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MACHINING TIME ESTIMATION BY EXPERIMENTAL METHOD USING NX CAM SOFTWARE FOCUSING CNC MACHINE

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Abstract— *Machining time estimation plays an important role in manufacturing process planning and scheduling. The estimation of machining time is of important because it provides manufacturing engineers with information to accurately predict the productivity of CNC machine. Many industries facing the problem of lagging in production schedule in this competitive market due to lack of efficient and effective time estimation. Therefore in this review paper we aims to study the various methods for time estimation during the design and development stage. NX CAM software is nowadays used for estimating the machining time. NX CAM software delivers a complete and proven system for machine tool programming. NX CAM software considers machine characteristics, geometry process information and other factors to estimate the machining time.*

Keywords- *Machining time estimation, NX CAM software, productivity*

I. INTRODUCTION

CNC machining time estimation plays an important role in manufacturing process planning and scheduling. It is one of the most important deciding factors for cost estimation . Based on machining time estimation, product designers can improve and optimize the design of products in order to shorten manufacturing cycle and reduce costs. For production engineers, machining time estimation is a critical step towards an optimal and practical production plan. While the accuracy of machining time estimation is important for cost estimation and effective process planning, the timeliness and efficiency of such estimation are also critical particularly when we target for outsourcing products quote, real time manufacturing process planning and scheduling systems.

However, due to the complexity of CNC machining processes, combination of multiple factors, as well as the dynamics of manufacturing environments, it is difficult to achieve an accurate machining time estimation of complex parts. CNC machining time of a part mainly depends on its geometry information, process plan, CNC program, and machine characteristics. Existing commercial software tools and research prototype systems do not fully consider these factors, and therefore they cannot provide accurate estimation. In this paper we conduct a review on the various research works being carried out in this field and understand the methodology for estimation of time.

II. LITERATURE REVIEW

The authorBorkar B. R. ,Puri, Y. M. ,Kuthe A. M. , Deshpande P. S presented a featured base process planning for optimization of machining time. In that describes an efficient algorithm for automatic machining sequence planning in different operations. Firstly programmed in Visual C# and forms the machining sequence planning module and that module is integrated with a feature based design system that determines required machining operations and parameters for each. This information is then sent to the machining sequence planning module for determining proper machining sequence plans for producing the part. The algorithm generates feasible machining sequences and optimizes it based on machining time.[1]

The author Changqing Liu, Yingguang Li a, Wei Wang ,Weiming Shen presented a feature based method for NC machining time estimation. In that CAD model is introduced and feature is recognized of that particular model after that process planning is send to NC programwhich contains geometry process information which controls various parameters and all these factors lead towards the machining time computation processor and which results in machining time estimation.[2]

The author B.S. So , Y.H. Jung , J.W. Park , D.W. Lee proposed a algorithm based on 5 axis CNC machine and estimates its machining time based on its characteristics. In that they first investigated the operational characteristics of five-axis machines then defined some dominant factors, including feed angle that is an independent variable for machining speedand with these factors they had developed a machining time calculation algorithm.[3]
The author Akash Shukla ,S.S.Jani , Dr. G.D.Acharya developed a new prototype feature based model for NC time estimation. The feature based time estimation method considers the different factors like material removal rate, geometry

information and machine characteristics as an input. In the proposed strategy the machine attributes are additionally put away in the learning based library including three constituents: machine library, CNC framework library and rate control mode library. The relationship among these data base library is that the machining information library call control system library and these will call control mode library and these finally all sums into a machining time estimation.[4]

The author Hector Siller, Ciro A. Rodriguez, Horacio Ahuettgiven the e cycle time prediction of high-speed milling for sculptured surfaces with high feed rates. CNC programs for machining these surfaces were executed in a SIEMENS 840D controller, with different levels of programmed feed rate. Discrepancies between programmed and actual feed rates were evaluated. A mechanistic approach for cycle time evaluation in high-speed milling of sculptured surfaces is proposed. The mechanistic model construction is based on: (a) the frequency distribution (histogram) of linear interpolation path lengths in the CNC program and (b) a characterization of the machine tool for brisk . Two case studies were used to demonstrate the effectiveness of the proposed approach. Then at last they compare the actual cycle time versus ideal cycle time under programmed feed rates.[5]

The author Eun-Young Heo , Dong-Won Kim , Bo-Hyun Kim , F. Frank Chen presented an NC machine time estimation model for machining sculptured surfaces, considering such dynamic characteristics of the machine. The proposed estimation model uses several factors, such as the distribution of NC blocks, angle between the blocks, federates, acceleration and deceleration constants, classifying tool feed rate patterns into four types based on the acceleration and deceleration profile, NC block length, and minimum feed rate. However, there exists an error for the actual machining time due to the lack of the measurement equipment or tools to gauge an exact minimum feed rate. They proposes a machining time estimation model using NC block distributions, lowering down the error caused by the inaccurate minimum feed rate.[6]

The author CosicPredrag developed application enabled the production time estimation, and consequently the production costs estimation. In this they have established possible connections between drawing /3D features and necessary production time /costs for manufacturing product . in their work they developed classification system of rotational parts by means of group technologies.[7]

The author K.Ramesh presents an experimental study to optimize cutting parameters during machining of SS 304 for simultaneous minimization and maximization of Surface roughness (Ra), machining time, geometrical tolerance of Stainless Steel affect the aesthetical aspect of the final product.The result of this research work showed that feed rate is the most significant factor for minimizing surface roughness. Higher feed rate provides higher surface roughness.[8]

The author Saric, T.; Simunovic, G.; Simunovic, K. &Svalina, I developed a model which is used to carry out the investigation aimed at learning and testing different algorithms of neural networks for estimation of machining time for cncmanufacturing.The paper describes the approach to solving machining time estimation in real manufacturing of complex production elements within the CNC machining systems.[9]

The author Rong-Shine Lin*, Shyh-Leh Chen, and J-H Liao proposed a new method for curve machining on 5-axis CNC machine tools.It uses the CNC interpolator approach, or called curve interpolator, which can produce accurate tool position as well as tool orientation.The interpolator calculates in real time a new command in the same time period needed for sampling the control-loop feedback devices.The interpolating result shows that it can produce high accurate tool positions as well as tool orientations.[10]

The author SnehaTulsyan given a thesis on Prediction and Reduction of Cycle Time for Five-Axis CNC Machine Tools.In this thesis, a cycle time prediction scheme is proposed for milling operations based on identified CNC machine dynamics in exact-stop and continuous mode.An analytical approach for predicting cycle time based on the identified CNC system dynamics and given part program is presented. It is shown that the cycle time of NC machining process is predominantly affected by trajectory generation and corner smoothing techniques implemented on CNC systems.[11]

The author Akash Shukla, S.S. Jani, G.D. Acharya developed a prototype system for calculating machining time based on feature based techniques. The suggested model consists of three modules: Data preparation module, Data module and Data calculation module.[12]

The author Wu Baohai ,*, Yan Xue , Luo Ming , Gao Ge proposed a cutting force prediction model considering the tool path curvature for circular end milling process.By taking tool path curvature into account the chip thickness model has been improved for circular end millingprocess. With the improved chip thickness model, cutting force model for circular end milling process has been deduced and the simulation results meet the measured results well. The deduced cutting force model can be used not only for linear and circular end milling processes.[13]

The author X. Yan*, K. Yamazaki, J. Liu has proposed a machining feature and feature topology for NC programs. In these a prototype is developed to extract the machining features and their associated operation data, and the machining

know-how database is generated accordingly. The recognition of a variety of machining features and topologies, as well as their associated machining operations, is demonstrated through an example part. The recognition of the features has been successfully verified by analyzing sample NC programs.[14]

III. CONCLUSION

In this paper author has considered all the methods used for early time estimation which can be employed for the industrial products. Hence it can be stated that the method suggested by various author conciders the following three factors for machining time estimation: Material removal rates , NC & CNC programs , machining characteristics and machining geometry. The existing methods suggested above cannot achieve the timeliness , accuracy and efficiency of time estimation.

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