Department of Mechanical Engineering

Academic Year -2017-18

3.3.1 Number of research papers published per teacher in the Journals notified on UGC website during the last five years

Paper Count -9

| Title of paper | Name of the author/s | Department of the teacher | Name of journal | Year of publication | ISSN number | Link to website of the Journal | Link to article / paper / abstract of the article | Is it listed in UGC Care list |
|---|---|---|---|---|---|---|---|---|
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| Rationalizing Mechanism to Develop &amp; Monitor &amp; Ensure a Quality Culture at the Institutional Level -QFD Case Study for Engineering Institute | Dr.Chandrashekhar K.Patil | Mechanical | Gurukul International Multidisciplinary Research Journal | 2017 | ISSN 2394-8426 | https://gurukuljournal.com/ | https://gurukuljournal.com/dec-2017/ | UGC |
| Exergy Analysis of a compression ignition engine using biodiesel blends: a review | Dr. Sanjay Anandrao Mohite | Mechanical | International Journal of Advanced Engineering Science and Technological Research (IJAESTR) | 2017 | ISSN: 2321-1202. | https://www.aestjournal.org/ | https://www.aestjournal.org/index.php?option=com_content&view=article&id=93:volume-5-issue-1-march-2017&catid=80:previous-issue&Itemid=277 | UGC |
| Analysis of manufacturing related measures by using analytic hierarchy process (AHP) | Dr. Sanjay Anandrao Mohite | Mechanical | International Journal of Engineering, Management & Sciences (IJEMS), | 2017 | ISSN: 2348-3733 | https://www.alliedjournals.com/index.php?page=search | https://www.alliedjournals.com/download_data/IJEMS_V4IS30027.pdf | UGC |
| The Quality Function Deployment Model Using ANN with Optimization Methods | Dr.Chandrashekhar K.Patil | Mechanical | Journal of Advanced Research in Dynamical &amp; Control Systems | 2018 | ISSN 1943-023X | https://www.worldscientific.com | https://www.worldscientific.com/doi/10.1142/S0219686718500087 | UGC |
| Study of Quality Function Deployment Model Based on Artificial Neural Network with Optimization Technique | Dr.Chandrashekhar K.Patil | Mechanical | Journal of Advanced Manufacturing Systems | 2018 | ISSN1793-6896 | https://www.worldscientific.com | https://www.worldscientific.com/doi/10.1142/S0219686718500087 | UGC |
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| Experimental Investigation to Minimize Resultant Vibration Signal in CNC Turing Operation of Hard AISI M2 Tool Steel | Krupal Pawar | Mechanical | International Journal for Research in Applied Science & Engineering Technology (IJRASET) | 2017 | ISSN: 2321-9653 | www.ijraset.com | https://www.ijraset.com/fileserve.php?FID=9285 | UGC |
| Analysis and Optimization of CNC Turning Process Parameters for Hard (62-64 HRC) AISI M2 to Minimize Surface Roughness | Krupal Pawar | Mechanical | International Journal for Research in Applied Science & Engineering Technology (IJRASET) | 2017 | ISSN: 2321-9653 | www.ijraset.com | https://www.ijraset.com/fileserve.php?FID=9319 | UGC |

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# Effect of TiCN and AlCrN Coating on Tribological Behaviour of Plasma-nitrided AISI 4140 Steel

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## ABSTRACT

In the present article, samples made of AISI 4140 steel, pre-treated with plasma nitriding (PN), and coated with different coatings like Titanium Carbonitride (TiCN), Aluminium Chromium Nitride (AlCrN), using Physical Vapor Deposition (PVD) technique, were investigated in terms of their microhardness, surface roughness, and dry sliding wear behaviour. Wear tests were performed with a pin-on-disc machine. Coatings were deposited on plasma nitrided samples. The wear behaviour, and wear mechanisms of TiCN- and AlCrN-coated, PN treated AISI 4140 specimens were investigated using a field emission Scanning Electron Microscope (SEM), equipped with an Energy Dispersive X-ray (EDX) analyzer. An SEM was used to study the surface morphology of the worn surfaces. Also, adhesion tests were conducted to investigate the adhesion quality of the coated specimens. The results of the investigation showed improved wear properties. Furthermore, the compound layer formed during nitriding was found to act as an intermediate hard layer, leading to superior sliding wear properties.

## KEYWORDS

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## Rationalizing a mechanism to develop, monitor and ensure a quality culture at the institutional level-a QFD case study for engineering institute

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Abstract

Higher education institutions have been facing challenges for some time and are expected to go through a fierce competition in future. In the new environment that higher education has entered the quality dimension which plays an increasingly important role. In the past decade, emphasis on quality improvement has been one of the most characteristic features of higher education in many countries. By now, Total Quality Management has been adopted by many universities and colleges in the higher education world. Engineering education colleges and universities have no alternative but to follow and take advantage of the anticipated benefits that TQM has to offer. This paper implements QFD technique to monitor quality at an engineering college in India. This research article overviews the status of engineering and technology education in India in general and more specifically the state of Maharashtra. It takes a brief account of the monitoring and regulatory authorities and principles to this segment of higher education. The efforts of the regulatory bodies are to be well supported and supplemented at the institute level to assure high standards of quality in engineering and technological evidence. This study also explores the use of Quality function deployment as a tool to monitor, maintain and regulate quality in engineering and technology education at the institute level. A case study on one of the engineering institutes was done and critically evaluated through QFD in qualitative comparison with other competing institute.

Keywords: Quality function deployment, House of quality, voice of customers, gross enrolment ratio, All India Council for Technical Education, University Grants Commission.

### 1.Introduction

The process of education brings a transformation into the knowledge, characteristics and behaviour of an individual. It is very difficult to predict the productivity of the educational process as it is reflected in other attributes 9Clayton, 1993). Thereby education process is thus conceived to be processing real resources with measurable value into resources with an imperceptible value (Browen, 1980).The role of higher education (HEI's) is to initiate, nurture and groom the creativity, logical and analytical skill. Once graduated, the students are expected to solve problems economically with a sustainable approach. Higher education mainly is a pathway with a specified times frame to achieve professional degree ultimately resulting in raising the e intellectual understanding of an individual. This academically strong individual with higher intellectual capacity in turn decides the social and economic state of the country (Zhumadil et al., 2005).In the modern day's higher education is being driven towards commercial competition imposed by economic forces [Owlia and Aspinwal, 1998].

### 1.1 Present status of higher education in India

The higher education sector in India has a three-tier structure comprising the university, college and course. This forms a vital link with the regulatory structure, and with accreditation agencies playing the key role in maintaining quality and standards in this sector.

Indian higher education system is the largest in the world with a student enrolment of the higher education system in India is mainly dominated by the private sector constituting nearly 60 % of

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# Exergy Analysis of a Compression Ignition Engine Using Biodiesel Blends: A Review

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## Abstract

It is the necessity of time to reduce consumption of energy and promote the use of renewable resources like biodiesel. Biodiesel is gaining popularity as an alternative fuel in diesel engines due to its use without any engine modification. This review collects and analyses some published papers concerning exergy analysis of diesel engine fuelled with biodiesel blends and it is found that exergy analysis is one of the best method to understand and improve the actual efficiencies of diesel engines fuelled with biodiesel blends.

## 1. Introduction

Exergy is defined as the maximum theoretical work output, which may be obtained from a system as it reaches to a state of equilibrium with environment of reference. The exergy content of a natural material input can be construed as a criterion of its quality and its ability to perform useful work. Exergy analysis is being used in simulation, design and assessment of thermal system performance. Various studies which involve the occurrence of losses in engines and methods to improve performance, which is based on second law of thermodynamics have been conducted by researchers [1].

Identification of energy losses can be done with energy analysis, but it cannot identify irreversible losses and their location. Modeling of engine processes can be done with the help of energy analysis, but it often does not determine the best engine operation. Actual efficiencies of the whole system can be understood and improved by exergy analysis. Exergy analysis is useful as it is based on the possibilities to determine the value of irreversibilities associated with the process. Exergy analysis is also called second law analysis or availability analysis [2]. Unlike energy, exergy may not be conserved. It may be generated, stored and destroyed. Exergy is usually destroyed when heat transfer takes place at lower temperatures and in the chemical reactions [3-4]. Exergy may be considered as a potential measure of a material for causing undesirable effects. This unutilised exergy may cause unwanted effects in the environment during conditions of non-equilibrium after interaction with its surroundings. An indication is given by the exergy content for ability of input in natural material to do useful work [5].

According to the first law of thermodynamics, fuel energy injected into the cylinder of a diesel engine should emerge as brake power output, as the heat given to coolant or as sensible and chemical energy in the exhaust. If the rejection of heat to the coolant is eliminated by cylinder insulation, then the energy which would be

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# Analysis of Manufacturing Related Measures By Using Analytic Hierarchy Process (AHP)

Hemant Sharma, Prof. Sanjay Mohite

*Abstract—* Authors have suggested to improve the productivity in the manufacturing system of SPRING industry by used Analytic Hierarchy Process(AHP). In this process collect the data and found dependency to each other. data was analyzed by based on higher priority .to select the process according to these rank   Set in the parametric form and arrange in the rank of process according to these priority. These rank arrange there higher to lower priority.

*Index Terms—*AHP,RM,FB,LS,IP,MT,RW,MA,MS,LG,OC.

## I. INTRODUCTION

Productivity is the most important part of industries. In the present spring industry face productivity problems due to the factors which affect productivity. We have considered some factor such as manufacturing, quality,customer service, and inventory and vendor selection have not 100% consistency.We tried to improve these consistency by using the analytical heirarchy processs. Many steps are involved in improve the productivity process of spring.We have collected the data of factors by literature review and survey.which have analysed by the ABC analysis.These data are inter relate to each other and calculating by AHP process and these are rearranged hiegher to lower priority.When we used these sequence of factors in the process we found to improved consistency of productivity factors which result improved productivity.

## II. RESEARCH PROBLEM

In this research  we have taken manufacturing factor. Consistency of priority selection in manufacturing is not appropriate. Hence it is need to be improve.

### Data Collection

Questionnaires will serve as the data collection methodology, as it falls within the broader definition of 'survey research' or 'descriptive survey'.  defines the concept of "survey" as, "the collection of a large quantity of evidence usually numeric, or evidence that will be converted

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to numbers, normally by means of a questionnaire". A questionnaire consists of a list of questions compiled in order to elicit reliable responses from a chosen sample with the aim to determine what the participants do, think or feel. There are two approaches in structuring questions namely, positivistic (structured 'closed' questions), and phenomenological (unstructured 'open-ended questions). The sample frame will consist of SME owners, managers, and line supervisors.

## III. LITERATURE REVIEWS

Haifeng Song(2015)  Case Company: Anhui Welbon Gaosen Paper Co.,Ltd - There are three main aspects will be elaborated in conclusions chapter, the whole thesis from start to finish will be briefly summarized, author's work will be self evaluated, and the thesis limitations will be pointed out. The structure of thesis was divided into six sections which consist of introduction, introduction of case company, literature review, JIT procurement supplier selection process, results and discussion, and finally conclusions. In the first introduction part, the author gives a short description of thesis background, problems which the case company facing and thesis objectives were stated, research methods were mentioned and the framework of the thesis was introduced. In introduction of case company chapter, the author presented specialty paper industrial background, the basic information of case company and related department description. In literature review chapter, three main theory plates were reviewed, which are purchasing, supplier selection and AHP method, purchasing plate involved purchasing behavior, purchasing objectives, purchasing importance, procurement process and JIT procurement; supplier selection part included supplier selection models, supplier selection process, supplier selection criteria and supplier relationship management; AHP method combined definition, typical application process and theoretical limitations. JIT procurement supplier selection process consisted of supplier selection criteria identification and AHP application, both questionnaires research and interview research methods were utilized to accumulate data and information for the goal. After practical research

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# Study of Quality Function Deployment Model Based on Artificial Neural Network with Optimization Techniques

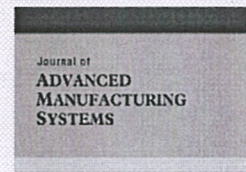Chandrashekhar K. Patil, M. Husain, and N. V. Halegowda

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## Abstract

In perceptible world the advanced technique is to progress the model of quality
function deployment (QFD) procedure with the consumer consummation level in the
industry with the help of artificial neural network (ANN) with inspired optimization

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# Investigation of Tribological Behaviour of Nitrided and Coated AISI 4140 Steel

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**ABSTRACT**

In the present study, samples made of AISI 4140 steel, pre-treated with plasma nitriding (PN) and coated with coatings like Titanium Nitride (TiN), Titanium Carbo Nitride (TiCN), Chromium Nitride (CrN), Aluminium Titanium Nitride (AlTiN) using Physical Vapour Deposition (PVD) technique, were investigated in terms of their dry and wet sliding wear behaviour. Wear tests were performed with a pin-on-disc machine. The results of the duplex treated samples were compared with the conventional hard chrome coated AISI 4140 steel.

The results showed improved wear properties of the duplex-treated specimens compared to the hard chrome coated AISI 4140 steel. TiCN coated and nitrided 4140 steel has shown the best performance among the investigated materials. Furthermore, the compound layer formed during nitriding was found to act as an intermediate hard layer leading to superior sliding wear properties. The improved performance of the duplex treated samples can be attributed to the presence of a nitrided subsurface.

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## Introduction

AISI 4140 steel is extensively used in the manufacture of many different parts and components, which encompass conveyor rolls, hydraulic machinery shafts, connecting rods, hollow shafts, axles, forming dies, ejectors, crankshafts, trim dies, and guides. Components of forming tool dies such as draw ring, ejector pin use AISI 4140 as material for their manufacturing. The integrity of the die cutting tools is essential to accomplish adequate product quality. An improperly formed tool will bring about inferior product shape. The components of forming tool dies are generally subjected to tribological loads which are greatly influenced by the material being formed [1], and, ultimately subjected to friction and wear. Moreover, such tools are also subjected to the normal and tangential forces created by the system [2]. However, as-received AISI 4140 steel shows poor tribological properties such as poor wear resistance and unstable friction behaviour. It also has strong adhesion when it slides against itself and other metals [3]. Such parts require pretreatment before being put to service. One of the ways of modifying the surface of forming tool to improve its wear resistance is thermo-chemical surface treatment such as nitriding, carbonitriding etc. [4]. Surface designing, which may incorporate surface treatment, are by and large, utilized to enhance wear resistance of steel substrates by improving surface hardness and limiting surface adhesion leading to reduced friction [5]. One of the methodologies adopted by the industry to reduce wear and improve life of the part is the utilization of physical vapour deposition (PVD) technique [3]. PVD hard coatings are outstanding for furnishing surfaces with high surface hardness and enhanced tribological properties [8]. In any case, it is verifiable truth that the use of PVD hard coatings to the substrate materials does not really prompt to ideal tribological properties, if the substrate material does not experience reasonable pretreatment. It is due to plastic deformation of the substrate, which may result in coating failure [8]. The prime necessity to enhance the wear properties of the substance is the correct and solid attachment of the coat to the substrate. Moreover, the substrate must have an ability to support hard and brittle coating [2]. Presence of hard nitride layer on the lower surface accomplishes legitimate attachment of the coat to the substrate [5, 8]. Nitriding prior to coating deposition emphatically influences the development and properties of the hard coating [9]. Iron nitride formed in the hardened surface layer after plasma nitriding increases surface hardness substantially [10]. Moreover, nitriding could promote the development of compressive stresses in the surface of the substrate; therefore, lessening the difference in stress environments in the coating and steel substrate [9, 11]. This was supported by the fact that the best adhesion results were obtained in work pieces with a larger diffusion zone and a thicker compound layer [3]. However, in order to increase the shear properties of the resulting coat, development of the interface layer between the coat and the substrate may be useful. Zaghni and Hashmi [5] and Stala et al. [12] studied the beneficial effects of nitriding of tool steel prior to PVD coating and found improved hardness and wear resistance. The authors, Devaraju et al. [3] and Yildiz et al. [11] experimented with plasma nitrided AISI 316 LN stainless steel and found improved wear behaviour at elevated temperature and improved fatigue properties, respectively. The nature and the prevailing wear mechanisms of nitrided and coated tools had been the subject matter of interest in many investigations. To name a few; Yilbas and Nizam [9] and Nickel et al. [13] experimented with PN treated and TiN coated drills, and observed longer tool lives under all machining conditions. The improvement in machining performance of the pre-nitrided drills was attributed to the role of the plasma nitriding in improving coating adhesion, and, thus, increasing the wear resistance of the coating. Abrasive

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# Analysis and Optimization of CNC Turning Process Parameters for Hard (62-64 HRC) AISI M2 to Minimize Surface Roughness

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*Abstract: In the present investigation, the influence of machining parameters including cutting speed, feed rate and depth of cut on surface roughness (Ra) in a dry turning environment for hard AISI M2 are investigated using the Taguchi method and analysis of variance (ANOVA). A three level, three parameter design of experiment, the L27 orthogonal array using Minitab 17 software, the single to noise (S/N) ratio are employed to study the performance characteristic in the turning of hard AISI M2 by taking nose radius of the PCBN insert (Kennametal) of 0.8mm. The analysis of variance (ANOVA) is applied to investigate the percentage contribution of each machining parameters. The results are verified by taking confirmation experiments. The present study indicates that cutting speed is the most influencing factor for surface roughness.*
*Keywords: CNC turning, Minitab17, Surface roughness, Taguchi method, Hard AISI M2, PCBN insert*

## I. INTRODUCTION

In the present era, the technology related to CNC has advanced significantly, in order to meet the advance needs in manufacturing fields, especially in the precision machining industries. The turning process is a most common machining process because it is involved in near about every manufacturing industry. In the turning process, one of the most important quality parameters is a surface finish. In order to improve the quality of turned components, it is very important to choose a proper set of machining parameters such as cutting speed, feed rate, depth of cut with proper insert material and nose radius.

E. Daniel Kirby, Zhe Zhang et.al [3] applied the Taguchi parameter design method to optimizing the surface finish in a turning operation for 6061-T6 aluminum alloy rod. They selected machining parameters such as spindle speed, feed rate, depth of cut, and tool nose radius to optimize the turning operation. They had taken noise factors such as varying room temperature, as well as the use of more than one insert of the same specification, which introduced tool dimension variability. They conducted a total of thirty-six experimental trials using an orthogonal array, and the ideal combination of control factor levels was determined for the optimal surface roughness and signal to noise ratio. They concluded that this method was efficient as well as effective in determining the best turning parameters for the optimal surface roughness. Krupal Pawar, R. D. Palhade [7] studied the effect of insert nose radius and machining parameters including cutting speed, feed rate, and depth of cut on surface roughness(Ra) and material removal rate(MRR) in a turning of HSS(M2). They adopted method for study were the Taguchi method and analysis of variance (ANOVA).They selected process parameters for study was cutting speed, feed rate, depth of cut, and nose radius (0.4mm, 0.6mm, 1.2mm).Single to noise ratios were employed to study the performance characteristics in the turning of HSS(M2).The analysis of variance was applied to investigate the percentage influence of each machining parameters while CNC turning of HSS(M2) material. They performed all experimental trials without cutting fluid and at a constant spindle speed 2800 rpm.They concluded that feed rate and nose radius are the most significant factors in case of material removal rate and surface roughness for turning of HSS (M2) material.Suha K Shihab, Zahid A Khan et.al [8] investigated the influence of cutting speed, feed rate, and depth of cut on surface integrity defined in terms of surface roughness and micro hardness in dry hard turning process. They selected hardened alloy steel AISI 52100 as specimen material and it machined on a CNC lathe with coated carbide tool under different settings of cutting parameters. They employed a central composite design (CCD) of experiment to collect experimental data for surface roughness and micro hardness. They employed analysis of variance (ANOVA) to determine significance of the cutting parameters. They applied response surface methodology (RSM) to determine optimal values of cutting parameters and checked the validity of assumptions by taking several diagnostic tests. They concluded that feed rate is the dominant factor affecting the surface roughness whereas the cutting speed is found to be the dominant factor affecting the micro-hardness. They also conclude that within the range investigated, good surface integrity is achieved when feed rate and depth of cut are near their low levels and

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# Experimental Investigation to Mininize Resultant Vibration Signal in CNC Turing Operation of Hard AISI M2 Tool Steel

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Abstract : In the present research work, the effect of machining factors including cutting speed, feed rate and depth of cut on resultant vibration signal in a dry turning environment for hard (62-64HRC)AISI M2 are studied using the Taguchi method and analysis of variance (ANOVA).The design of experiment is done by Taguchi method. PCBN CNMG insert (Kennametal Company) of 0.8m is utilized for turning operation.The results are validated by taking confirmation experiments.The present study indicates that the feed rate is most influencing factors for resultant vibration while turning hard AISI M2 material.
Keywords: CNC Turning, Resultant Vibration Signal, Taguchi Method, AISI M2, PCBN Insert

## I. INTRODUCTION

In the present days, there is very much importance for vibration signal study in various machining process such as drilling, milling, and turning etc. Because due to minimizing resultant vibration signal, we gets the various benefits such as minimum possible tool wear, better surface finish, tool life increases, and productivity is also increased due to minimum setting time for machine therefore, it is very important to study and optimize the resultant vibration signals in machining process.

Dimla et al. [1], studied the experimental and analytical method for online tool condition monitoring system. They used three mutually perpendicular components of cutting forces (static and dynamic) and vibration signature measurements. They employed the Kistler mini accelerometers (type 8730A) for acceleration signal measurement in three mutually perpendicular directions and Kistler tool post dynamometer platform (type 9263A) for cutting force measurement again in three planes. They investigated that vertical components (z-direction) of both cutting forces and the vibration signatures were the most sensitive to tool wear, with nose wear being the most useful indicator of eminent tool failure. In the second part, studied the multilayer neural network and input is given to distinguish and classify the tool wear state. Abouelatta, O. B. et al. [2], employed FFT analyser to measure tool vibration in radial direction and feed direction and for measurement of surface roughness the Surtronic 3+ measuring instrument used and correlation between surface roughness and cutting vibration during turning established.They developed mathematical model to the predicted roughness parameter based on the cutting parameter and machine tool vibration for better understanding of the relation. Finally the measured results were analysed by commercial software MATALAB, BC++, SPSS. Bhuiyan. M. S. H. et al. [3], investigated various sensor used to monitor tool condition using different signal like optical, electrical and magnetic. They studied transient elastic wave gnererated during machining known as acoustic emission (AE).In this study, they proposed use of acoustic emission sensor and tri-axial accelerometer placed on thank of cutting tool holder was capable to monitor tool condition. Acoustic emission sensor assessed the internal change whereas vibration sensor asses external information of tool state. They illustrated use of RMS signal and fast Fourier transform as output of sensor. They proved that vibration components, Vx, Vy and Vz change with feed rate, depth of cut and cutting speed respectively.

The amplitude of vibration components decreases with the increase of cutting speed, and increases with the increase of feed rate and depth of cut. Alonso, F. J. and Salgado, D. R. [4], developed a reliable tool condition monitoring system (TCMS) for industrial application. They employed singular spectrum analysis (SSA) and cluster analysis for analysis of the tool vibration signals.SSA was non-parametric technique, of time series analysis that decomposes the acquired tool vibration signals and Cluster analysis was used to group the SSA decomposition in order to obtain several independent components in the frequency domain and that are apply to feed forward back-propagation (FFBP) neural network to determine the tool flank wear. Aliustaoglu, C. et al. [5], studied tool wear condition monitoring using a sensor fusion model based on fuzzy inference system.They mainly concentrated on the drilling and milling operation. They used two stage fuzzy logic schemes for developing the advanced tool condition monitoring system. They

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| Analysis of Influence of Tool Geometry on the Strength of Friction Stir Welded AA6061 Aluminum Alloy | Dr.H.N.Kudal | Mechanical | INTERNATIONAL JOURNAL OF SCIENTIFIC DEVELOPMENT AND RESEARCH | 2018 | 2455-2631 | https://www.ijsdr.org/ | https://www.ijsdr.org/papers/IJSDR1807051.pdf | UGC |

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# Tribological Failure Analysis and Suitability of Grease Lubrication for Sugarcane Crushing Mill Journal Bearings

P. N. Nagare ✉ & H. N. Kudal

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## Abstract

Influence of tribological performance parameters like speed, eccentricity ratio, load and frictional torque on the performance of sugarcane mill heavily loaded slow-speed journal bearing was examined. Reasons for tribological failure of sugarcane crushing mill journal bearings were

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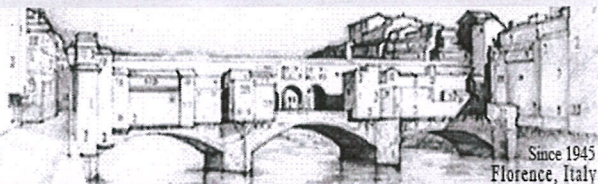
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### QFD A TOOL FOR QUALITY IMPROVEMENT IN THE MANUFACTURING INDUSTRY-A CASE STUDY ON PUMP

Author(s): Chandrashekhar K. Patil ,M. Husain, N.V. Halegowda

Abstract:
The pump manufacturers in India are continuously under a pressure of the dynamic customer requirement which need to be meet in order to have a competitive edge in the rapidly growing and highly volatile and competitive pump industries. In order to meet the customers� requirements and satisfaction for the product organization are adopting the Quality deployment while developing and launching new products or upgrading the existing ones. This case study is an attempt to apply the QFD approach to MP-10, a pump manufactured by Minimax Pumps Pvt. Ltd. India. The outcomes are to be adopted in order to meet the customer�s requirement and in the technical design of MP-10.

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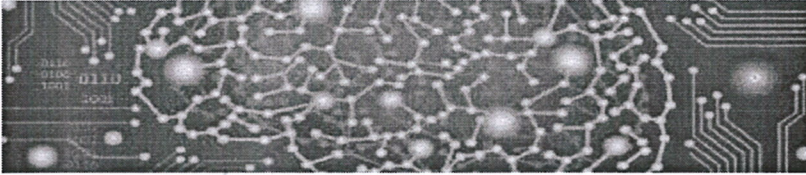
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# Enhancing the productivity implementing triz method

**Rajit Singhal, Sanjay Mohite, Sanjay Goyal**

Mechanical Engineering Department, Maharana Pratap College of Technology, Gwalior, Madhya Pradesh, India.

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*Abstract: This work is to increase the productivity of Drum Back Plate by minimizing the rejection rework in production of Drum Back Plate in Admach Auto India Ltd. Faridabad (Haryana). Author has opt out various operation of work which is performed during the production work in plant. These operations are Inspection, Shaping, Punching, Knurling, Trimming, Angular Punching. Author first observed the rejection of Drum Back Plate due to Denting, Burr, Height of Bose and Cracking. Aiming at the mitigation in rejection rate of plate author used TRIZ Methodology. In this methodology a matrix of 39 feature is used to find the most suitable solution of identified problem. This solution is one solution among the 40 principle of TRIZ implementing the observed solution, author found that the rejection rate of drum plate and rework has reduced. In this way author save 78% rejection. Using more option of optimism tool one can achieve the target of zero percent rejection.*

*Keyword: Triz, Angular Punching, Trimming, Knurling, Denting, Shaping, Burr, Cracking*

## INTRODUCTION

Today many big organizations involved in producing products with high degree of customer satisfaction keeping maximum productivity. The success of a product or service largely depends on how they meet the customer's demand. More

efforts are employed in getting the information necessary for determining what the customer truly wants. A continuous improvement is required to catch up with rapidly changing development throughout the world understanding of customer needs leads to successful product and shorter development time. A poor product definition commonly leads to either failure of that product in market or extended product development time. Cost reduction and continuous improvement are becoming increasingly crucial to the future industry and also for existing ones. The new competition is in terms of reduced cost, improved quality, higher product performance with good service and wider range of products in large scale industries. Work is distributed among the trained employees according to their efficiency which improves the productivity. Also these industries use huge capital with latest technologies which resulted in raised productivity and reduced cost per head.
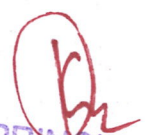
## TRIZ METHOD

### History of TRIZ

1. TRIZ is a Russian acronym meaning "theory of inventive problem solving". In 1946, Generich Altshuller, the founder of TRIZ.

2. TRIZ has 6 classical ways to resolve "physical contradiction" and these are known as "separation principles for "physical contradiction".

a. Separation in space

b. Separation in time

c. Separation at micro level; transition to sub system

# Performance analyses of construction work of plant using A.H.P. method

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ABSTRACT:-This work is to find out best output of construction work using Analytic Hierarchy Process (A.H.P. Process). Author has opt out various operation of work which is performed during the construction work of plant. These operation has placed in five useful act they are Customer satisfaction, Inventory, Administration and planning, Construction and Vendor selection. Fifteen parameters which makes effect in performance have been selected in each act. According to analysis of importance and effect of parameter they have been reduced to eight. These has accomplished by ABC analysis methodology. Application of A.H.P. process author has calculate the present consistency or each act on the basis of priorities which has been using up to now. Need of improvement has been observed in all act of construction work in plant. To make the all act economic and efficient priorities of parameters have been redesign on the basis of literature and our own experience and again consistency of each act calculated. A marginal improvement have been observed in the consistency of all act. In this way author has found optimum rate of priority of parameters in all required act of construction work. Using this priorities construction work of plant become lean and agile.

Keywords : A.H.P.(Analytic Hierarchy Process), KPI(Key performance indicator),CR(Consistency ratio), RI(Random index), ABC analysis

## INTRODUCTION

A supply chain is a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer. Supply chain activities transform natural resources, raw materials, and components into a finished product that is delivered to the end customer. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. Supply chains link value chains.

## ANALYTIC HIERARCHY PROCESS (AHP) METHODE:-

The Analytic Hierarchy Process (AHP), introduced by Thomas Saaty (1980), is an effective tool for dealing with complex decision making, and may aid the decision maker to set priorities and make the best decision.

## RATING OF PREFERENCE

| Numerical rating | Verbal judgments of preferences |
|---|---|
| 9 | Extremely preferred |
| 8 | Very strongly to extremely |
| 7 | Very strongly preferred |
| 6 | Strongly to very strongly |
| 5 | Strongly preferred |
| 4 | Moderately to strongly |
| 3 | Moderately preferred |
| 2 | Equally to moderately |
| 1 | Equally preferred |

# Total Quality Management for Sustainable Development

Sanjay Mohite, S.L. Verma
Department of Mechanical Engineering
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**Abstract**
Quality is considered as a main criteria for manufacturing units in this competitive world. TQM philosophy is mainly adopted by large companies. Researcher made an empirical relationship between TQM and SMEs (Small Medium Enterprises) performance. SMEs are the major source of employment in developing countries. Importance of Quality, Strategy for TQM implementation, TQM Research Model, TQM concepts and Energy management for sustainable development have been discussed in this paper.
**Keywords:** TQM, Quality, Energy, Management, Sustainable Development

## 1. Introduction

TQM is a process designed to focus expectations of customers preventing problem building, commitment to quality in the work force and promoting open decision making. TQM is an effective system for integrating quality development, quality maintenance, quality improvement efforts of various groups in the organisation so as to enable products and services at the most economical level, which allows the customer satisfaction. TQM is an integrated organisational approach in delighting customers by meeting their expectations on a continuous improvement in all products , services and processes along with problem solving methodology.TQM is practised to improve organisational effectiveness to achieve customers satisfaction. TQM involves continuous improvement of quality, cost reduction, timely delivery of goods and innovation to strengthen the competitive edge in the process. Quality is considered as a main criteria for manufacturing units in this competitive world. TQM philosophy is mainly adopted by large companies [1-2]. Many small and medium firms are force to modify and optimize their operations at the strategic and

actical levels due to increased global competition and customer requirement [3]. Manufacturing SMEs are slow to adopt TQM as compared to large companies in India [4]. A structured certified quality management system of a company increases the customer confidence [5].

## 2. Importance of Quality

The importance of quality can be understood with the following block diagram: -
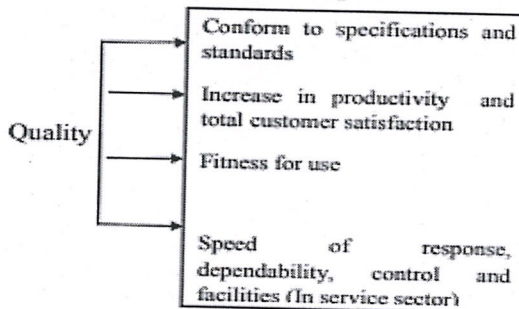


## 3. Strategy for TQM implementation

TQM may be implemented with the consideration of the following areas of business performance which are related to short term and long term results[6]:-

1. Customer satisfaction

2. Employee motivation

3. Market share and growth rate

4. Return on total assets

5. Revenue growth

# Analysis of Influence of Tool Geometry on the Strength of Friction Stir Welded AA6061 Aluminum Alloy

[1]Suhas N. Bhagwat [2]Dr. H. N. Kudal [3]Prof. B. C. Londhe [4]Prof. A. P. Ghodake

[1]Lecturer, [2]Principal, [3]Professor, [4]Professor

Mechanical Engineering Department
Santosh N. Darade Polytechnic, Nashik, India

*Abstract*— Friction Stir Welding (FSW) was invented by Wayne Thomas at TWI (The Welding Institute), and the first patent applications were filed in the UK in December 1991 for butt and lap welding of metals and Plastics. FSW is a solid state welding process and joining similar or dissimilar metals in which the relative motion between the tool and the work piece produces heat which makes the material of two edges being joined by plastic atomic diffusion. This method relies on the direct conversion of mechanical energy to thermal energy to form the weld without the application of heat from conventional source. The rotational speed of the tools, the axial pressure, tool tilt angle and welding speed are the principal variables that are controlled in order to provide the necessary combination of heat and pressure to form the weld. This joining technique is energy efficient, environment friendly, and versatile. The advantages of this process include high reproducibility, short production time and low energy input. FSW process used for the aerospace, railway, land transportation, the construction industries. In this experimental work the effect of process parameters and tool geometry on the strength of AA 6061 Aluminum alloy is investigated. Weld strength is taken as response variable during the welding process. Experiments were performed using Taguchi method and analysis of experimental results is carried out by using MINITAB 16 software.

*Keywords* – Friction stir welding, taguchi method, axial pressure, tool tilt angle and welding speed.

## I. INTRODUCTION

Friction stir welding (FSW) is a relatively new solid state welding process which is used for butt joints. FSW was invented by The Welding Institute, Cambridge, UK in 1991 and has emerged as a new process for welding of aluminum alloys. This process has made possible to weld a number of aluminum alloys that were previously not recommended (2000 series & copper containing 7000 series aluminum alloys) for welding. Because the material subjected to FSW does not melt and re-solidify, the resultant weld metal is free of porosity with lower distortion. An added the advantage that it is an environmentally friendly process. FSW is a solid state, localized thermo mechanical, joining process.

In FSW, a non-consumable rotating shouldered-pin-tool is plunged into the interface between two plates being welded, until the shoulder touches the surface of the base material, and then tool is transverse along the weld line. In FSW, frictional heat is generated by rubbing of tool shoulder and base material surface. During traversing, softened material from the leading edge moves to the trailing edge due to the tool rotation and the transverse movement of the tool, and this transferred material is consolidated in the trailing edge of the tool by the application of an axial force. FSW parameters are tool geometry, axial force, rotational speed, transverse speed and tool tilt angle.
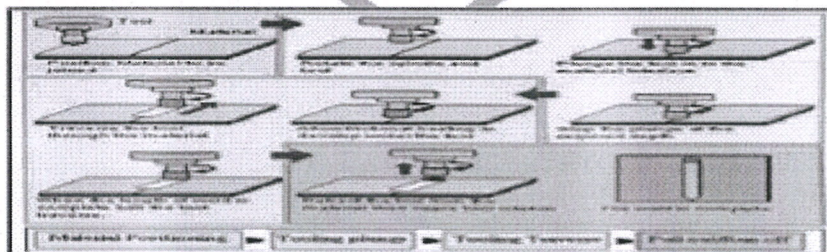


Fig. 1 Friction Stir Welding Process Flow chart

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# Determination of Brand Loyalty in Telecommunication Industry: a Literatur Review

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| Biofuel Certification Performance: A Review & Analysis | Dr. Sanjay Anandrao Mohite | Mechanical | European Journal of Sustainable Development Research | 2020 | ISSN:2542-4742 | https://www.ejosdr.com | https://www.ejosdr.com/download/biofuel-certification-performance-a-review-analysis-7864.pdf | UGC |
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| Frequency Optimization of Robot Support Structure for Inverted Operation | Dr.S.H.Pawar | Mechanical | International Journal of Innovative Technology and Exploring Engineering (IJITEE) | 2019 | ISSN 2278-3075 | https://www.ijitee.org | https://www.ijitee.org/wp-content/uploads/papers/v9i5/E2775039520.pdf | UGC |

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# Multi-criteria decision-making approach to material selection in tribological application

Santosh Vitthal Bhaskar and Hari Narayan Kudal

ABOUT

## Abstract

This paper presents application of various multi-criteria decision-making (MCDM) techniques to material selection in tribological application. The alternative materials considered for ranking are variants of AISI 4140 which is nitrided and then coated with various low-friction surface coating materials. This study analyses and discusses the priority settings on the basis of constructed model which compares the ranking outcomes among simple additive weighting (SAW), multiplicative analytic hierarchy process (MAHP), technique for order preference by similarity to ideal solution (TOPSIS), modified-TOPSIS (M-TOPSIS) and compromise ranking method (VIKOR). Attribute weights obtained by analytic hierarchy process (AHP), are used as the inputs and outputs are materials' rankings on the basis of material selection index (MSI), which help designers and engineers to reach a consensus on materials.

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# Biofuel Certification Performance: A Review & Analysis

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[2] Department of Mechanical Engineering, Delhi Technological University, Shahbad Daulatpur, Main Bawana Road, Delhi, Pin Code 110042, INDIA
*Corresponding Author: smohite001@yahoo.com

| ARTICLE INFO | ABSTRACT |
|---|---|
| Received: 25 Nov. 2019<br>Accepted: 11 Mar. 2020 | The biofuel performance certification's scope is reviewed. An operational definition of biofuel performance certification has been developed. The certification of biofuel performance has been recognized as an effective assessment methodology and tool to manage biofuel consumption and improve biofuel performance systematically. It is found that a biofuel performance certification method is required in biofuel industry and biofuel research to authenticate the biodiesel and its blends for use in diesel engine. |
| | Keywords: biofuel, performance, certification, energy audit |

## GLOBAL CONSUMPTION OF BIOFUEL

There are various advantages with the use of biofuels such as sustainability, greenhouse gas emissions reduction, regional development, social structure and agriculture. A carbon neutral renewable energy is required to mitigate the greenhouse gas effect (Demirbas et al., 2007). Diesel engine causes harmful emissions which affect ecological system adversely. Alternative sources are being explored to solve this problem. Biodiesel is one of the alternative source (Verma et al., 2015).

The 80% share of primary energy is consumed by fossil fuel globally and out of this, 58% is consumed by the transport industry. The International Energy Agency reported that there was a 23% increase in the consumption of diesel while the increase in the consumption of other petroleum products was 7% from 2000 to 2008 (Ayetor et al., 2015). It is reported that there are 100 billion barrels reserves of petroleum globally and are expected to be exhausted in around 40 years (Orhan et al., 2004). It is stated in the International Energy Agency (IEA) report, that 50% more amount of energy will be required than today in 2030. A growth of 1.8% per year would be estimated for the use of global transport energy from 2005 to 2035. It is also reported that the transport industry is responsible for about 60% oil demand in the world. In the transport sector, 97.6% of the fossil fuel energy consumption is oil and the rest is natural gas. Transport sector causes 30% of total U. S. greenhouse gas emissions and it is the second largest source of GHG emissions after electric power sector in the United States. It is reported that production of biodiesel rised from 15 thousand barrels per day to 289 thousand barrels per day from 2000 to 2008. European Union contributes 85% biodiesel production globally (Atabani et al., 2012).

## BIOFUEL PERFORMANCE MEASUREMENT

To promote biofuel performance, efficiency of diesel engine's measures such as performance and emission characteristics, energy management monitoring, modelling and optimization have been carried out worldwide. These measures are inadequate in proper evaluation and certification of energy performance in use of biofuel.

Efficiency, performance and emission characteristics, energy measurement and monitoring are an effective measure to provide efficiency data in the support of reliability and applicability of biofuel. These data are useful:

1. To reduce energy consumption
2. To establish environmental performance goals
3. To understand the requirement of diesel engine

Efficiency and energy use should be measured and quantified to control efficiency and energy use in diesel engine, performance and emission characteristics. Energy consumption and energy savings are judged and evaluated with monitoring. Energy modelling and optimization are also the basis to study biofuel performance and have received researchers attention.

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# Importance of Energy Audit in Diesel Engine Fuelled with Biodiesel Blends: Review and Analysis

Sanjay Mohite [1,2*], Sagar Maji [3]

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[2] Department of Mechanical Engineering, Brahma Valley College of Engineering & Research Institute, Nashik, INDIA
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*Corresponding Author: smohite001@yahoo.com

| ARTICLE INFO | ABSTRACT |
|---|---|
| | Number of experiments have been performed on various performance and emission characteristics, effect of biodiesel blends on lubricity and input and output energy distribution in diesel engine fuelled with biodiesel blends. It is also reviewed that energy audit is used in buildings, plants, process and equipments and energy audit method was developed for fishing vessels based on similar systems for land based industries. In land based businesses, industries and households, energy audits are presently used to investigate the use of energy and to identify opportunities for the efficiency improvement and effectiveness in the energy use. Energy audits have been used in various sectors, industries and utilities. This paper is a review paper of energy audit and it is found that there is a vast scope for implementation of standardized energy audit in diese engines fuelled with biodiesel blends. Its objective is to find out a standard energy audit method for diesel engine fuelled with biodiesel blends which evaluate the feasibility of biodiesel blend as fuel and also harmonise the research of biodiesel as fuel.<br><br>**Keywords:** energy audit, biodiesel blends, diesel engine, performance and emission characteristics, heat flow analysis |

## ABBREVIATIONS

| | |
|---|---|
| A/F Ratio | : Air Fuel Ratio |
| BSEC | : Brake Specific Energy Consumption |
| BSFC | : Brake Specific Fuel Consumption |
| BTE | : Brake Thermal Efficiency |
| EGT | : Exhaust Gas Temperature |
| JB | : Jatropha Biodiesel |
| KB | : Karanja Biodiesel |
| PB | : Polanga Biodiesel |

## INTRODUCTION

It is reported that an energy audit is used to find out energy use within a structure, plant, process or equipment system and also investigate the energy conservation. The first step of energy audit is the determination of the ways in which energy is consumed, which includes how, what, when, where, why and how much quantity of energy is consumed. If consumption of energy is found out, then, it is simpler to investigate methods to reduce energy consumption with improved management, efficiency and conservation (Parker, 2015).

The latest concept of the energy audit is to focus on the strategy of cost effectiveness towards energy conservation with the considerations of energy costs, government regulations, new technologies, environmental concerns and emerging services in business. Residential, commercial and industrial types of facility are auditable. The audit can be applied to a facility or it can be applied on a focus area of the structure, specified equipments, isolated processes and systems. Energy audit's scope may include electric, gas, oil, water and sewage etc. types of utility services. The audit of refrigerants, boilers emissions and chemical process

# Design and Optimization of Robot Support Structure for Inverted Operation

Santosh H.Pawar, G.R.Selokar

*Abstract: In this paper we present an new method for optimization of robot structure for inverted operations, as rapid development is seen in the fields of robotics, robots are being designed for different operations. Robots move with higher speeds & create inertia loads, & during emergency operation there is sudden spike in load & the robot support structure needs to accommodate these loads. In this project we are analyze the robot support structure. Robot support structure means the main supportive member which is the base of the robot and it gives support as well as stabilization to the robot. 3D geometry of robot support structure is designed as per dimension in the workbench by using ANSYS 16.0. Upon applying boundary conditions such as robot weight, forces applied to his body and moments applied to the structure of the robot support. Following this, stress analysis, von-misses stress, total deformation of the structure of the robot support.*

*Keywords : Finite Element Analysis, Vibration analysis, Material classification for vibration properties, Non Linear FEA, Robot Pedestal design.*

## I. INTRODUCTION

Automation has been rising in the industry for a few days now. Automation is a combination of technologies that result in process and computer operation with no significant human intervention and achieve superior performance than manual operation. Robots are used in many industrial automation projects to develop solutions such as machining, pick & position, etc. Robot word the Czech novelist pronounced in 1920. The word robot comes from the Czech word robota, the meaning of which is to do work or compulsory duty aggressively. Robot can be reprogram, multifunctional manipulator designed to move material, pieces, & tools & accomplish a variety of tasks. In simpler words, it means performing a variety of tasks in less time as a human being and faster in work. To keep the work piece during service, it requires a specialized frame. Precision made robot table and robot platform are standard equipment of capital and are needed in the manufacturing companies of high technology today.Robots are designed to perform complicated tasks for specific functions in a custom environment. Typically, each robot requires its own custom-made robot pedestal, custom-made to size and strength to ensure immobility while supporting the robot firmly.

The robot base is the substructure of any robot that should maintain the robot's motion stable under each type of load.

Due to the importance of the structural base frame, the structural base frame design must be optimized using structural optimization methods in terms of stability, strength, weight and material utilization.

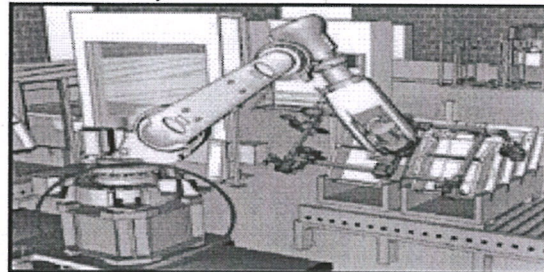From figure given below we can see the location or the structure of robot pedestal.



**Fig. 1: Robot Pedestal**

Robot includes a complex supporting system to carry the work piece correctly during the operations. Precision made robot table and robot platform are standard capital equipment and are needed in today's manufacturing companies with high technology. Most robots are designed to perform high-level tasks for specific functions within a custom environment. Due to dynamic forces, robotic construction is difficult. The force amplifies itself during the process of an emergency stop. The robotic structure should not fail to withstand during stops, so it should be properly designed to take transport load into consideration. The project's aim is to design and analyze the robotic pedestal and optimize the pedestal's structural aspect.

## II. LITERATURE SURVEY

X. Liao (2010)[1] works on the basis of the welding robot in this project. By using ANSYS-10.0, the natural frequencies, robot welding base mode shapes and robot dynamic analysis were discovered. Model analysis findings are, the base's upper edge & tail edge has a greater vibration that can be tired and harmed. At the 7th natural frequency, they find a peak amplitude of 39,249 Hz. The results are fast and reliable by using ANSYS -10.0 code

G. Chung et al. (2010)[2] This work is based on heavy duty industrial robot design. After checking or figuring out the static & dynamic analysis of heavy duty applications, i.e. at a weight of 600kgf(max).

# Frequency Optimization of Robot Support Structure for Inverted Operation

Santosh Haribhau Pawar, G. R. Selokar

*Abstract: : In this paper we have represented new method of optimization of the robot structure for various reverted operation In today's age the rapid development in robotics is been noticed, robots are developed for multipurpose operations in industrial field. The high inertia load are created due to emergency operation, the gradually applied and suddenly applied loads are developed, the structure should withstand this type of loads Furthermore, the robot has a certain frequency of operation, & the structure frequency needs to be higher than that of robot, to avoid failure due to resonance. The structure has a complex web of members hence finite element analysis is needed to perform analysis. The new structure, the robot is mounted in an inverted manner on the ceiling, this adds to the complexity of the analysis. The proposed method is compared with state of art systems.*

*Keywords: Finite Element Method, Modal analysis, Non Linear FEA, Robot Support structure design.*

## I. INTRODUCTION

The robot birth took place in year 1920, by Czech Karel Capek by Rossum's Universal Robot, in Czech the robot stands for work. The term has been applied to a great variety of devices, such as humanoids (trying to mimic humans), domestic robots like robot vacuums cleaners and robot lawn movers, underwater vessels, military missiles, autonomous land rowers, etc. Almost anything that operates with a point of independence, usually under computer regulator, has at some point been called a robot. This paper deals with industrial robots, which consist of a mechanical arm with a number of joints, the robot arms are actuated by means of (electric) motor with the transmission lines. The controlling of the robot movement is done by computer controlled system this type of robot is usually called robot manipulator or simply manipulator. A widely accepted definition of a robot consistent with the Robot Institute of America (Spong and Vidyasagar, 1989) is: The robot is multi-functional manipulator and designed for the purpose of moving the materials, tools, an specialized device though repeated programmable device for different tasks. Industrial robots are

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Dr. G. R. Selokar, Professor, SSSUTMS, Sehore, (M.P.) India.

essential in doing the complex works. They won't save the cost but increased the productivity and quality, and there is elimination of the labor work. The accuracy of the manipulator is based on mathematical model, and they should accurate. The model described the complicated non linear motion between robot motion and motor motion. The models are designed in such a way that they can withstand the robot structure load, and used in many fields like mechanical designed, performance simulation, control diagnosis, and supervision. A trend of light weight robot structure are now-a-days introduced, where the load is reduced in preserved payload capacity. This is motivated by cost reduction also as questions of safety, but leads to a weaker (more compliant) mechanical structure with enhanced elastic effects. For high performance, it's therefore necessary to possess models describing these elastic effects.

## II. LITERATURE SURVEY

Robert J. Sayer et al. (2003)[2] The finite element technique can be used for the dynamic analysis of existing equipment and also evaluate the dynamic characteristics of machine or structures prior to fabrication. FEA models can be used to find "stress stiffening" effects in rotating machine elements. This method is used to approximate the natural frequency and mode shapes of the mechanical systems. The FEM method is approximate numerical method. The accuracy of the solution is obtained by FEA depends upon the various factors. The factors are as follows:

1) Degree of refinement of the element mesh.
2) Appropriateness of the finite element types used to model a machine/structure.
3) Boundary conditions used at the limits of the finite element model.

Juren xie [2012] in his report FEA technology has became an important tool for evaluating the structural performance of offshore platforms. The evaluation is done when the structure is in special loading conditions such as earthquakes and vessel impacts. Although submerged oil wells were drilled from platforms as early as 1890's, the first modern offshore drilling/production platform was installed in 1947 off the coast of Louisiana at a depth of 6.1 m.

## III. ROBOT SPECIFICATION

### A. Specification

We are designing robot pedestal for six robot for given load condition in specification library.

3.3.1 Number of research papers published per teacher in the Journals notified on UGC website during the last five years

Academic Year 2019-20

Paper Count-01

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| | | | | | | Link to website of the Journal | Link to article / paper / abstract of the article | |
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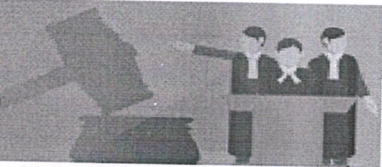
## DETERMINANTS OF MSME COMPETITIVENESS IN ACEH PROVINCE

### Chairil Akhyar[1], Ikramuddin[2], Em. Yusuf Iis[3], Mariyudi[4]

[1,2,3,4] Departement of Management, Faculty of Economic and Business Universitas Malikussaleh

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### Abstract

*Micro, Small and Medium Enterprises are one of the drivers of national economic growth, because of their ability to absorb workers equal to 95% with a total investment of 60.4%. This study aims to examine the effect of capital capability, empowerment, and product innovation on the competitiveness of micro, small and medium enterprises. And the role of product innovation as a mediating variable in the indirect influence between the coaching program and capital on the competitiveness of micro, small and medium enterprises in Aceh. Study designs a Quantitative Research. This research was conducted on micro, small and medium enterprises (MSMEs) in Aceh Province, Indonesia. The population in this study were micro, small and medium enterprises (MSMEs). The research sample was determined by purposive sampling, with a sample size of 272 SMEs. While the data analysis tool usesStructural Equation Modeling (SEM) Amos to test the effect between exogenous variables and endogenous variables. Pdirect effect test found that capital has no effect on product innovation by -0.035, P-Value 0.754 (Not supported H1). Empowerment has a significant effect on product innovation by 0.249, p-value 0.030 (Supported H2). Capital has a significant effect on the competitiveness of SMEs by 0.220, p-vale 0.014 (Supported H3). Empowerment has a significant effect on MSME competitiveness by 0.542, and p-value 0.000 (Supported H4), and product innovation has a significant effect on MSME competitiveness by 0.274 and p-value 0.000 (supported H5). To test the indirect effect using the Sobel test calculator, it was found that product innovation variables were able to partially mediate the relationship between capital and empowerment on the competitiveness of SMEs. The results of the study indicate that the Empowerment and Product Innovation variables have a significant effect on the competitiveness of MSMEs both directly and indirectly, except for the Capital variable which is found to be insignificant to Product Innovation. Finally, the researcher concludes that the competitiveness of micro, small and medium enterprises in Aceh is determined by the factors of capital capability, empowerment program and product innovation.*

Keywords: *Capital Ability, Development, Product innovation, Competitive advantage, SMEs.*

## 1. INTRODUCTION

Indonesia is currently entering the demographic bonus phase, where the proportion of young people currently amounting to more than 25 percent of the total of about 270 million Indonesians combined with 59.2 million Micro, Small, Medium Enterprises (MSMEs) units that make a big contribution to the National Gross Domestic Product (GDP) (Central Bureau of Statistics (BPS), 2020). The high rate of population growth is not proportional to the high growth of entrepreneurship. Indonesia's entrepreneurial growth until 2020 is 3.47% or Indonesia is in position 94 out of 137 countries in the world(Adam, Ibrahim, Ikramuddin, & Syahputra, 2020). According to the magazine(CEOWORLD. Magazine's, 2021), Entrepreneurship Index Indonesia in 2021 ranks 45th as the most entrepreneurial country in the world out of 100 surveyed countries, with the ability to access capital of 226.52 and openness for business of 0.44 percent. In addition, for the category of the most innovative country, Indonesia is ranked 3.95. This percentage is much smaller than other Asean countries. On average, developed countries have an entrepreneurial growth rate of 14 percent.

The low growth of entrepreneurship in Indonesia is influenced by several weaknesses that can affect the competitiveness and productivity of small and medium enterprises. The concept of

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3.3.1 Number of research papers published per teacher in the Journals notified on UGC website during the last five years

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# Experimental Investigation of New Innovative Flat Plate Collector for Solar Water Heater

P.P.Patil, Dr.D.S.Deshmukh, Dr.A.M.Vaidya, I.D.Paul

*Abstract:*

Paper Water heating is the need for domestic as well as industry. Heating of water by solar water heating system is present but the system takes more time and losses heat fast in a cloud environment. The objective of the paper is to develop a flat plate collector for solar water heater which can heat the water fast i.e. we can get warm water, hot water as per need. The experiment is carried out with two developed model of flat plate collector and comparative results with conventional model are presented.

*Index Terms: Solar water heater, Concentrator collector, Variable riser tubes, Solar collectors.*

## I. INTRODUCTION

There is numerous solar water heating system used so far [2]. As per the literature available on solar water, heater cost is the major factor and therefore different heating element is used for solar water heating. PVC also gives the effective result and it is available at low cost [3]. [4] Gives the experimental studies of the water heating with a humid climate and found there is a need for auxiliary heating. [5] fabricated the solar water heater (SWH) using the locally available material and the performance got was remarkable with 510 C to 550 C. [6-11] experimentally and theoretically analyzed the performance of SWH collector by the effect of spacing between the riser tubes. [12]

uses the TRNSYS software to study the effect of thermal conductivity of the steel, aluminum & copper absorber plate in SWH system. [13] Study the effect of sandwich absorber sheet of GI and copper sheet to analyzed the temperature difference using Hottel-Whillier Bliss efficiency curves. [14] Uses the aluminum pocket of size 0.35 m X 0.1 m and aluminum pipe. The absorber is made of the aluminum box and used in flat plate collector. the result obtained with a maximum of 690C. [14] studied the performance of the absorber plate with several profile shapes and optimize for better performance. It studied rectangular, trapezoidal and rectangular profile shape. The trapezoidal profile gives better performance than the other profile. [15] study found that the reduction in the heat transfer rate is due to the non-uniform temperature distribution between pipes.[18] design a low-cost type of integrated collector storage solar water heater with a compound parabolic collector (CPC). The design suppresses the thermal losses and increases the optical efficiency with low investment cost. [19 & 20] study the concentration system using asymmetric CPC reflector troughs with an ICS system made up of two storage tanks. Another researcher [21 & 22] used the single and double cylindrical tank in combination with symmetric CPC-type reflectors.[23] uses a solar PV panel with single and double collector flat plate collector in mahsana Gujrat and found the overall increase in efficiency by 12% in double flat plate collector.[24] investigate the performance characteristics of the solar flat plate collector with Solchrome, Matt black and Black chrome coating for riser and header tubes. It is found that black chrome gives better radiant then other. [25] investigate the combined system and SWH model for the incrementally improved performance of the combined system for load, size, and location.

The literature gives the efforts of the researcher for increasing the thermal performance and overall efficiency of the SWH system. The researcher tries many ways by changing the absorber sheet, coating using a PV panel and got the results for their study. The study incorporated in this paper is to replace the absorber sheet with the angular reflector sheet and to use the different diameter of the riser tube for studying the effect on output temperature and overall efficiency of the collector.

# Design and fabrication of Oil Collector

S H Pawar[1], Shukla Amit Kumar[2], Ahire Vishu[2], Patil Yashodhan[2], Patil Mayuresh[2]

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**Abstract:** - World has witnessed big oil spillage accidents into ocean and made huge impact to the environment. Apart this, sometimes Oil is getting spillage through being the results of chronic and careless habits in the use of oil industries and oil products. Offshore drilling & production operations and spills or leaks from ships or tankers are typically contributing less than 8% of the total whereas routine maintenance of ships (nearly 20%), onshore air pollution & hydrocarbon particles (about 13%) and natural seepage from the sea floor (over 8%). This has caused ever lasting damage to aquatic life. To separate the mixed oil from the water, industries wide various type of oil skimmers is getting used. Herewith, the objective of this project is to design and conduct efficiency studies of belt type oil skimmer by using various materialed belts. The belts absorb the oil from water which can be scooped out and collect into a vessel by providing piping arrangements.

**Key Words:** — *Oil spillage, offshore Drilling& production, Aquatic life, Oil skimmer.*

## I. INTRODUCTION

Pollution is a major area of concern in the modern era. The main reason of water pollution throughout the globe is oil and oil spills. Therefore, our aim is to control this type of pollution by designing equipment which separates oil from water. Hence, proper collection, disposition and storage of oil are necessary.

Many countries have made stringent safety norms for waste water disposal contained with oils mainly typically from petrochemical and process industries so that such industries are equipped with such kind of oil skimmers/Skimmers to separate the oils from disposal water. There are various methods are used for collecting the oil from water. Different types of machines are used for oil collection purpose.

The collection of spilled oil is performed by means of special vessels called oil skimmers/Skimmer. The ultimate aim of any recovery operation is to collect as much oil as is reasonably and economically possible.

A skimmer is defined as any mechanical device designed for the removal of oil (or oil/water mixture) from the surface of water without altering the water physical and/or chemical characteristics. The principles for skimmers' operation are based on the fluidity properties of oil and oil/water mixture, density differences between oil or oil/water mixtures, and water or differences in adhesion to materials.

These technologies are commonly used for oil spill remediation but are also commonly found in industrial applications such as removing oil from machine tool coolant and removing oil from aqueous parts washers. They are often required to remove oils, grease and fats prior to further treatment for environmental discharge compliance. By removing the top layer of oils, water stagnation, smell and unsightly surface scum can be reduced;

Placed before an oily water treatment system may give greater oil separation efficiency for improved waste water quality. It should be noted that all oil skimmers will pick up a percentage of water with the oil which will need to be decanted to obtain concentrated oil.

## II. BODY

### A. Types of oil Skimmers

#### 1. Oleophilic type oil skimmers:

Oleophilic skimmers recover oil based on the properties of specific materials, which have greater affinity for oil than for water. There exist numerous types of oleophilic skimmers and they are therefore divided into subgroups such as disc skimmers, drum skimmers, rope mop skimmers, belt skimmers, and brush skimmers. Regardless of the type of skimmer, the principle behind the technique used is the same

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# State of Charge Estimation of Lithium-Ion Battery for Electric Vehicles Using Machine Learning Algorithms

Venkatesan Chandran [1], Chandrashekhar K. Patil [2], Alagar Karthick [3,*], Dharmaraj Ganeshaperumal [4], Robbi Rahim [5] and Aritra Ghosh [6,*]

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**Abstract:** The durability and reliability of battery management systems in electric vehicles to forecast the state of charge (SoC) is a tedious task. As the process of battery degradation is usually non-linear, it is extremely cumbersome work to predict SoC estimation with substantially less degradation. This paper presents the SoC estimation of lithium-ion battery systems using six machine learning algorithms for electric vehicles application. The employed algorithms are artificial neural network (ANN), support vector machine (SVM), linear regression (LR), Gaussian process regression (GPR), ensemble bagging (EBa), and ensemble boosting (EBo). Error analysis of the model is carried out to optimize the battery's performance parameter. Finally, all six algorithms are compared using performance indices. ANN and GPR are found to be the best methods based on MSE and RMSE of (0.0004, 0.00170) and (0.023, 0.04118), respectively.

**Keywords:** lithium-ion battery; battery management; sustainable energy; machine learning algorithms; electric vehicles; state of charge

## 1. Introduction

The transport industry accounts for the bulk of greenhouse gas emissions and pollution to the environment [1]. The transport sector can be improved by the introduction of the e-mobility applications such as electric vehicles (EVs) [2], hybrid locomotives and other battery-energy storage systems [3]. The energy storage system is one of the most significant parts of EVs and smart grid technologies [4–7]. The smart grid technology is the emerging technology in electricity transmission and distribution lines. Numerous batteries are available in the market for various energy storage applications. Specifically, lithium-ion batteries are selected as an energy storage technology for EVs due to its gravimetric and volumetric density, high hour's efficiency, and long life [8,9]. However, thermal management of batteries for EV application is important [10]. EV charging stations are widely used internationally, and ports have been expanded at public and private charging points [11]. In Belgium, two EVs with different battery capacities are investigated. It is reported that the grid utility for the EVs leads to volatility in power supply, electricity quality and grid control issues [12,13]. Currently research is going on to transform buildings from energy consumers to energy producers by integrating renewable energy systems into the building

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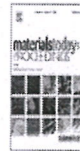
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# Review on application of phase change material for BIPV system

V. Kumar Chinnaiyan [a], Chandrashekhar K. Patil [b], Milind M. Patil [c], Prasad Ramchandra Baviskar [c], Alagar Karthick [a] ⚲ ✉, P. Selvakumar [d], S. Rajkumar [e]

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# Studies on mechanical properties of brake friction materials derived from carbon fibres reinforced polymer composite

Udaykumar V. Saindane *, Sandeep Soni, Jyoti V. Menghani

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## ARTICLE INFO

## ABSTRACT

Friction formulation which is derived from combinations of carbon based materials including those which are present in nano scale are introduced to fabricate carbon fibers reinforced polymer composite to enhance the friction performance in this paper. Two samples of decided combinations of ingredients are prepared adopting the procedure of powder metallurgy method. Mold of cast steel is developed by welding and forging process for preparation of sample number 2, while plastic mold is developed for fabrication of sample number 1. Mixture is poured into plastic mold at room temperature after proper mixing and stirring for 20 min time and allowed it to cure for two days inside mold cavity to fabricate the Sample No.1. Similarly mixture is poured into steel mold and put into stir cast furnace for 10 min at temperature 180 °C and 15 Mpa pressure, then mixture is allowed to cure by removing out from stir cast furnace for 6 h and sample No.2 is fabricated. Test specimen from both samples are prepared and tested performing shore D hardness test and compression test following standard test procedure. Test results are reported which shows higher hardness and compression strength values for sample no.2 which is manufactured by application of pressure and temperature and validated by comparison with properties of commercial brake pad mentioned in the literature. In a nutshell, carbon based polymer friction composite is developed and characterization is done to check mechanical behavior of composite.
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## 1. Introduction

Different hybrid composite materials have been studied in recent years. A mixture of nanoparticle fillers, fibres and resins has been found to provide the ideal properties required for the application of the brake pad. The history of brake pads shows that the output of a brake pad depends on the functionality of component of the brake pad. It is therefore necessary to determine the functionality and composition of materials used for the application of brake pads.

A. Koval'chuk et al. [1] studied the impact of integrating C11-MWCNTs on the structural, electrical, and mechanical properties of nanocomposites based on polypropylene. Chemical functionalization of MWCNT by attaching-(CH2)10 CH3 alkyl chains has been investigated.

F. H. Gojny et al. [3] reported that the thermo-mechanical properties of MWCNT / epoxy composites are influenced by the functionalisation of multi-wall carbon nanotubes (MWCNTs). Epoxy resin-based samples and different percentage weights of MWCNTs (functionalized and non-functionalized) were prepared. The determination of the thermo-mechanical properties of the nanocomposites resulted, with the addition of nanotubes, in a general increase in thermal stability.

Nano-CaCO3, nano-SiO2, and nano-TiO2 as fillers significantly improve the mechanical properties and wear-resistance of the carbon fabric, according to F. h Su et al. [4]. The addition of nanoparticulates as fillers improved the bonding strength between the fabric and the adhesive resin.

Gbadeyan, O.G. et al. [5] observed that the performance of short carbon fibres (SCF) and multi-walled carbon nanotube (MWCNT) was superior. Due to the cooperation between SCF and MWCNT compared to SCF alone, a reduction in wear rate was observed. It could be inferred that SCF has synergistic roles. A better tribological effect is given by MWCNTs in hybrid composites without any micro crack with even furrow wear.

J. Li et al. [7] discovered that a carbon fiber content of 20% results in the most effective wear reduction. The adherence and

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# Multi objective optimization in turning operation of SS304 sheet metal component

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**ARTICLE INFO**

**ABSTRACT**

A thorough investigation is conducted on turning operation machining parameters on SS 304. Using the Grey–Based Taguchi approach, this research looks at multi-objective Turning process optimization in order to locate best parametric in conjunction for a minimum production time and maximum tool life. Feed rate, Cutting speed as well as depth of cut are all called turning parameters. In order to overcome the multi-response optimization problem, total nine test runs based on Taguchi's L9 OA were performed. Grey relational analysis follows. The Grey relational grade value was used to determine optimum parameter levels. The use of analysis of variance (ANOVA) will be crucial in the recognition of the most significant parameters among speed, feed, and cut depth.
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## 1. Introduction

The process of determining optimum machining parameters is a continuous engineering task with the goals of decreasing production time and increasing tool life. Tool life is among the most significant performance indicators in the turning phase. Tool life is a commonly used quality indicator and, in most cases, a technological condition for mechanical items. Around the same time, production time is taken into account as a factor that has a direct impact on production costs and machining hour rates. In a turning process, selection of cutting parameters for high cutting quality efficiency for a specific machine and conditions is critical. In order to increase tool life and reduce production time, this paper used a multiple quality optimization approach to assess the best combination of Grey relational analysis along with the Taguchi approach values of cutting parameters. Taguchi's L9 OA, which consists of same no. of factors and levels i.e. three each, was used to improve the various parameters of good quality finished turning process over a small number of trials in order to find the best method. The cutting speed, depth of cut, and feed rate were chosen as the three controlling variables. To reduce a multi-objective problem to a single objective, a GR grade is used. GRA was used to locate the best process parameters in combination that optimize tool life while reducing production time [1–4].

R. Viswanathan et al. [5] The goal of this research is to investigate cutting power, tool flank wear, material removal rate and surface roughness while performing turning operation on magnesium alloy under dry conditions for a carbide insert coated with physical vapour deposition. Taguchi's L27 OA was used for the trials. The best parameter settings were determined by combining principal component analysis and GRA. According to the study of variance, the depth of cut is the most influencing parameter in this phase of multiple-output characteristics.

P. Umamaheswarao et al. [6] this study shows how to use multi-objective optimization to get the best surface quality, machining power, and the temperature of the workpiece's surface while hard turning AISI 52,100 steel. Input Feed rate, depth of cut, cutting speed, and nose radius are all variables to consider. The L9 orthogonal Taguchi array is used in the experiments. GRA and Principle Component Analysis are also used to perform multi-objective optimization. The most important factor influencing the response analyzed was the nose radius, followed by speed, feed and depth of cut.

R.A. Kazeem et al. [7] this is the goal analysis were to see how well some not-so-known vegetable oils performed as machining cutting fluids. The impact roughness of the surface of jatropha oil

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# Investigation on the turning process parameters for tool life and production time using Taguchi analysis

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## ARTICLE INFO

## ABSTRACT

This study applies Taguchi method for optimizing process parameters using for SS304 material for better tool life and less production time. Feed rate, Cutting speed and Depth of Cut are the machining parameters are used with consideration of tool life and production time for application of Taguchi method, Analysis of Variance (ANOVA). Outcomes of the experimentations used for the measurement of S/N ratios, which are further used to optimize the tool life and production time parameters. The maximum tool life and minimum production are then predicted using confirmation test. Results revealed that feed rate has significant effect on tool life and cutting speed has significant effect on production time. The optimal parameters for maximize tool life is found to feed rate 0.14 mm/rev, depth of cut 0.40 mm and cutting speed of 350 m/min and For optimizing minimum production time, the optimum conditions are cutting speed 550 m/min, feed rate 0.14 mm/rev, and depth of cut 0.40 mm.

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## 1. Introduction

In most of the industries turning is used for extracting metal. Many industries like automotive, aerospace, machinery design as well as in manufacturing industries employ turning process. One of the significant and commonly used development methods in the engineering industry is metal cutting. The metal cutting analysis focuses on tool characteristics, input work materials, system parameters and output efficiency responses. Optimization of method parameters defines and specifies the areas containing important process control factors that lead to a substantial improvement in process efficiency can be obtained desired outputs with sufficient variations to ensure a lower production. Processes such as turning, some vital elements are cutting speed, feed rate and cutting depth. An essential role in the successful utilizing a machine tool is played. For a realistic machining situation, because there is no suitable machining circumstance for the prediction of existence the tool life as well as production time, machining theory is available to predict these parameters, one is compelled to rely on empirical equations. However there are a variety of constants

involved in these empirical equations, which are not immediately accessible. In addition, these constants are dependent on many factors, a large amount of data is therefore needed for an extremely difficult task is a general workshop situation and collecting and handling such data. The cutting parameters of SS 304 in CNC turning machines are investigated and optimized in these paper parameters for cutting, such as feed rate, cutting speed and depth of cut.

## 2. Literature review

The aim of the literature review is to determine the scope of the research community's efforts and the contributions of various researchers in the field of dynamic behavior analysis. This effort was made to obtain current knowledge, completed work, and future potential in this area. The following are the major results of their research. Ahmet Hasçalık et al. [1] in this paper, Ti-6Al-4V have been tested on tool life using same machining parameters. This study concludes that tool life has significant effect of depth of cut.

Hamdi Aouici et al. [2] investigated the flank wear because of criteria for cutting using CBN tools under the hardened metal turning operation AISI H11. Based on the response, the machining

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| Optimization on the Turning Process Parameters of SS 304 Using Taguchi and TOPSIS | Prof.N.J.Rathod, | Mechanical | Annals of Data Science | 2021 | 21985812, 21985804. | https://www.springer.com/journal/40745 | https://doi.org/10.1007/s40745-021-00369-2 | UGC |
| Dry Sliding Behavior of Carbon-based Brake Pad Materials | Prof.U.V.Saidane | Mechanical | International Journal of Engineering | 2021-22 | ISSN 1025-2496 | https://www.ije.ir/ | https://www.ije.ir/article_138424.html | UGC |
| Split Journal Bearings Design Optimization Using Multi Objective Genetic Algorithm· | Dr.H.N.Kudal | Mechanical | Gradiva Review Journal, , Volume 7 | 2021 | ISSN No : 0363-8057 | https://gradivareview.com/ | https://drive.google.com/file/d/14XGtGY0ttkxQ5gtSZzYkQpfb6GTzEOmV/view | UGC |
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| Design and Optimization of process parameters for hard turning of AISI 304 Stainless Steel using Taguchi-GRA-PCA | Dr.S.H.Pawar, N.J.Rathod | Mechanical | International Journal on Interactive Design and Manufacturing (IJIDeM) | | ISSN1955-2505 | https://link.springer.com/ | https://link.springer.com/article/10.1007/s12008-022-01021-w | UGC |
| fabrication of al-zr-mg-ni matrix composite with tic reinforcement multi pass recursive fricyion stir processingits charactorization and | Dr.Chandrashekhar K.Patil | Mechanical | Materials Today: Proceedings | 2022 | ISSN2214-7853 | https://www.sciencedirect.com | https://www.sciencedirect.com/science/article/pii/S2214785322002607 | UGC |

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# Friction and Wear Performance of Brake Pad and Optimization of Manufacturing Parameters using Grey Relational Analysis

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PAPER INFO

ABSTRACT

Brake pads play very important role in the safety of automobiles as they control the speed of the vehicle. Therefore manufacturing aspects of the brake pads and improvement in their performance were studied in this paper. Experiments are designed based on Taguchi's L9 orthogonal array. Manufacturing pressure, temperature and time are taken into consideration as process variables. Nine sets of experiments were conducted. Each experiment consisted of distinct combination process variables. Thus Brake pads with Kevlar and Lapinus fibers as a reinforcement and Epoxy resin as a binder, Barium sulfate as a filler and Aluminium oxide as a friction modifier were manufactured using the hot compression method during each experiment. Friction and Wear performance was accessed by the measurement of the coefficient of friction and weight loss during the trial on the pin on disc apparatus. Specific wear rate was obtained by measuring the differences in density and weight values before and after the trial run. The required values of process parameters i.e. pressure (500 psi), time (8 min.) and temperature (180 °C) which give optimum values of coefficient of friction and Wear were determined using Grey relational analysis.

## NOMENCLATURE

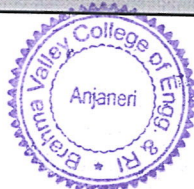| COF | Coefficient of friction | CBP | Commercial brake pad sample |
|-----|------------------------|-----|------------------------------|
| SWR | Wear rate | GRA | Grey relational analysis |

## 1. INTRODUCTION

The performance assessment of brake pads is required on regularly because the brake pad is mainly responsible for maintaining the vehicle's safety and control. The performance of the brake pad is assessed by the comparison method. In this comparison, friction and wear characteristics of newly developed brake pads were compared with the same characteristics of commercial brake pads available in the market. The friction and wear characteristics for both the brake pads are obtained by conduction of trial using pin on disc apparatus or dynamometers. The dry sliding behavior of friction composite predicts the accurate friction performance for

the automobile brake pads [1]. The comparison of dry sliding behavior and wear mechanism of low metallic and copper-free brake pads was performed to select the optimum friction composite [2]. Two commercial pads 1) high metallic fiber material, includes 7% copper fibers, 2) low metallic friction material contains thermal graphite (TG), and cellulose fibers as copper substitutes were investigated. The thermal behavior of the two friction materials was nearly identical. Cu-based friction material, on the other hand, was more thermally stable. This work is related to the work discussed in this paper as both compares newly developed brake pads with commercial brake pad used in practice. Pin-on-disc testing was performed to investigate the sliding behavior

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# Optimization on the Turning Process Parameters of SS 304 Using Taguchi and TOPSIS

Nikhil J. Rathod[1] · Manoj K. Chopra[1] · Prem Kumar Chaurasiya[2] · Umesh S. Vidhate[3] · Abhishek Dasore[4]

## Abstract

Turning is a basic machining technique where parameters may be optimised to improve machining performance. The Taguchi and TOPSIS methods were used to find the parameters of optimum process in turning SS 304 using coated carbide tools. Cutting speed, feed rate, and depth of cut are all considered in the operation. This improves tool life while lowering production time and surface roughness. TOPSI and an orthogonal array are used to investigate the effects of input parameters on output parameters. In this work, S/N ratios are utilized to create a decision matrix, which is then utilized to convert a problem with multiple criteria for solving into a single-criteria issue using the TOPSIS approach. The results demonstrated that the strategy proposed is suitable for resolving multi-criteria process parameter enhancements. The best combination of process specifics was found to be 350 m/min cutting speed, 0.12 mm/rev feed rate, and 0.40 mm cut depth.

**Keywords** Surface roughness · Tool life · Production time · Optimization · TOPSIS
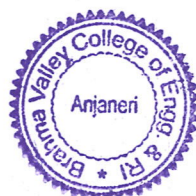
## Abbreviations

Cs   Cutting speed
Fr   Feed rate

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# Dry Sliding Behavior of Carbon-based Brake Pad Materials

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**PAPER INFO**

**ABSTRACT**

The brake pad plays a crucial role in the control of vehicle and machinery equipment and subsequent safety. There is always a need for a new functional material with improved properties than existing ones. The present research study was carried out to develop a new brake pad material made up of polymer nanocomposite for enhanced physical, mechanical, and frictional characteristics in comparison to existing brake pad materials. In this study, polymer nanocomposite samples were developed and their physical properties namely density, water-oil absorption, and porosity were evaluated. Mechanical hardness of developed samples was estimated with Vicker's hardness tester. Frictional characteristics of samples and wear values determined with pin or disc apparatus. Dry sliding behavior was examined by conducting multiple trials with sliding speed in the span of 2-10 m/s and load were changed from 20 N to 100 N to discuss the effect of velocity, the effect of nominal contact pressure and the effect of sliding distance on friction and temperature parameters. Morphology of prepared brake pad samples was characterized with the scanning electron microscope. Scanning electron micrographs of brake pad surfaces showed different shape wear debris and plateaus significantly affecting the friction characteristics. Developed samples along with commercial specimens show excellent resistance to water and oil absorption. Thus obtained results for evaluated polymer nanocomposite brake pad samples demonstrate their potential for brake pad applications.

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**NOMENCLATURE**

| | | | |
|---|---|---|---|
| FBP | Fabricated brake pad | POD | Pin on Disc |
| CBP | commercial brake pad | SCF | short carbon fibers |
| COF | Coefficient of friction | CNT | carbon nanotubes |
| MWCNT | Multiwall carbon nanotubes | WA | Water absorption |
| CI | Cast iron | OA | Oil absorption |

## 1. INTRODUCTION

The braking mechanism is a critical part of cars and machinery equipment. As opposed to drum brakes, most cars now use disc brakes because they escape heat faster and thus reduce fade. Brake pads transform the vehicle's kinetic energy to thermal energy. The brake pad is making contact with the disk to provide force for stopping, it gets heated up as a result minor quantities of friction compounds are transferred to the disc or pad [1]. However, no particular material could meet the expected performance-related requirements like safety and reliability under different brake conditions in a disc brake system. The friction materials must provide a stable COF and high wear resistance at different operating pressures, speeds, environmental conditions and temperatures. Additionally, these materials should be compliant with the material of the rotor to minimize wear of rotor, friction, and braking noise [2].
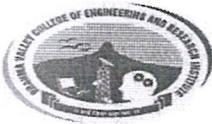
Some of the unique benefits of hybrid composites over traditional composites are balanced strength and stiffness, balanced bending and membrane mechanical characteristics, balanced thermal distortion stability, and decreased cost and weight. Various hybrid composite

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# SPLIT JOURNAL BEARINGS DESIGN OPTIMIZATION USING MULTI OBJECTIVE GENETIC ALGORITHM

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## ABSTRACT

This paper deals with objective of minimization of oil flow, minimization of temperature rise and minimization of power loss of heavily loaded journal bearings. The case study of sugarcane mills heavily loaded journal bearing is considered for design optimization. Design variables like length to diameter ratio, lubricant viscosity, clearance, eccentricity ratio and journal speed are considered for design optimization. Hybrid solution scheme of journal bearings is used for constructing multi objective function. In the design of journal bearings l/d ratio, clearance, viscosity of lubricant, speed and eccentricity ratio are considered as designed variables. A genetic algorithm with pareto optimality concept is used to eliminate difficulty of selecting weighting factor for multi objective optimization problem. Pareto optimal set gives superior design vectors. Results of pareto optimal front are tabulated and explained graphically in the paper. Design optimization results shows that optimum range clearance falls in between 208 microns to 269 microns and bounds for clearance is 200 microns to 300 microns. This justifies that larger clearance for cane mill journal bearings will reduce frictional power losses but will increase the oil flow rate. Viscosity of oil shows variation from 0.038 Pa-s to 0.040 Pa-s. A lower value of viscosity of oil is given preference for design considering minimum oil flow rate and minimum temperature rise. Other design variables like length to diameter ratio speed and eccentricity does not show any variations from lower bound to upper bound. Obtained results of optimization are the recommendations for selecting design variables of heavily loaded journal bearings of sugar cane mills.

KEY WORDS: Journal Bearing, Multi Objective Optimization, Genetic Algorithm, Pareto Optimality.

## INTRODUCTION

Journal bearings are used in rotating machineries of industrial applications due to their large load carrying capacities, less wear and better damping characteristics. In the design of journal bearing nonlinear second order Reynolds equation is solved [1]. Different techniques are used in solving Reynolds equation like finite bearing approximations, infinite bearing approximations, finite difference methods, etc. [2-5]. Results of short bearing approximations are suitable for smaller eccentricity ratios and smaller length to diameter ratio, whereas results of long bearing approximations are suitable of larger eccentricity ratio and length to diameter ratio. In the present paper journal bearing design table provided by the hybrid approach [6] of solving Reynolds equation is used for multi objective optimization problem of heavily loaded journal bearing. Performance of journal bearing depends on variables like viscosity of oil, radial clearance, length to diameter ratio and supply pressure.

The optimization problem of journal bearing is related to three tasks, namely to obtain a precise function for the evaluation of journal bearing performance, develop optimization objectives along with design variable constraint and select rapidly converging optimization technique to obtain global minima or maxima for defined objectives. Multi-objective optimization of bearings can be viewed as a minimization of temperature increase and side leakage [7, 8]. Optimization of high-speed, short journal bearings (0.2 < λ < 0.6) using weighting and scaling factors to combine the two objective functions into one multi-objective function was achieved [7-10]. However, this has the disadvantage that the designer must have prior knowledge about the relative importance of each objective. Optimization of journal bearing by minimizing the leakage and power loss, considering them as two "independent axioms" was done [11, 12]. An alternative approach to multi-objective optimization, namely Pareto optimal fronts was used [13, 14]. This approach uses a posteriori articulation of the weights in that the designer initially generates a number of non-inferior (a set of equally efficient) solutions from which a final decision is made on any one solution. Aggregate several performances using a scaling and weighting strategy was adopted [17]. The scaling and weighting factors are arbitrarily chosen, which determine the generation of a single objective space in which the solution is found in terms of the optimization process and the objective design, a genetic algorithm was used to minimize oil consumption and power loss, which are conflicting, aims [18]. Hence, the optimal choice of parameters for the design of journal bearings is a multivariable and multi objective problem

The present work deals with objective of minimization of oil flow, minimization of temperature rise and minimization of power loss of heavily loaded journal bearings. The case study of sugarcane mills heavily loaded journal bearing was considered for design optimization. Design variables like length to diameter ratio, lubricant viscosity, clearance, eccentricity ratio and journal speed are considered for design optimization. Hybrid solution scheme of journal bearings is used for constructing multi objective function. In the design of journal bearings length to diameter ratio, clearance, viscosity of lubricant, speed and eccentricity ratio are considered as designed variables.

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## Agricultural Technology, Marketing and Finance in Maharashtra

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**Abstract:**

The agriculture sector has always remained a focal point of our economy. It embodies the three thrust areas viz. technological promotion of inclusive growth, enhancement in rural income and sustenance of food security. Agricultural technology research is the utilization of innovation in farming area fully intent on further developing yield, proficiency and benefit. Beginning around 1960, after the 'green upheaval, the nation has not seen any major innovative leap forward in agribusiness. Various schemes are being implemented to improve performance in agriculture. Indian farmers are responding well to opportunities in commercial agriculture and diversifying to meet the rising demand for food products. Such patterns show that the yield efficiency is differentiating towards non-food grains and high-esteem wares like products of the soil. Furthermore, an expansion in efficiency drives up horticultural pay and works on the seriousness of this area. It is noticed that there has been constant change in land use with the increasing pressure of population and consequent demand for food, development activities and technological improvements. The volume of creation relies not just upon the capital ventures and promoting systems yet in addition on the specialized limit utilized during the creation and handling stage.

**Introduction:**

Risk and uncertainties are common in agriculture due to the very characteristic of agriculture i.e., dependence on nature. There are number of elements that influence the profits from cultivating, a considerable lot of which are past the control of farmers. Events of dry spell, flood, unfavorable precipitation, hailstorm and so forth are a couple among the extensive rundown of elements that influence the profits from cultivating straightforwardly. India is viewed as powerless against the impacts of environmental change because of a few elements like high reliance on horticulture, low inclination of water system, lower asset accessibility at individual homesteads and inaccessibility of legitimate innovation to battle the gamble. Different variables like strength of little and medium measured property combined with innate lacunae like farmers. This kind of study is valuable for innovative improvement in agrarian, showcasing and arranging.
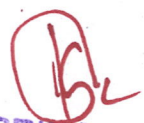
**Objective of Research:**
i. To get the Agricultural expression Problem in Maharashtra
ii. To concentrate on the amount and worth of appearances in Agricultural

**Utilization of Technology in Agribusiness:**

* **Utilization of machines on farms:** Now a farmers can develop on multiple sections of land of land with less work, and can reduce expenses considerably really collecting innovation, versus new hardware. The utilization of grower and collectors makes the interaction so natural. Current rural innovation permits few individuals to develop huge amounts of food and fiber in a most brief timeframe.
* **Cooling offices:** These are utilized by farmers to convey tomatoes and other transitory yields to keep them new as they transport them to the market. This is a mutually advantageous arrangement for both the shoppers and the farmers. Farmers will sell every one of their items on the grounds that the interest will be high.
* **Genetically created plants:** Plants like potatoes can oppose infections and nuisances, which compensates the farmers with great yields and saves them time. These harvests develop quickly producing sound yields.
* **Present day's transportation:** This helps in making items accessible on business sectors on schedule from the homestead. With current transportation, customers will consume a new around the same time.
* **Development of animal feeds:** This has tackled the issue of chasing after grass to take care of creatures, presently these feeds can be produced and consumed by creatures. The cost of these feed is fair so a low pay farmers can manage the cost of them. In agribusiness, the strength of a creature will decide its result.

ORIGINAL PAPER

# Design and optimization of process parameters for hard turning of AISI 304 stainless steel using Taguchi-GRA-PCA

N. J. Rathod[1] · M. K. Chopra[1] · Prem Kumar Chaurasiya[2] · S. H. Pawar[3] · Damodar Tiwari[2] · Rajan Kumar[4] · Kuldeep K. Saxena[5] · Dharam Buddhi[6]

## Abstract

This study used the Taguchi technique to optimise the parameters for the AISI 304 stainless steel material in an effort to increase tool life, shorten production times, and lessen surface roughness. For the Taguchi process, ANOVA, Machining criteria are used that take tool life, surface roughness, and production time into account. These criteria include feed rate, cutting speed, and depth of cut (ANOVA). The statistical components of the experiment are prepared using Taguchi, GRA, and PCA. Tool life, Surface Roughness, and production time factors are maximised by the trials' findings, which were then used to determine S/N ratios. Then, surface roughness, minimal production time, and overall tool life are predicted using confirmation tests. The results show that cutting speed significantly affects tool life, cutting speed significantly affects production time, and cutting depth significantly affects surface roughness. For maximum tool life, it was discovered that a feed rate of 0.10 mm/rev, a depth of cut of 0.35 mm, and a cutting speed of 500 m/min were the ideal settings. The ideal circumstances for reducing production time include a cutting speed of 500 m/min, a feed rate of 0.20 mm/rev, and a depth of cut of 0.45 mm. The ideal circumstances for producing the lowest surface roughness are a cutting speed of 300 m/min, a feed rate of 0.15 mm/rev, and a depth of cut of 0.45 mm.

**Keywords** SS 304 · Tool life · Production time · Surface roughness · Taguchi · ANOVA · GRA · PCA

## 1 Introduction

The procedure of identifying optimal machining specifics is a constant technical activity that aims to reduce production time and surface roughness and increase tool life. During the turning procedure, tool life and production time are two of the most crucial performance indicators. Tool life and surface roughness are both quality indicators and, in most situations, technological conditions for mechanical products. Production time is also considered as an element that has an immediate consequence on production costs and machining hour rates. The choosing of cutting settings for superior cutting aspect for a certain machine and in the turning process, circumstances are key factors. This paper utilized numerous quality enhancements strategy to evaluate the optimal in conjunction of Grey relational analysis and Principle Component Analysis, as well as the Taguchi method values of cutting parameters, to be able maximize tool life and lessen production time and surface roughness. Taguchi's L9 OA was accustomed to enhance the many specifics of a high-standard completed dividing the process into a modest number of tests discover the optimal approach. The three controlling variables were selected being cutting speed, depth of cut, and feed rate. A GR grade is used to simplify a multi-goal challenge a solitary goal. GRA was utilized to identify the best method variable in conjunction for maximizing tool life while minimizing production time and surface roughness.

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