Optimization of Parameters in CNC Turning Operation: A Review

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ABSTRACT

Today due to ecumenical competition in manufacturing industries, the conventional machining processes have been superseded by advanced manufacturing processes. Several advanced nonconvention al machine implements are available concretely computer numerical control (CNC) turning is the major used machine implement in metal predicated industries. Due to the incrementing authoritative ordinance of the higher precision components for its functional aspect, surface roughness of a machined part plays a consequential role in the modern manufacturing process. To get the minimum surface roughness sundry turning parameter like cutting speed, depth of cut, aliment rate, metal abstraction rate (MRR) and implement geometry etc. are required among all these parameter optimal parameter are resolute by utilizing sundry optimization techniques. Productivity as well as quality both has a homogeneous impact on final product. This paper describes sundry optimizatio n techniques and the literature review for the influence of CNC turning parameter on surface roughness as well as other replication variables.

Keyword: - *Turning machining parameter, Optimization techniques, CNC machine tool.*

1. INTRODUCTION

The automation of machine implement industry witnessed a revolution in 1949, by the Development of CNC. Presently most conventional machine implement has been superseded by CNC machine implement where all forms of kineticism of the machine implements are programmed and controlled electronically rather than by the conventional denotes. Among the metal cutting methods, turning is one of the widely used manufacturing processes in industry in which a single point cutting implement abstracts unwanted material from the s urface of a rotating cylindrical work piece. The cutting implement is victualed linearly in a direction parallel to the axis of rotation. In integration to implement and work piece material, cutting speed (v), aliment rate (f), depth of cut (d) are most consequential cutting parameters which highly affect the performance characteristics. It is obligatory to cull the most congruous cutting parameters and cutting implements in order to amend cutting efficiency, process at low-cost and engender high quality products. To get optimum turning process parameter soft computing techniques are required. In present many optimization techniques are available but only few have been utilized for CNC turning process parameter. This paper brings to the forefront the work done in this area, the techniques used along with the results established.

2. OPTIMIZATION ISSUES INRELATED TO TURNING OPERATION

2.1 Work Piece Materials

The work piece materials used for the optimization of CNC turning process parameters ware Al/SiC-MMC, Aluminum rod, Glass fiber reinforced plastics (GFRP), cylindrical bar of AISI 1080 steel, Ti-6Al- 4V alloy, AISI 1040 carbon steel, S45C, semi-crystalline thermoplastic polyethylene (PE), EN 24 medium alloy steel, Al 6063 with 10% silicon carbide metal matrix composites, AISI 52100 steel, Red mud-based aluminum metal matrix composites, 6061 aluminum, Inconel 718, Martensitic stainless steel (SS40) steel.

2.2 Cutting Tools

The cutting tools used for the optimization of CNC turning process parameters ware T max- U positive rhombic insert (uncoated tungsten carbide WC), CERMET cutting tool, HSS single point cutting tool, CNMG 120408-883 inserts, cemented carbide (K20), CNMG 120408-883 inserts, Mitsubishi NX2525 insert, C type negative, Multilayer

coated inserts CNMG 120404, inserts VCGX16 04 04-AL (H10), Ti-N coated tungsten carbide inserts, Mixed ceramic (AL2 O3+TiC) inserts, Coated carbide tool inserts M30,Ti-Al-N- coated tungsten carbide.

2.3 Input Parameters

The input process parameters used for optimization to get qualitative response parameters in machining process ware:

Table 1: Influencing parameters

Cutting tool properties	Tool materials
	Tool Shape
	Tool Signature(Rake angle, Nose radius)
	Run out error
	Tool overhang
	Cutting edge geometry
Machining parameter	Cutting Speed
	Feed Rate
	Depth of Cut
	Tool Angle
	Cutting Fluid
Work-piece properties	Work-piece Material
	Work-piece Length, Diameter etc.
	Work-piece Hardness
	Mechanical Properties
Cutting condition	Cutting Force
	Friction
	Cutting Velocity
	Types of Chip Formation
	Vibration

2.4 Performance Parameters (Response Variable)

The performance parameters like surface roughness, Tool wear rate, Flank wear, Crater wear, Tool life, cutting time, total cost, power consumption and vibration, Material removal rate those are depend on independent process parameter.

3. BRIEF INTRODUCTION OF SOFT COMPUTING TECHNIQUES

3.1 Taguchi's Method

Taguchi's method is the best cull which was developed by Taguchi's itself in the year 1980.First Taguchi's implemented to amend the poor communication system in Japan after Second World War. Taguchi's method is performed on the statistical principles which include- (a) A categorical loss function, (b) Offline quality control, (c) Innovation in the design of experiments. It gives the consistent, efficient and facile to understandable optimization results with deference to performance, quality and cost. The Taguchi's method is a experimental design technique which provides a simple way to design an efficient, systematic approach for the optimization of experimental design and performance quality as well as cost efficacious experiment. Utilizing this method efficiently reduces the number of conventional experimental tasks. The performance measure signal-to-noise proposed by Taguchi's is utilized to obtain the optimal parameter coalescences.

3.2 Artificial Neural Network (ANN)

Simple neural network had been proposed in 1943 by Warren McCulloch and Walter Pitts. ANN is an astute technique, which mimics the functioning of a human brain and biological neural system i.e. living brain was a model for ANN to solve highly intricate quandaries. It simulates human intuition in making decision and drawing conclusions when presented with involute, strepitous, extraneous and partial information. ANN result is more efficacious than conventional method and withal extensively utilized in Mechanical Engineering applications. By utilizing these techniques human efforts and time can be reduced.

3.3 Genetic Algorithm (GA)

Pioneered by John Holland in the 1970's and conception emanated from Darwinian evolution [David Hales]. Genetic algorithm can be acclimated to solve a variety of quandaries that are not facile to solve by utilizing other techniques. For understanding purport there are some biological term which is utilized like gene, chromosome, mutation, and crossover. Each cell of a living thing contains chromosomes - strings of DNA ,each chromosome

contains a set of genes - blocks of DNA, each gene determines some aspect of the organism (like ocular perceiver colour),an amassment of genes is called a genotype ,an amassment of aspects (like ocular perceiver colour) is called a phenotype, reproduction involves recombination of genes from parents and then modicums of mutation (errors) in facsimileing ,the fitness of an organism is how much it can reproduce afore it dies, evolution predicated on "survival of the fittest".

3.4 Fuzzy Logic

Development of fuzzy logic was commenced with the Buddhist philosophy that the world is plenary of contradictions i.e. virtually everything contains some of its antitheses. About 200 years later binary logic has been developed by the Greek Philomath Aristotle, according to Aristotle thought that world was made-up of antitheses like true /erroneous, sultry/cold, male/female, active/passive etc. Fuzzy logic was introduced in 1965 by Pedagogia Lotfi A. Zadeh. Fuzzy logic gives the partial result of true and erroneous and according to Buddha "precision is not truth". First fuzzy logic controller was habituated to control the speed of a diminutive steam engine. This was developed by E.H Mamdani, London. Major role of fuzzy logic is in control engineering. Fundamental elements of fuzzy logic system are fuzzification, fuzzy inference and defuzzification.

3.5 Simulated Annealing

This technique was incentivized from the Annealing in Metals. In 1958, a Monte Carlo technique predicated simple algorithm was introduced by Metropolis et al. Later simulated annealing has been utilized for combinatorial quandary in 1985-1986 by Kirkpatrick et al. and Cerny et al. simulated annealing is an optimization implement dealing with the highly non-linear model sand it has been utilized for discrete optimization and perpetual variable quandary.

4. APPLICATION OF SOFT COMPUTING TECHNIQUES IN TURNING OPERATION

4.1Taguchi's Method

A.Manna. B. Bhattacharyya (2004) [2] have worked on turning of Al/SiC-MMC utilizing a fine-tuned rhombic tooling system. The different set of experiments was performed utilizing a Kirloskar centre Lathe with T-max-U positive rhombic insert (uncoated tungsten carbide WC). Analysis of variance (ANOVA), F-test was utilized for optimizing the machining parameters (cutting speed, aliment rate and depth of cut) for dependent variables (surface roughness heights Ra and Rt). The experimental results show two vital facts, the first one is average surface roughness heights Ra and Rt are low at high cutting speed and comparatively high at low cutting speed. The Second is the effect of victual on the average surface roughness heights Ra and Rt are low at low aliment and average surface roughness heights Ra and Rt are low at higher depth of cut.

E. Daniel Kirby et al. (2006) [3] conducted experiment on aluminum rod utilizing CNC lathe and determined the optimal turning operation parameters for surface finish under varying conditions utilizing the Taguchi's method. This method was applied utilizing a concrete set of control (spindle speed, victual rate, depth of cut and implement nasal perceiver radius) and noise parameters (implement number and temperature range) and a replication variable of surface roughness. And found that the control factor has varying effects on the responsible variable, with aliment rate and implement nasal perceiver radius having the highest effects; on the other hand the noise factor does not have any conspicuous effect. Concluded the utilization of the Taguchi's Parameter Design Techniques was considered prosperous as an efficient method to optimize surface roughness in turning operation.

Birhan Isik (2008) [7] has worked on the turning operation on glass fiber reinforced plastics (GFRP) on CNC turning machine with CERMET cutting implement. Cutting parameters (depth of cut, victual rate, implement geometry and cutting speed) and the resulting cutting forces have great effects on the machinability surface roughness of unidirectional glass-fiber reinforced plastic composite. Result shows that the surface roughness decreases with the incrementation of cutting speed. The surface roughness decreases with the incrementation of implement radius and cutting speed. The surface roughness increases with the incrementation of rake angle and victual rate. An incrementation of the cutting depth does not have a consequential effect on the surface roughness.

Suresh Dhiman et al (2008) [8] have done experiments on a cylindrical bar of AISI 1080 steel on Lathe machine implement by HSS single point cutting implement without utilizing any coolant. Samples were yare on polishing machine utilizing different grades of empery paper and final polishing was done on cloth with abrasive alumina powder. Study the machining and non-machining characteristics of AISI 1018 steel. AISI 1018 steels find many applications in manufacturing of axles, bolts, shafts, machinery components, gears, pinions, worms, kingpins and ratchets. The study result shows among cutting parameters affecting machining variables (implement tip temperature, SR and cutting force) for AISI 1018 steel, speed has maximum effect and depth of cut has minimum effect. Implement tip temperature increases with increase in cutting speed. At high speed surface finish is least

affected. The Surface finish deteriorates at high victual rates hence to obtain good surface finish victual rate may be kept low. At low speeds cutting forces are high and proclivity of work material to compose a built up edge is withal more vigorous. Victual and depth of cut have sizably voluminous effect on surface roughness.

S. Arvindan et al (2008) [9] have done turning on advance composite material glass fiber reinforced plastic (GFRP) utilizing CNC lathe with cemented carbide (K20) cutting implement. Machining characteristics are investigated predicated on replication variable (flank wear, crater wear and surface roughness). The machining parameter (cutting velocity, aliment rate and depth of cut) is optimized by employing statistical techniques of analysis of variance (ANOVA) obtained from regression analysis. Turning experiments were orchestrated predicated on Taguchi's design of experiments. The application of Taguchi's design of experiments (DOE) methodology amends the flank wear, crater wear and surface roughness.

Ahmet Hascalik, Ulas Caydas (2008) [10] have performed turning operation on commercial Ti-6Al-4V alloy utilizing CNC lathe with CNMG 120408-883 inserts. The effect and optimization of machining parameters (cutting speed, victual rate and depth of cut) on surface roughness and implement life was investigated by utilizing the ANOVA and Taguchi's method. The purport of the statistical analysis of variance is to investigate which design parameter significantly affects the surface roughness and implement life. Predicated on the ANOVA, the relative consequentiality of the machining parameters with deference to dependent variable was investigated to determine more accurately the optimum cumulation of the machining parameters and the highly efficacious parameters on both the surface roughness and implement life were tenacious i.e. the aliment rate is the main factor that has the highest consequentiality on the surface roughness. The cutting speed does not have much influence on the surface roughness. The implement life is affected vigorously by the cutting speed, whereas the aliment rate and depth of cut have a paramount statistical influence.

M. Munawar et al. (2009) [13] in an experiment carried out on AISI 1040 carbon steel bar utilizing CNC lathe machine with C type negative, multilayer coated inserts CNMG 120404. Optimized the independent variables like machine implement condition (vibration amplitude) victual rate and insert nasal perceiver radius for better surface roughness utilizing Taguchi's and ANOVA method. Optimized result shows that vibration amplitude and aliment rate has moderate effect on the surface roughness and insert nasal discerner radius had the highest paramount effect on the surface roughness. It was withal found that a machine implement with low vibration amplitude engendered better surface roughness and insert with more sizably voluminous nasal discerner radius engendered better surface roughness at low victual rate.

Turning operation of S45C on an ECOCA-CNC lathe with Mitsubishi NX2525 insert was done by **Tian-Syung Lan, Ming-Yang Wang [11].** They investigated the influence of turning process parameters (speed, cutting depth, and aliment rate and implement nasal discerner runoff) on independent objectives (surface roughness and implement wear ratio) for developing two amalgamations of optimum single-objective cutting parameters utilizing competitive Taguchi's Method. It is observed that the surface roughness under optimum competitive parameters is decrementing. However, the Implement Wear Ratio and MRR are greatly incremented.

Dr. E. Daniel Kirby (2010) [14] investigated into optimizing a quality characteristic, while considering productivity, through the utilization of Taguchi's parameter designs. Optimized the turning process parameters (aliment rate, spindle speed and depth of cut) and noise factor (implement insert, implement manufacture) for the replication factor (surface roughness) utilizing the Taguchi's method. It was found that the aliment rate and spindle speed had paramount effects on surface roughness, while depth of cut had a nonessential effect and noise factors were not found to be statistically consequential. The victual rate and spindle speed become avenues for future studies. Taguchi's parameter design can be acclimated to determine the optimal levels of controlled parameters to meet a quality target without sacrificing productivity.

H. H. Shahabi. M. M. Ratnam (2010) [15] has done comparative study on (AISI 304 alloy steel bar utilizing conventional lathe machine implement with cemented carbide implement) utilizing two approach one is replication surface methodology and another is machine vision approach. This study has done on simulated model and authentic work piece and compares these results. The effect of input parameter (machining time, victual rate, cutting speed and depth of cut) on output parameters (surface roughness and dimensional deviation) utilizing above verbally expressed approach. 2-D image of cutting implements were acclimated to engender simulated work pieces from which surface roughness and dimensional deviation data were tenacious. The result of this study shows the minor distinction between authentic experiment and the simulated model. This error occur due to the lathe machine inaccuracy and instability.

R. S. Pawade, Suhas S. Joshi (2011) [18] have conducted turning operation on Inconel 718 utilizing CNC lathe with cubic boron nitride (CBN). A coupled approach Taguchi's grey relational analysis (TGRA) has been employed for optimum turning process parameters. Grey relational analysis utilized for convert the multi-performance characteristics into single performance characteristics. The effect of independent parameters (cutting speed, aliment,

depth of cut and edge geometry) on replication factors (Cutting force, victual force, radial force and surface roughness) have been analyzed utilizing TGRA and identified the paramount process parameters utilizing ANOVA method. In this study result shows that aliment rate have most paramount for replication factors.

D. Lazarevic et al. (2012) [23] conducted experiment on semi-crystalline thermoplastic polyethylene (PE) utilizing macrocosmic lathe machine with inserts VCGX16 04 04-AL (H10) and done optimization of the turning process parameters (cutting speed, aliment rate, depth of cut and implement nasal discerner radius) for the performance parameter (surface roughness) utilizing Taguchi's method and experimental result was analyzed with the avail of analysis of denotes (ANOM) and analysis of variance (ANOVA).Study reveals that with ANOM derive alone is possible optimum coalescence of the turning process parameters with veneration to average surface roughness. The purport of the ANOVA is to investigate which cutting parameters significantly affect the surface quality characteristics. Optimized result shows that the victual rate is the most consequential parameter, followed by implement nasal perceiver radius and cutting speed, whereas the influence of depth of cut is negligible.

M. Korat , N.Agarwal (2012) [24] performed an experimental study on EN 24 medium alloy steel utilizing CNC turning machine with TiN coated tungsten carbide inserts. To optimize the effect of turning process parameters (speed, aliment, depth of cut, nasal discerner radius and cutting environment) for minimum surface roughness and maximum material abstraction rate utilized the Taguchi's method and experimental data is analyzed utilizing Minitab 16 statistical software. Optimized results show that ANOVA suggests the nasal discerner radius is the most consequential factor and cutting environment is most frivolous factor for both surface roughness and MRR.

M. Suresh kumar et al. (2013) [28] did an experimental study on AL 6063 with 10% silicon carbide metal matrix composites utilizing CNC lathe and optimized the turning process parameters (cutting speed, aliment rate and depth of cut) for the performance characteristics (surface roughness) utilizing analysis of variance (ANOVA) and Taguchi's method . ANOVA is utilized to study the effect of process parameters on the machining process. Experimental results were accumulated and analyzed with the avail of the MINITAB 16 software and withal utilizing the same software the regression model has been developed for the experiment. Optimized result shows that cutting speed has a more preponderant influence on the surface roughness followed by aliment and depth of cut had least influence on the surface roughness.

P. Shanmugha sundaram et al (2013) [33] did an experimental investigation on the surface roughness of pristine commercial Al-fly ash/ graphite composites utilizing CNC lathe with multilayered coated carbide implement insert. The effect of independent parameter (cutting speed, aliment rate and depth of cut) on the replication factor (surface roughness) has optimized utilizing Taguchi's and ANOVA approach. Concluded the aliment rate has the highest influence on surface roughness in machining of same composite followed by cutting speed and depth of cut. Additionally in the presence of fly ash particles reduces the surface roughness of composites compared with pristine Al.

K. Chandra sekaran (2013) [31] has conducted turning operation on AISI 410 stainless steel utilizing CNC Lathe with three type of cutting inserts. Analysis of variance ANOVA has been employed for identifying the optimum machining parameters (speed, victual and depth and cut) on multi-replication parameter (surface roughness). Predicated on ANOVA two result shows (a) the aliment rate and cutting speed are the paramount cutting parameter when utilizing Ti(C, N, and B) and (Ti, Al0 N. (b) aliment rate and depth of cut are the consequential cutting parameter when utilizing TiCN + Al2O3.

B. Satyanarayana et al (2013) [29] have conducted machining on nickel predicated super alloy Inconel 718 utilizing CNC lathe in dry condition with uncoated cemented carbide implement insert. A coupled approach (Taguchi's method predicated grey relational) has been utilized for obtaining the optimum turning process parameters and for analysis the effect of control factor (cutting speed, aliment and depth of cut) on multi replication factor (Cutting force, Implement flank wear and surface roughness). This approach directly converts the multi-replication into single replication characteristics called as grey relational grade. Predicated on this approach victual rate is more consequential compared to depth of cut and cutting speed.

4.2 Principal Component Analysis

A. P. Paiva et al (2009) [12] have performed turning operation on AISI 52100 steel utilizing CNC lathe with commixed ceramic (AL2 O3 + TiC) inserts. Optimize the multiple process characteristics (cutting speed, aliment rate and depth of cut) for the multi-objective parameter (Implement life, cutting time, total cost, material abstraction rate and surface roughness) without considering the variance-covariance structure among the replication. Utilize the amalgamated principal component analysis (PCA) with replication surface methodology (RSM). The optimization is predicated on the concept of multivariate mean square error (MMSE). He concluded that two set of PCA components are utilized, first principle component was responsible for most of the variance-covariance present in

the pristine data associated with the implement life, cutting time, total machining cost, total turning cycle time and material abstraction rate. The second principle component was utilized as an alternative to amend the explication of the surface roughness deportment of the machined part. The result denotes that RSM coalesced with PCA is a very subsidiary technique to model and to engender equations for forecasting and optimizing, utilizing the fewest experiments possible.

S. Rajesh et al. (2013) [30] analyzed experimental investigation on red mud-predicated aluminum metal matrix composites utilizing CNC turning machine under dry condition and optimizing the machining parameters (cutting speed, aliment, depth of cut and nasal discerner radius) for three performance characteristics (surface roughness, power consumption and vibration) utilizing coupled techniques such as grey-predicated Taguchi's method and principle component analysis. The principle component analysis used to determine the corresponding weighting values of each performance characteristics while applying grey relational analysis to a quandary with multiple performance characteristics, is proven to be capable of objectively reflecting the relative consequentiality for each performance characteristics. This coupled technique convert optimization of the multiple performance characteristics into optimization of single performance characteristic.

4.3 Neural Network

Julie Z. Zang et al (2007) [6] have evaluated the turning operation on 6061 aluminum utilizing CNC lathe. A full factorial design is utilized in the experimental design. An In-Process Surface Roughness Adaptive Control (ISRAC) System has been developed for turning operations. An artificial neural network (ANN) was employed to establish two subsystem: the neural network-predicated, in-process surface roughness prognostication (INNSRP) subsystem and the neural network-predicated, in-process adaptive parameter control (INNAPC) subsystem. The two subsystems soothsaid surface roughness and acclimated victual rate utilizing cutting parameters (aliment rate, spindle speed and depth of cut) and additionally vibration signal detected by an accelerometer sensor hence the result shows the vibration signal detected by the accelerometer employed in the proposed system was a good designator of surface roughness. Victual rate is the most consequential factor impacting the surface quality of turned products.

Ulas Caydas, Sami Ekici (2012) [20] have conducted turning operation in dry condition on AISI 304 utilizing Fanuc CNC Lathe machine with cemented carbide inserts. Artificial neural network (ANN) and three type of fortification vector machines (SVM) (Least square SVM, Spider SVM and SVM-KM) has been utilized for the optimization of independent parameters (cutting speed, victual rate and depth of cut) for surface roughness. To investigate the performance of ANN a multi layered aliment forward neural network with the back-propagation algorithm have employed. In this comparative study SVM computation time was less than the ANN because ANN takes more time for computation. Spider SVM model found most predictive while other two was found less precise model.

J.S. Senthi kumar et al (2012) [26] have performed machining experiment (Turning and Facing) on Inconel 718 utilizing CNC lathe with K 10 type uncoated carbide inserts. The effect of control variables (cutting speed, victual and depth of cut) on multi-replication variable (flank wear, surface roughness) has prognosticated utilizing artificial neural network (ANN) and analysis of variance (ANOVA) techniques. The result of this experimental study shows that aliment has the most consequential factor on surface roughness in facing operation and low cutting speed, medium depth of cut and low victual are the optimum machining parameter for the turning operation.

I. Asilturk (2012) [25] has conducted turning operation on AISI 1040 steel as a work piece utilizing CNC turning machine with single insert.The effect of input machining parameters (cutting speed, aliment rate, depth of cut and nasal perceiver radius) on replication factor (surface roughness mean and total) utilizing neural network and multiple regression techniques. In Neural network multilayer perceptron structure of victual forward has utilized for mathematical modeling. After comparisons of both method found that ANN give more precise result than multiple regressions and in both victual rate has the most paramount factor which affect the surface roughness.

4.4 Genetic Algorithm

A.N. Sait (2010) [17] has conducted turning operation on glass fiber reinforced plastic (GFRP) materials (which made from resin composition of Isophthalic and Vinylester) utilizing CNC lathe with coated carbide implement inserts. The effect of independent process parameter (cutting speed, aliment rate and depth of cut) on multi-replication variable (surface roughness, machining force and implement wear) has been optimized utilizing conventional (Taguchi's method) as well as nonconventional (Genetic algorithm and particle swarm optimization) optimization techniques. The investigation shows the performance of PSO was more precise than others and two consequential result came (a) lower cutting velocity, moderate victual rate, and moderate depth of cut are the ideal

machining conditions for machining hand layup GFRP pipes. (b) moderate cutting velocity, lower aliment rate and higher depth of cut was the ideal machining conditioning for machining filament wound GFRP pipes.

K.Saravana kumar et al (2012) [19] have performed experiments of Inconel 718 (Nickel predicated alloy) on CNC turning lath with Coated Carbide implement inserts M30. Investigate the influence of machining process parameters (cutting speed, victual rate and depth of cut) on the output parameters (material abstraction rate and surface roughness). Genetic algorithm have utilized for optimization of CNC turning process parameter and found that parameter effect in decrementing order (speed, aliment, depth of cut) on turning of INCONEL718.

Poornima et al. (2012) [22] did turning operation on martensitic stainless steel (SS40) steel utilizing CNC machine implement. Optimized the turning process parameters (cutting speed, aliment, and depth of cut) for replication factor (surface roughness) utilizing RSM and Genetic Algorithm. Result obtained from Replication Surface Methodology (RSM) and Genetic Algorithm which designates that machining process parameters (speed, aliment and depth of cut) have significantly affected the replication.

Rasool Mokhtari Homami et al. (2013) [27] conducted experiment on commercial Inconel 718 nickel-predicated super alloy utilizing CNC lathe with Ti-Al-N-coated tungsten carbide cutting implement prepared by PVD and done optimization of turning process parameter (Cutting velocity, Aliment rate, Nasal discerner radius, Approach angle, Depth of cut) for two dependent variables such as implement wear and surface roughness utilizing design of experiment (DOE) for full factorial design, statistical analysis for experimental result analysis, artificial neural network (ANN) for system modeling and determinately genetic algorithm (GA) for optimization. The applied keenly intellective techniques results show that victual rate, nasal perceiver radius and approach angle have a paramount effect on the flank wear and the surface roughness, but the cutting velocity has a paramount effect on the flank wear alone.

H. Ganesan. G. Mohan Kumar (2013) [32] has conducted turning operation on EN 8 work piece material utilizing CNC machine implement with CNMG implement tip. Genetic algorithm (Nondominated) sorting genetic algorithm (NSGA-II) has been utilized for the optimization and find the influence of independent factor (cutting speed, Depth of cut and Victual rate) on replication factor (Minimum operating time, minimum engenderment cost and Minimum implement wear).

5. ACKNOWLEDGEMENT

All authors wants to wish special thanks to Prof. Murlidhar Patil , Head of Department, Sharadchandra Pawar College of Engineering, for their kind help and attention.

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