



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 5, May 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Design, Development and CAE Analysis of Pipe Notching Machine Using Python Program

Dr.Kiran Shiralkar¹, Unmesh Rangari², Vivek Chaudhari³, Samarth Malgave⁴, Yash Bhavsar⁵

Professor, Department of Mechanical Engineering, D. Y. Patil College of Engineering, Akurdi, India.¹

UG Student, Department of Mechanical Engineering, D. Y. Patil College of Engineering, Akurdi, India²⁻⁵

ABSTRACT: Conceptualizing the system design, understanding the need for the system with a collaborative approach and developing the pipe cutting machine. Grooving of pipes is done on a manual hand sander, where an impression of the groove profile from the CATIA file is pasted on the pipe and it is ground manually. Due to human error, the accuracy achieved was minimal. Therefore, to increase the precision of the notched pipe, we use an automatic notching machine to perfect the shape, and then the joint is made using a welding process. The main focus of the project is to study the various parameters of SPM and solve the problem related to production speed and machine design to beat the odds of the conventional process. Various software like ANSYS, CATIA etc will be used for analysis and design purposes. To study various parameters like material selection for machine, parts required for machine manufacturing, machine feasibility for manufacturing depending on final machine cost and various SPM design parameters. The main goal of the project is to improve the accuracy and speed of the production of pipe notching.

KEYWORDS: Machine, Notch, Piping, Ansys, Automatic.

I. INTRODUCTION

An engineer is always focused on the challenge of bringing ideas and concepts to life. It is therefore necessary to constantly develop and introduce machines and modern techniques for the economical production of products. At the same time, we should make sure that there is no compromise with the quality of execution and accuracy. In the era of automation, machines are becoming an integral part of human beings. Using machine automation to prove that it provides a higher production rate than manual production rate. In a crowded market, everyone wants to increase their production and make their machine multi-purpose. The engineer is constantly attuned to the challenge of bringing ideas, innovation and design to reality. New machines and techniques are constantly being developed to produce different products at lower prices and high quality. For Pipe Industries & Process Industry and make it multi-purpose and should be used to cut pipe at different angle to improve joint preparation for welding. The machine is easy to maintain and easy to operate on the pneumatic principle of "pipe notching machine". This machine is one of the main machines in the pipe industry and is used for notching the ends of metal pipes for welding. It is mainly used as the name indicates for Notching.

II. LITERATURE SURVEY

1. "DESIGN AND FABRICATION OF OUTER THREAD CUTTING MACHINE" By K Manikandan, S. Pradeep, P. Prakash, A. Pravin Kumar.

In today's competitive global economy, manufacturers are under more pressure than ever to automate their manufacturing processes. As a result, automation system designers face many challenges during system development, some of which have far-reaching implications that may not be realized initially. The goal of this project is to evaluate these design decisions and present them in a general way that can be applied to other systems and applications. Specifically, this project deals with the design of an automatic loading and unloading system for a thread rolling machine used in the production of threaded rods. The design of any automation system should start at the macro level. Questions such as the system's role in the overall manufacturing process and material flow through the plant should be resolved before any specific mechanical designs are considered.



2. "DESIGN AND FABRICATION OF AUTOMATIC PIPE CUTTING MACHINE" By B. Anbarasan, K.M. Sharan, T. Udayprasad, B. CVignesh.

The project "Design and manufacture of automatic pipe cutting machine" was carried out in SLI at SIDCO. Automatic pipe cutting machine is a device that cuts more pieces efficiently and comparatively, reducing the time consumption than normal cutting operations. They are used in custom and mass production. Pipe Cutting Machine Technical Field The invention relates to pipe cutting machines used for cutting pipes to different lengths based on requirements. It is a primary object of the invention to provide an improved machine of the nature indicated which is fully automatic in operation and which cuts pipe in a rapid and efficient manner. This operation is usually done by hand and is slow and laborious and involves creating templates for each pipe diameter and for each combination of pipe diameters when one of the pipes is smaller than the other.

3. "DEVELOPMENT OF MECHANISM FOR NOTCH CUTTING ON CIRCULAR OBJECTS" By Ijazahmed Dandekar Adnan Dongarkar Saif Mahimkar Musharaf Sheikh.

Pipe notching is most often done before the pipes are joined together to form a T or similar joint. One or both tubes may be notched prior to welding. End notching is the process of making a cut at the end of a pipe to create a shape that will match the existing pipe. Side notching (offset notching) is the process of cutting a hole into the side of a pipe to create a V-notch for bending or a V-notch for a T-joint. Notching is a metal cutting process used on sheet metal or thin bar, sometimes on angle profiles or tubes. The shearing or punching process is used in a press to cut vertically down and perpendicular to the surface, working from the edge of the workpiece. Sometimes the goal is just the notch itself, but usually it's a precursor to some other process: like bending a corner of sheet metal, or joining two pipes in a T-piece, notching one to fit snugly against the other.

4. "ANALYSIS OF FEASIBILITY STUDY OF A PRECISION GRINDING PROCESS FOR INDUSTRIAL BLADES USED IN THE CUTTING OF SOFT TISSUES" by a Prototype 5-Axis CNC Grinding Machine by Bartosz Zieliński, Wojciech Kapłonek, Marzena Sutowska and Krzysztof Nado.

In order to effectively separate the soft tissue of raw fish, it is often necessary to obtain a high quality product (fillet). Intensive technical processes and many adverse factors can wear out the flat and weak industrial cutting blades used for this purpose. Due to the relatively short effective working time of the blades, production stoppages are required for replacement, which can lead to significant economic losses. The wear of industrial cutting blades is one of the key problems that arise in the seafood industry, especially in the fields related to fish processing, but it has not yet been satisfactorily solved.

5. "DESIGN OF GRINDING MACHINES SPINDLE" by Ing. Lukasz Rudolf, MAPE 2018, volume 1, issue 1, pp. 69-76."

The grinding operation is done to obtain a fine surface after the turning operation is done on the lathe for cylindrical work. This is done to obtain the required dimensions of the part to be used in any assembly. Thus, the attachment is designed to perform these two operations on the same machine. To verify the design, the attachment is made. This work describes an attempt to reduce the loading and unloading time of workpieces with the required surface treatment. The report describes the selection of grinding wheels. It also takes into account the stiffness of the structure, the damping of vibrations due to the engine speed and the strength analysis of the critical part of the structure, which is analyzed in the INVENTOR software and compared with theoretical calculations

III. DESIGN

CALCULATION SELECTION OF MOTOR:

$$\begin{aligned} \text{Single phase AC motor, Power } 500\text{-watt Motor Torque } P &= 2 \pi N T / 60 \\ T &= 60 \times 500 / 2 \pi \times \\ 2600 T &= 1.83 \text{ N-m} \\ T_{\text{Max}} &= 1.3 * T_{\text{operating}} \\ &= 2.38 \text{ N-m.} \end{aligned}$$



DESIGN OF SHAFT:

Design of shaft Since the loads on most of the shafts connected to machinery is not constant, it is necessary to make proper allowance for reduce the harmful effects of load fluctuations According to ASME code permissible values of shear stress for material Fe415 (mild Steel) is 63.33 N/mm²

$$T = \frac{\pi \sigma_s d^3}{16}$$

$$T = \frac{\pi \sigma_s d^3}{16}$$

D=5.67mm

SELECTION OF BEARING:

In the selection procedure of ball bearing the main governing factor is the system design of the drive i.e.; the size of the ball bearing is of major importance; hence we shall first select an appropriate ball bearing. Taking into consideration the convenience of mounting the ball bearing. As the shaft diameter is 20 mm so we have welded a supporter of the shaft 20mm to it & selected a pedestal ball bearing having shaft outer dia-20mm ball bearing to support the shaft of 20mm.

Total radial load on bearings = Assume = 4kg = 40N

Radial load on each bearing Fr = 40/2 = 20N. Equivalent dynamic load Pe = V.Fr.Ka = 1 X 20 X 1.5 Pe = 30N

$$L^{10} = \frac{31500 \times 60 \times 4300}{10^6} \quad L^{10} = \frac{L_{h10} \times 60 \times n}{10^6}$$

Lh10 from graph 4.6 PSG Design data book for 16000 rpm maximum speed of ball bearing is 315000 Hours. L 10 = 8127 million revolutions.

$$L^{10} = \left(\frac{C}{P_e} \right)^{\left(\frac{10}{3} \right)}$$

C=446KN



IV. DESIGN & ANALYSIS

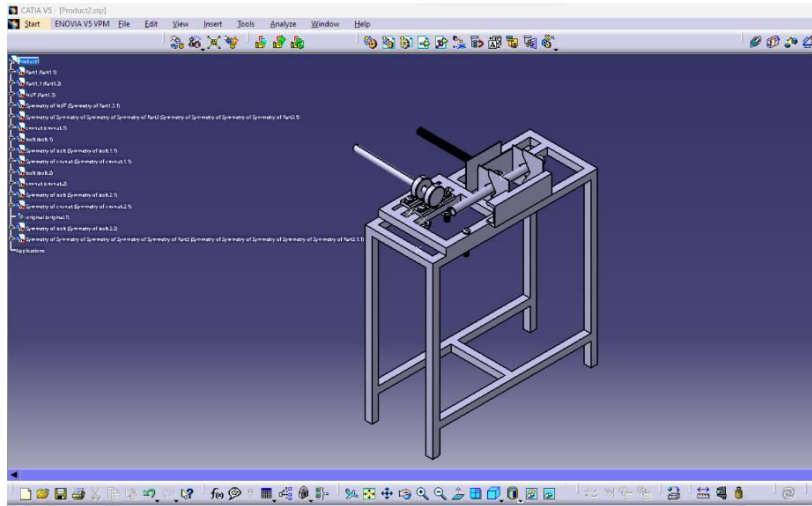


Fig.1 CAD MODEL

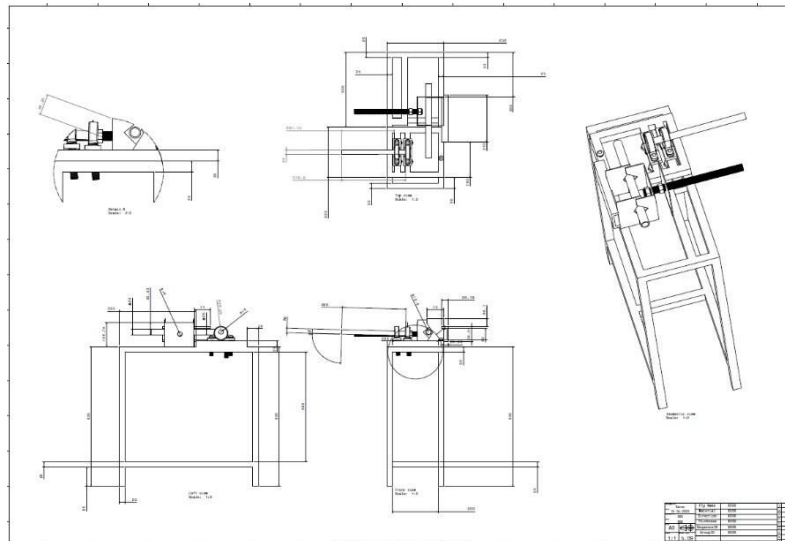


Fig.2 Drafting of CAD Model

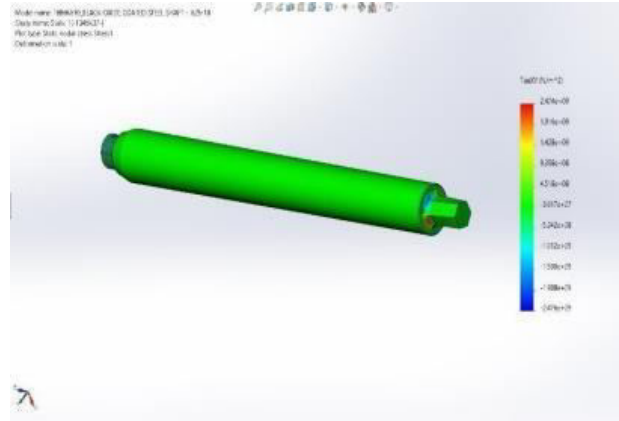


Fig. 3. Ansys of shaft

V. STEPS OF ANALYSIS

Step1:Modelling:

The part is modeled excluding complex geometric features. This is the first and most crucial step in any analysis. Just take it from me, if you model your domain correctly you will save a lot of time on rework. So, pay a lot of attention to the geometry and try to understand why you are simulating this component. This will provide you with the insight to remove insignificant features from your geometry and ultimately save some computation time and unwanted complexity. Always remember, simpler, better.

Step2:Material definition:

Material properties are defined in this step. These material properties depend on the type of analysis that needs to be carried out. A literature survey for similar problems can help you a lot in tackling this step. Fortunately, if the material you want to use in your simulation exists in your FE tool's material library, you're almost done. All you have to do is import the material from the library by selecting the properties.

Step 3:Definition o floads

This step is about determining the external forces acting on some of the body forces due to the weight of the component. To avoid problems like singularities, we need to be careful about the type of force definition.

Step4:Boundary conditions

This step is mainly done to reduce the complexity of the problem from a technical point of view. For example, in some problems the user may know some initial conditions before starting the analysis (such as the displacement of a point in the geometry).Such cases fall under the "initial value problem"

Step 5:Meshing

Your geometry is broken down into smaller and simpler shapes called finite elements. Any standard FEM textbook will contain information on different types of elements and their applications. Recently, many software tend to automate this process to avoid problems for the end user.

Step 6:Solution

This step is done in the backend after defining the simulation properties. Have you ever heard of the concept of



discretization? Simply put, this means that partial differential equations are converted to algebraic equations. This will help the code to represent the equations in terms of matrices. Matrices of individual elements are compiled into global matrices for the entire geometry, which are then solved by solvers for unknown variables

Step 7: Post-processing

Any FEM software will have some form of indicator to show the user if the solution has been successfully completed. Once the solver issues this report, the variables (Displacement, von Mises Stress, etc.) that have been calculated are presented in the form of contour plots or graphs. I think for most beginners this would be the exciting part. A decent physical understanding of the phenomenon you are simulating is very important to verify the simulation results. It is always much better to compare your results and solution approach with literature or experiments.

VI. CONCLUSION

Mass production of different notches on different tubes and pipes requires advanced programming languages like Python for different materials.

Project-based learning through a review of design-related literature and developments.

The portability of portable machine manufacturing will be adaptable to SSI, medium to large industries due to economic productivity in all aspects of the process/

REFERENCES

- [1] P.S.Gdesigndata,Coimbatore,firsteditionKalaikaikathirAchchagam,2003.
- [2] KhurmiR.S.,GuptaJ.K.,Atextbookofmachinedesign,firstedition,S.ChandPublication,1979.
- [3] ThomasBevan,TheTheoryofMachines,Thirdedition,CBSpublishers,2005.
- [4] BallanyP.L.,Thoryofmachines&mechanisms,Twentyforthedition,Khannapublishers,2005.
- [5] BhandariV.B.,Design ofmachineelements,eighteenth edition,MCgraw-hillcompanies,2003.
- [6] JosephE.Shigley,Mechanicalengineering design,sixthedition,TataMcgrawhill,2005
- [7] BartoszZieliński, WojciechKaplonek, MarzenaSutowska and Krzysztof Nadolny, Analysis of a FeasibilityStudy of a Precision Grinding Process for Industrial Blades Used in the Cutting of Soft Tissues by a Prototype 5-AxisCNCGrindingMachine,Appl. Sci.2019,9, 3883;doi:10.3390/app9183883,pp.1-20.
- [8] . BartoszZieliński, WojciechKaplonek, MarzenaSutowska and Krzysztof Nadolny, Analysis of a FeasibilityStudy of a Precision Grinding Process for Industrial Blades Used in the Cutting of Soft Tissues by a Prototype 5-AxisCNCGrindingMachine,Appl. Sci.2019,9, 3883;doi:10.3390/app9183883,pp.1-20.
- [9] 9.Ing. LukasRudolf, DesignOfGrinding Machine Spindle,MAPE2018,volume1, issue1,pp.69-76.
- [10] 10.AutomationofInFeedCenterlessGrindingMachinePiyushaP.Jadhav,SachinV.Lomte,SudhirSurve,InternationalJournal OfEngineering Sciences&Research Technology, April, 2017,pp.718-726



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.423



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 **6381 907 438** **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details