

# Modelling & Fabrication of Portable belt Grinding Machine for Plastic and Wood

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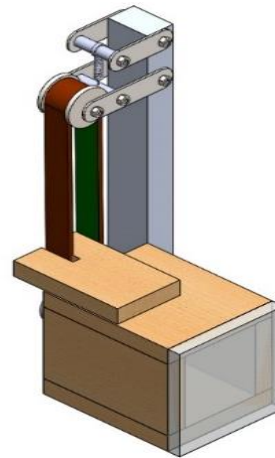
**Abstract-** Portable belt grinding is a machining process utilized on plastic and wood material. It is commonly utilized as a finishing process in manufacturing industry. An abrasive belt covered in rough material is kept running over the pulleys and the abrasive belt helps to remove material or create the ideal finish. This Portable belt grinder project is made up of wood. This Portable belt grinder Project consists of 775 DC motor which is fundamentally rotates the pulley attached to it, along with an abrasive belt. The second pulley is attached to the support frame vertically with the tensioner spring. Abrasive belt is then fitted in pulley. To support the portable grinder a base frame is provided as bed, it helps as bed in grinding machine for grinding plastic and wooden materials. The portable belt grinding can reduce the surface roughness of work pieces and accuracy meanwhile Aluminum oxide belt (Abrasive belt) with high stock removal cleaning and polishing is effectual. Components used for making this Portable belt grinder are DC motor, spring, base Frame (support frame), abrasive grinder belt (Aluminum oxide belt), coupling and a pulleys. Belt grinder helps to shape the material without putting much effort and produced accurate results.

**Index Terms-** Portable grinding machine, Aluminum oxide Belt (Abrasive belt), Nylon pulleys, Tensioner spring Accurate finishing for plastic sand wood materials

## I. INTRODUCTION

Portable Belt grinder is a finishing machining procedure utilized on plastic and wood materials. It is commonly utilized as a finishing process for smoothening the surface of the material or to grind the uneven surface of the material in the industries. An abrasive belt is kept running over the surface for grinding material surface or create the ideal finish of the material. This Belt Grinder is made by wooden surface. This portable grinding machine consists of 775 motor which is fundamentally rotates the pulley

attached to it, along with a grinding paper and an abrasive belt grinder. Another pulley is attached to the wooden base vertically with the tensioner spring. Grinding paper is then fitted in pulley. To support the mini grinder a base frame is provided as bed, it helps in grinding wooden and plastic material. Components used for making this belt grinder are DC motor, spring, base Frame (support frame), abrasive grinder belt, coupling and a pulley. Belt grinder helps to shape the material without putting much effort and produced accurate results.



## II. LITERATURE REVIEW

M. Chandrasekar, et. al. [1], have given a newly developed and innovative concept designed for achieving a superior surface finish on specimens. Utilizing an AC current operated motor as its power source, this equipment demonstrates high efficiency compared to alternatives. The machine has been specifically fabricated for grinding specimens, ensuring a quality surface finish that meets industry standards. With its effective performance, this

abrasive grinding machine proves to be a valuable tool for achieving precise and superior results in various industrial applications. Nguyen Thuan [2], had designing and manufacturing a mini belt grinding machine, this machine can be easily moved to area where the workpieces need to be manufactured. The mini belt grinding machine is small and easy to move, but it still enough rigidity. The parameters calculated during the design process include: speed chain and whole the kinematic diagram of this grinding machine. The mini belt grinding machine after successfully manufactured have been widely applied in addition to actual production. It is typically used as a finishing process in industry. Shailesh Padmakar Bhujade, et. al. [3], objective of this project is to design and fabricate a versatile abrasive belt grinding machine capable of rotating its work area from 0 to 180 degrees. This innovative design allows for different grinding orientations: the 0-degree position facilitates bottom grinding, the 90-degree position enables vertical grinding, and the 180-degree position supports top grinding of components. The concept of a Multi-Function Operating Machine is geared towards enhancing efficiency in production-based industries, focusing on minimizing production, machinery, and inventory costs. Marija Matejic, et. al. [4], has designed and tested for grinding any shape of object like circular, rectangular, or polygon. In this project, the work abrasive belt is used to grind the various types' material of material such as metal, plastic, wood etc. The abrasive belt is rotated by a three-phase induction motor. The particular abrasive belt grinding machine has been developed for the purposes of experimental research. Hence this project namely adjustable belt grinder. The machining accuracy and surface quality of workpieces are the key factors that ultimately determine the performance of the equipment. The test workpieces are presented in the paper and their characteristics are commented. The paper concludes with comments on achieved results and directions for further research on this topic. Mr. Hanumanta Narayanrao Balpande, et. al. [5], has given the statement that the work of abrasive belt is used to grinding the material. The abrasive belt is rotated by the single phase induction motor. Hence our project namely abrasive belt grinder is a Special type of Machine. According to the type of material to be grind, the grinding tool can be changed. This project gives details of grinding various shapes and sizes of

components. This machine can be widely applied in almost all type of industries. By varying the pulley sizes I can get a high end speed of over 10,000 rpm if needed. K.Durgarao1, et. al. [6], has given the statement that grinding is a metal removal process by the action of rotation abrasive wheel. An abrasive is a material whose particles are extremely hard and can be used to machine materials such as hardened steel, glass, carbide, wood etc. The grinding operation may be used for removing thick layer (0.5mm) of material in general class of work. Abrasive belt grinding is a common finishing process in the metal and wood industry. Belt grinding can be used for both coarse and fine grinding. The principle parts of this attachment are main body, motor with pulleys and conveyor abrasive belt etc. Mr. Shubham Patil, et. al. [7], has designed and fabricated is used for grinding any shape of object like circular, rectangular and polygon. In our project the work abrasive belt is used to grinding the material. The abrasive belt is rotated by single phase induction motor. Hence our project namely adjustable belt grinder. In this project we use aluminum oxide belt. The aluminum oxide belt grind any material like wood, stainless steel, cast iron, glass etc. As per material specification we can also vary speed with the help of the VFD. It is conclude that aluminum oxide belt hardness makes it suitable for use as an abrasive and as a component in cutting tools with significant proportion. Avinash parkhe Rahul khadtare, et. al. [8], has declared that grinding is an abrasive machining process that uses a grinding wheel as the cutting tool. A wide variety of machines are used for grinding. Although mini belt grinding abrasive belt have stronger cutting ability than that on the grinding wheel. The main aim of this paper is to design vertical abrasive belts grinding machine to achieve good tolerance as well as better surface finish for various materials such as metal, glass, ceramic, rock and specified material. The abrasive belt grinding can reduce the surface roughness of work pieces and accuracy meanwhile Aluminium oxide belt with high stock removal cleaning and polishing is effectual. The abrasive belt grinding as compared to wheel grinding have more efficient with efficiency and parameter range. Deng ruixiang, , et. al. [9], given an overview that abrasive belt grinding technology is an important part of the precision forming process of complex profile parts. Based on the planning of grinding path, contact model and material removal model, the

research and application progress of abrasive belt grinding technology at home and abroad are summarized, and the problems and research directions in the research of complex profile abrasive belt grinding technology are pointed out.

Harshal G.Suryawanshi , , et.al.[19] overviewed most of the industries grinding is the final stage in manufacturing process, there is no any further process. Grinding is a machining process which uses an abrasive wheel or belt type cutting tool. This grinding machine is used in various industries for finishing of work pieces and give high surface quality. Kyle Odum , , et.al.[20] discussed the issue relating to the power supply, occupational Health hazard and advertised sustainable feature of abrasive power tool and abrasive media option in market today. Also another sources of motor are Brushless Permanent magnet motor which have very high efficiency 80-90% more than universal motor. Aside from electric power tool, pneumatic power tool that run on a compressed air are the most common in the U.S. Some advantages are: the lack of electric shock Hazards, absence of spark or ignition sources and lightweight during operation. Vigneashwara Pandiyan ,et.al.[21] determined the surface roughness inspection is an off-line operation which is time consuming in robotic abrasive belt machining process with Support Vector Machine (SVM). Predictive model such as ANN, ANFIS and SVM were developed in this researches and correlation were established between predicted surface roughness values .The technical features based on SVM such as Linear SVM, Quadratic SVM, Cubic SVM with four different surface roughness. By performance testing it is observed that Quadratic SVM and Cubic SVM were the best in terms of predictive ability. The accuracy of SVM's are 94.5%, 96.9% and 96.9% respectively. This technique is established on planar surfaces while machining free from surfaces are subject to further research. Dong Zhang, , et.al.[22] had discussed a new structure of robotic grinding system in which a new robot frame including active work piece frame and passive tool frame was presented. In the industrial robot are recently introduced to the belt grinding of complex shape surfaces to obtain high productive efficiency and constant surface quality.

### III. METHODOLOGY

The methodology of portable belt grinding machine is an abrasive belt is used for grinding the surface of wood and plastic components. The pulleys are used for holding abrasive belt and also for power transmission. One pulley is connected to the motor and another to the support frame these both are connected through the abrasive belt. While the motor start rotating the pulley connected to the motor rotates and simultaneously another pulley rotates due the connection of abrasive belt the power gets transferred. The pulley is used for transmission of power from electric motor to the roller shaft. As the first shaft from the motor is rotated then all the pulleys rotated with same speed because of abrasive belt connected to the surface. When we keep the any small part on abrasive belt and apply the pressure over the surface of the belt, then the small component gets grinded. Belt grinding machine may be dry wet belt or combination belt. Belt grinding machine is used for heavy stoke removal or for light polishing work depending upon the type of belt grade used. This oblique grinding machine is used for the grinding of any oblique surface. The grinding can be done for the stationary object. The angle grinding is done based on the position of the two adjustable rollers in the machine. The flexibility of the belts are adjusted using the screw. Thus, the finishing will be smooth and any angled parts are finished. This machine is fabricated on one base plate and is supported through vertical support frame column. The motor is also mounted on base plate from which drive is given to grinding belts through pulleys. One adjustable couplings is also provided to attach and remove the belts easily. The grinding belt rotates when motor starts and its movement used to grind or finish the surface similar to grinding wheel. The table is also attached to vertical column to put the work piece while performing the grinding operation. Due to this vertical rotation of belts its maximum area is utilized for finish the surface due to which less time is required for grinding with maximum material removal rate than wheel grinding operation.

IV. COMPARISION BETWEEN PROJECT AND EXISTING

s.no	Proposed Portable Belt Grinding Machine	Existing Belt Grinding Machine
1.	Compact and portable ,suitable for small workshops or DIY projects	Bigger in size and stationary ,designed for industrial applications with more significant material handling
2.	Lower motor power suitable for light duty tasks.	Higher motor power to handle heavy duty grinding and polishing
3.	Smaller belt size, limiting the surface area covered per pass.	Larger belts for more extensive coverage, increasing efficiency for larger surfaces.
4.	Generally used for finer detail work. Offering better precision.	Suited for tasks where precision is not as critical focusing more on material removal.
5.	Lower material removal rate due to smaller size and less powerful motor.	Higher material removal rate ,making it efficient for heavy stock removal
6.	Limited in terms of applications, primarily for small scale projects.	Versatile, capable of handling a wide range of materials, and applications
7.	Limited tool rest options, may lack advanced support features.	Often equipped with adjustable tool rests and supports for better control and stability.
8.	Limited or basic cooling mechanisms.	Advanced cooling systems to prevent overheating during prolonged use.

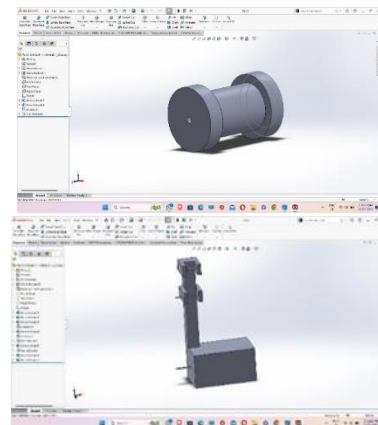
9.	Generally more affordable, suitable for budget conscious operations.	Higher cost due to large size, more powerful motor, and advanced features.
10.	Beginner friendly , suitable for those new to grinding operations	May require more skill and experience to operate effeciently
11.	Generally produces less noise.	Higher powered motors may lead to louder operation.
12.	Limited dust collection features.	Often equipped with efficient dust collection systems for a cleaner working environment.

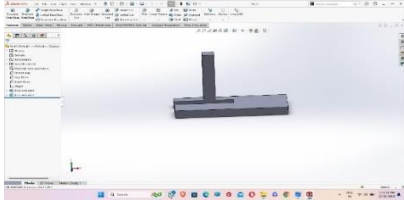
V. MODELLING

The modelling of the belt grinding machine in solid works is not directly made in 3D. The modelling is made in 3 various parts and finally it is assembled. This modelling is made for the reference for fabrication of the belt grinding machine.

The modelling is made in 2D and then it is converted into the 3D. We have used various commands like Sketch, Extrude, Circle, Line etc.

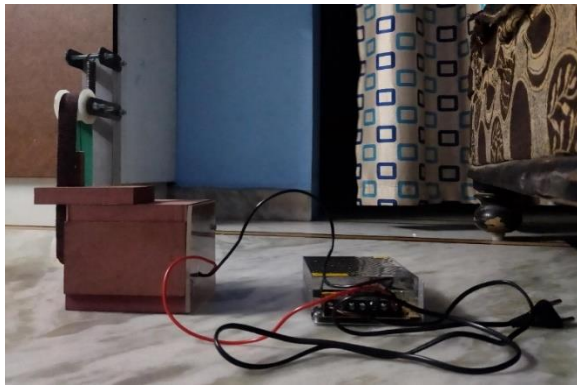
The commands are used and the modelling has been done. The body, pulley, bed are modelled as different sketches as the dimensions, then at the last it is assembled.





## VI. FABRICATION

This portable grinding machine is consists of various components like Abrasive Belt, DC Motor, Couplings, Joints, Mounts, Rods, Base Frame, Screws & Bolts. These components are assembled together at their particular position for the finishing process of the material. The motor is fixed inside the body of the prototype and the pulleys are connected to the motors. While the power is supplied the motor rotates due to the pulley is connected to motor the pulley to starts rotating. The pulleys are connected to the frame. The abrasive belt is fixed to the pulleys. Beside the pulley there will be a coupling connection and it is fixed by the flexible spring to adjust the height of the pulley. When the lower pulley starts rotating the upper pulley too rotates due to attachment of the belt.



## VII. RESULTS AND CONCLUSION

The project “Modelling and fabrication of portable The grinding machine for plastic and wood” has been fabricated and final testing has been done using the plastic and wood material. In the testing mode we have used the plastic and wood material for grinding. The project “Modelling and fabrication of portable grinding machine for plastic and wood” portable belt grinding is a rough machining process utilized on wood and plastics. It is commonly utilized as a finishing process in manufacturing industry. A belt,

covered in rough material, is kept running over the surface to be handled so as to remove material or create the ideal finish. This Belt Grinder project is made from wood. This Mini grinder Project consists of 775 motor which is fundamentally rotates the pulley attached to it, along with a belt, grinding paper and an abrasive belt grinder. The second pulley is attached to the wooden base vertically with the tensioner spring. The portable belt grinding can reduce the surface roughness of work pieces and accuracy meanwhile Aluminium oxide belt with high stock removal cleaning and polishing is effectual. Components used for making this belt grinder are DC motor, spring, base Frame (support frame), abrasive grinder belt, coupling and a pulley. Belt grinder helps to shape the material without putting much effort and produced accurate results.

## WORKING

The portable grinding machine is a simple machine for grinding the wooden and plastic material. The abrasive belt is used to grind the wood or plastic. This abrasive belt is rotated by the DC motor, this consists of pulleys, shaft, DC motor and abrasive belt. All the components are fixed on the frame structure where the components rests. The pulleys are mounted on the suitable places one is fixed at the motor and another pulley is fixed to the mount. These 2 pulleys used in our project to rotate the abrasive belt. One side of the pulley is fixed to the motor another to the body which is used to rotate the abrasive belt through the belt drive mechanism. Belt grinding is an abrasive machining process used on plastic and wooden materials for finishing and grinding process. It is typically used as a finishing process in industries. A belt coated in abrasive material, is run over the surface to be processed in order to remove material or produces the desired finish.

## BILL OF MATERIALS

S.N	Equipment	Specification	Cost
1.	Nylon Pulley	Durable	280/-
2.	Abrasive belt	Composition of abrasive grains,	530/-

		bonded of cloth paper or polyster film backing	
3.	DC 775 Motor	12V-36V,300W-1500W,6000rpm	500/-
4.	SMPS 12V 5A	12V,5A SMPS	600/-
5.	Support frame	Durable	200/-
6.	Frame MDF	High pressure,uniform board	500/-
7.	Acrylic Paint	Fast drying paint	300/-
8.	Screws&Bolts	Dia. Thread pitch, length,material,Head type	200/-
	Total Cost of the project		3,110/-

APPLICATIONS

- Any size of body can be grinded easily.
- It mainly does the finishing surface roughness, removal of micron burrs, finishes polishing.
- Deburring, burrs removal, edge smoothening.
- Cleaning eliminating mill or tool marks dimensioning.

ADVANTAGES

The machine is portable and rigid in size.

- Maintenance cost is less.
- It can be used on any place of small grinding application.
- By varying the pulley dia
- meter the speed of the abrasive belt to be changed

SAFETY INSTRUCTIONS

- Inspect the Machine
- Stable position
- Correct belt fitting
- No over load
- Avoid Excessive Force
- Regular maintenance

CONCLUSION

Grinding is an abrasive finishing process that uses a grinding wheel as the cutting tool. It is mostly used for the finishing process and to decrease the size of the material. Remove the small amount of burrs. Although portable belt grinding belt have stronger cutting ability than that on the grinding wheel. But as wheel grinding is having some disadvantages in form of time required to finish the surface, material removal rate, surface finish obtained etc. To over such disadvantages this vertical belt grinding machine is designed using Solid works software to overcome disadvantages of wheel grinding machine. Also this machine helps too grind or to finish the surface using belts which to be mounted on this designed machine. Due to this the abrasive belts used maximum area of belt is comes in contact with workpiece due to which material removal rate or surface finish rate is more in less time as compared to wheel grinding machine.

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