International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

DESIGN AND ANALYSIS OF PEDAL DRILLING MACHINE AND DRILL BITS

Awanish Kumar Singh[1], Pratheep K[2], Visweswara Rao D[3], Yaswanth M[4], Akhil K[5]

[1]BTech Students, Dept of Mechanical Engineering, Lingayas Institute of Management & Technology, Madalavarigudem, Vijayawada, Andhra Pradesh, India

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Abstract - Nowadays Power generation is a considerable one in our world. Small force operations are to be performed by manual power. Then only we Save the Electric energy. In this drilling machine we give power same as pedaling operation to get rotation of the drill bit. Sprockets are used to increase the speed of the drill. We can achieve different speed rate of spindle with respect to drive the pedaling force.
Here power transmission losses are less due to use the chain drive. We can also do tapping operation, boring operation without changing of mechanisms except tool. Electrical input is also possible while we replace the pedal instead of motor shaft with coupling the manufacturing sector of India mainly depends on its productivity and quality. In many manufacturing activities is an ordinary operation that forms the main machining cost. With a slight improvement in drill bit geometric properties, we can minimize stress and improve the tool's quality and life.

Key Words: Electric energy, Drilling Machine, Drill bit, Pedalling force, Drilling.

1.INTRODUCTION

Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multipoint. The bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work piece, cutting off chips (swarf) from the hole as it is drilled.

In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements. The hammering action can be performed from outside of the hole (top-hammer drill) or within the hole (down-the-hole drill, DTH). Drills used for horizontal drilling are called drifter drills. In rare cases, specially-shaped bits are used to cut holes of non-circular cross-section; a square cross-section is possible.

1.1 Drilling Process

Drilled holes are characterized by their sharp edge on the entrance side and the presence of burrs on the exit side (unless they have been removed). Also, the inside of the hole usually has helical feed marks.

Drilling may affect the mechanical properties of the workpiece by creating low residual stresses around the hole opening and a very thin layer of highly stressed and disturbed material on the newly formed surface. This causes the workpiece to become more susceptible to corrosion and crack propagation at the stressed surface. A finish operation may be done to avoid these detrimental conditions.

1.2 Drilling in Metal

High speed steel twist bit drilling into aluminum with ethylated spirits lubricant Under normal usage, scarf is carried up and away from the tip of the drill bit by the fluting of the drill bit. The cutting edges produce more chips which continue the movement of the chip's outwards from the hole. This is successful until the chips pack too tightly, either because of deeper than normal holes or insufficient backing off (removing the drill slightly or totally from the hole while drilling). Cutting fluid is sometimes used to ease this problem and to prolong the tool's life by cooling and lubricating the tip and chip flow. Coolant may be introduced via holes through the drill shank, which is common when using a gun drill. When cutting aluminium in particular, cutting fluid helps ensure a smooth and accurate hole while preventing the metal from grabbing the drill bit in the process of drilling the hole. When cutting brass, and other soft metals that can grab the drill bit and causes "chatter", a face of approx. 1-2 millimeters can be ground on the cutting edge to create an obtuse angle of 91 to 93 degrees. This prevents "chatter" during which the drill tears rather than cuts the metal. However, with that shape of bit cutting edge, the drill is pushing the metal away, rather than grabbing the metal. This creates high friction.

2. DRILLING MACHINE OPERATIONS

2.1 Reaming

It is a finishing operation of a predrilled hole using a reamer, which has multi longitudinal straight flutes. To obtain a smoothly finished accurate size hole, a slightly under size hole will be drilled first. It is then finished with a reamer. In such a case the amount of material to be removed should not exceed 0. 125mm.Design of a Universal Micro Radial Drilling Machine

2.2 Boring

It is an enlarging operation of a pre-drilled hole using a boring tool, which has a single cutting point. In order to produce a non-standard size hole, the nearest size hole is drilled first using the standard drill. Later it can be enlarged using a boring tool.

2.3 Counter-Sinking

It is an operation to produce a conical surface at the end of a predrilled hole, using a counter sink. A conical shaped cutting tool. The angle size of the hole depends on the angle size of the screw thread, whichever is to be seated in it. A countersink hole avoids unwanted projection over the top surface of the work piece, e.g., furniture, joints in doors, windows etc.

2.4 Counter-Boring

It is an operation to enlarge one end of the pre drilled hole concentrically to the required depth, using a counter bore tool, to form a square shoulder. The counter bore is used to drive in the socket head screw, bolts, bolts, and pins etc. the pilot of the tool helps to maintain concentricity with the original hole. It is replaceable depending on the required size.)

2.5 Spot-Facing

It is an operation to produce a smooth flat seating at the top of the hole surface for bolt heads, washers, nuts etc. it may be done using counter bores or special spot facing tools.

2.6 Tapping

It is an internal thread generating operation in a predrilled hole, using a set of 3 taps, used one after the in succession. To generate a specific size thread, a nearest drill size is calculated and drilled first. Then using standard size taps, slowly and gradually the threads are generated.

3. LITERATURE REVIEW

Pedal operated grinding and drilling machine

The pedal operated drilling and grinding machine is the project which is best option for rural areas where there is a problem of electric supply and shortage of electric supply. This article represents an advanced griding and drilling machine that is operated manually by pedal cycling to eases human labor in cutting wood, plastic and other basic light materials. Here, the drilling and grinder machine performs in drilling and grinding objects with its sharp and replaceable blades and dill bits. Pedal power is the transfer of energy from a human source through the use of foot pedal and crank system. This technology is most commonly used for transportation. In a system we used bevel gear for power transfer for done two operations at a time with same human power. We used Straight bevel gear cause of They have a conical pitch surface, but the teeth are straight, consistently tapering toward the apex of the system. The system performance is measured and results are found satisfactory for real time application

Design & Fabrication of Pedal Operated Multipurpose Machine

Our concept is regarding “Design & Fabrication of Pedal Operated Multi-Purpose Machine". Nowadays most of the machines are performing one operation at one time because of that it consumes much more time & also those machines are driven by electricity and highly expensive. The machine operating by means of electricity has limited application in the rural area. Therefore, it is possible to convert human applied energy through pedaling into mechanical work. It will save cost, electricity as well as find application in rural area. Two operations like grinding and drilling will be done by pedaling. A person can generate four times more power by pedaling than by hand cranking. The system is also useful for the work out purpose because pedaling will act as a health exercise and also doing a useful work.

4. METHODOLOGY

Components Used in Machine Pedals, sprocket set (big end sprocket and small end sprocket), bicycle seat, flywheel, bearing house, eccentric disc mechanism, primary shaft and secondary shaft, bush and connecting rod arrangement, pipe vice, grinding blades, drilling chuck, drilling bit, drilling chuck key, pulley and belt drive, bevel gear. Project Setup. The Pedal powered machine consists of 3 operations i.e., drilling, grinding and cutting. It consists of chain drive and v belt drive for power transmission. The chain used is simplex chain. It consists of chain and sprocket arrangement on which chain is fitted. The pedal is fitted at big sprocket and small sprocket is fitted on the shaft

5. INTRODUCTION TO CAD

Computer-aided design (**CAD**) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term **CADD** (for Computer Aided Design and Drafting) is also used.
Its use in designing electronic systems is known as electronic design automation, or **EDA**. In mechanical design it is known as mechanical design automation (**MDA**) or **computer-aided drafting** (**CAD**), which includes the process of creating a technical drawing with the use of computer software. CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also

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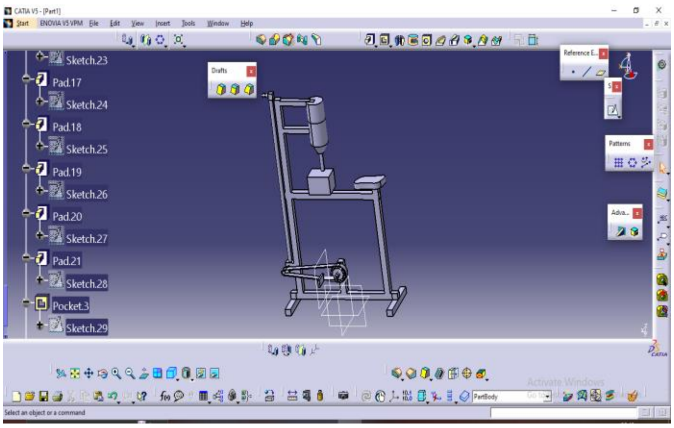
produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space.

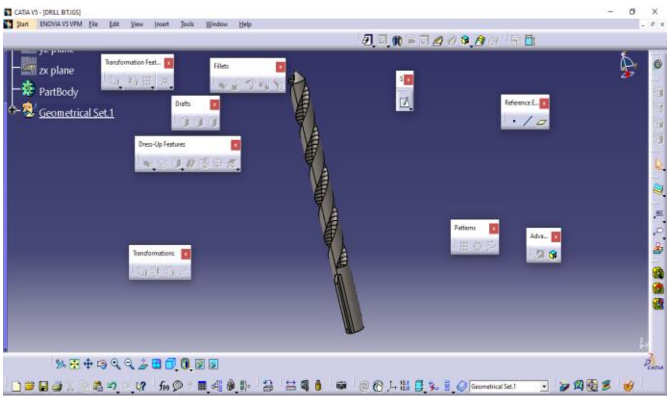
5.1 Advantages of CATIA Parametric Software

1. Optimized for model-based enterprises
2. Increased engineer productivity
3. Better enabled concept design
4. Increased engineering capabilities
5. Increased manufacturing capabilities
6. Better simulation
7. Design capabilities for additive manufacturing

CATIA parametric modules

1. Sketcher
2. Part modeling
3. Assembly
4. Drafting





5.2 Static Structural Analysis

Materials

Stainless steel
Young's modules :1.93E+11 Pa
Poisson's ratio :0.31

Titanium alloy
Young's modulus :9.6E+10 Pa
Poisson's ratio :0.36

Gray cast iron
Young's modulus :1.1E+11 Pa
Poisson's ratio :0.28

6. INTRODUCTION TO ANSYS

ANSYS is general-purpose finite element analysis (FEA) software package. Finite Element Analysis is a numerical method of deconstructing a complex system into very small pieces (of user-designated size) called elements. The software implements equations that govern the behaviour of these elements and solves them all; creating a comprehensive explanation of how the system acts as a whole. These results then can be presented in tabulated, or graphical forms. This type of analysis is typically used for the design and optimization of a system far too complex to analyse by hand. Systems that may fit into this category are too complex due to their geometry, scale, or governing equations.
ANSYS is the standard FEA teaching tool within the Mechanical Engineering Department at many colleges. ANSYS is also used in Civil and Electrical Engineering, as well as the Physics and Chemistry departments.

6.1 Generic steps to solving any problem in ANSYS

Build Geometry

Construct a two- or three-dimensional representation of the object to be modelled and tested using the work plane coordinate system within ANSYS.

Define Material Properties

Now that the part exists, define a library of the necessary materials that compose the object (or project) being modelled. This includes thermal and mechanical properties.

Generate Mesh

At this point ANSYS understands the makeup of the part. Now define how the modelled system should be broken down into finite pieces.

Apply Loads

Once the system is fully designed, the last task is to dmd burden the system with constraints, such as physical loadings or boundary conditions.

Obtain Solution

This is actually a step, because ANSYS needs to understand within what state (steady state, transient… etc.) the problem must be solved.

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Present the Results

After the solution has been obtained, there are many ways to present ANSYS' results, choose from many options such as tables, graphs, and contour plots.

6.2 Specific capabilities of ANSYS

Structural

Structural analysis is probably the most common application of the finite element method as it implies bridges and buildings, naval, aeronautical, and mechanical structures such as ship hulls, aircraft bodies, and machine housings, as well as mechanical components such as pistons, machine parts, and tools.

Static Analysis

Used to determine displacements, stresses, etc. under static loading conditions. ANSYS can compute both linear and nonlinear static analyses. Nonlinearities can include plasticity, stress stiffening, large deflection, large strain, hyper elasticity, contact surfaces, and creep.

Transient Dynamic Analysis

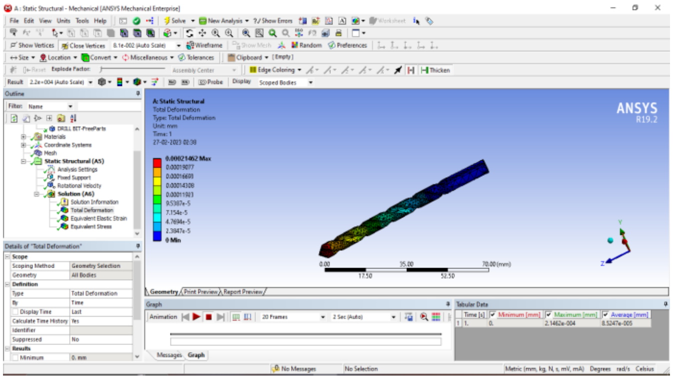
Used to determine the response of a structure to arbitrarily time-varying loads. All nonlinearities mentioned under Static Analysis above are allowed.

Buckling Analysis

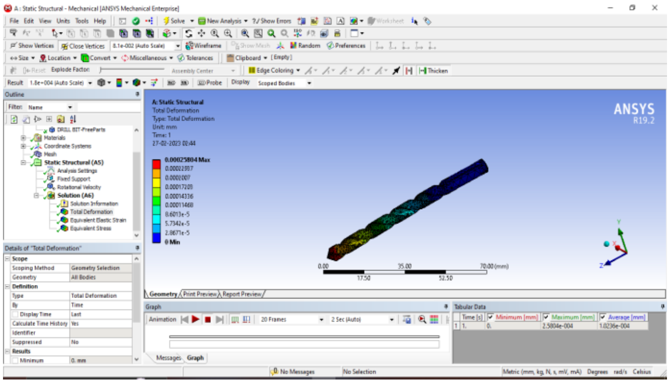
Used to calculate the buckling loads and determine the buckling mode shape. Both linear (eigenvalue) buckling and nonlinear buckling analyses are possible.

In addition to the above analysis types, several special-purpose features are available such as **Fracture mechanics**, **Composite material analysis**, **Fatigue**, and both **p-Method and Beam analyses.**

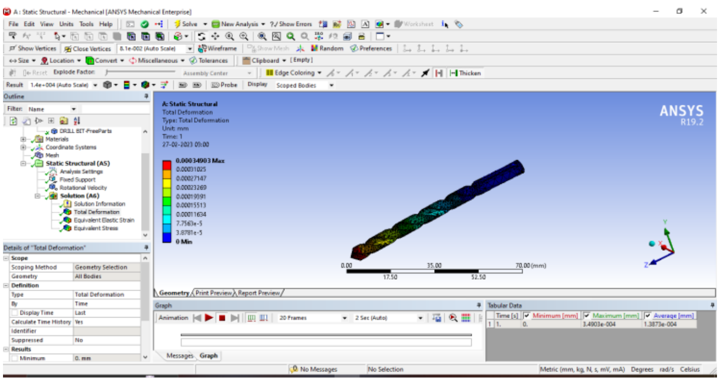
Total Deformation of stainless steel at 100 rad\sec



Total Deformation of Titanium alloy at 100 rad\sec



Total Deformation of Cast iron at 100rad\sec



6.3 RESULT TABLE

MATERIALS	ROTATIONAL VELOCITY, rad/s	TOTAL DEFORMATION mm	STRAIN	STRESS Mpa
STAINLESS STEEL	100	0.00021462	3.0563e-7	0.0058966
	200	0.00085849	1.2225e-6	0.23586
	300	0.0019316	2.7506e-6	0.53069
TITANIUM ALLOY	100	0.00025804	3.6447e-7	0.034976
	200	0.0010322	1.4579e-6	0.13991
	300	0.0023224	3.2802e-6	0.31479
GRAY CAST IRON	100	0.00034903	4.9976e-7	0.054955
	200	0.0013961	1.999e-6	0.21982
	300	0.0031413	4.4978e-6	0.49459

7.CONCLUSION

In many manufacturing activities, drilling is an ordinary operation that forms the main machining cost. With a slight improvement in drill bit geometric properties, we can minimize stress and improve the tool's quality and life.

In this thesis pedal operated drilling machine manufactured and determine the deformation, stress, strain values of the drill bit using different materials. In this project drill bit 3d modelling done in CATIA, static analysis done in Ansys software at different rotational velocities i.e., 100m/s, 200m/s, 300m/s and different materials used i.e., stainless steel, titanium alloy, gray cast iron.

By observing the structural analysis deformation values and stress values are less for stainless steel compare to the titanium alloy and gray cast iron.

When the rotational velocity increases automatically the deformation and stress values are increased so we conclude that stainless steel is better at low rotational velocity i.e. 100 rad/sec.

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BIOGRAPHIES (Optional not mandatory)

Awanish Kumar Singh[1,]
Assistant Professor,
Dept of Mechanical Engineering,
Lingayas Institute of Management and Technology.

K. Pratheep[2]
UG Student,
Dept of Mechanical Engineering,
Lingayas Institute of Management and Technology.

M. Yaswanth[3]
UG Student,
Dept of Mechanical Engineering,
Lingayas Institute of Management and Technology.

D. Visweswara Rao[4]
UG Student,
Dept of Mechanical Engineering,
Lingayas Institute of Management and Technology.

K. Akhil[5]
UG Student,
Dept of Mechanical Engineering,
Lingayas Institute of Management and Technology.