Technol.*, vol. 10, no. 4, pp. 240–262, 1995.

[16] K. Waiyagan and E. L. J. Bohez, "Intelligent feature based process planning for five-axis lathe," in *Ninth International Conference on Computer Aided Design and Computer Graphics (CAD-CG'05)*, 2005, pp. 7-pp.

[17] B. Denkena, M. Shpitalni, P. Kowalski, G. Molcho, and Y. Zipori, "Knowledge Management in Process Planning," *CIRP Ann.*, vol. 56, no. 1, pp. 175–180, 2007, doi: https://doi.org/10.1016/j.cirp.2007.05.042.