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A REVIEW ON DESIGN OF DRILL JIG

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Abstract: Mass production lowers the unit price for high productivity and makes it compatible and easy to assemble. This can be achieved by using a device. The device is equipped with tool guide elements such as drill bushings. This project attempts to design and optimize a drill jig for a variety of factors to perform a practical analysis of automated parts. The project also demonstrates modal and static structural analysis of drilling jigs. For drilling operations at different angles and positions, such devices are designed for accurate and accurate drilling operations. Drill jigs increase productivity by eliminating the need for individual positioning, marking and frequent checks. The device itself also takes over the task of locating, clamping, and guiding the tool, reducing the number of iterations required when drilling.

INTRODUCTION

The jig accelerates the positioning of repetitive hole centers in multiple replaceable parts by acting as a template that guides twist drills and other drilling devices to the exact location of the center of each desired hole. It is a type of jig. In metalworking practices, a hardened drill bushing typically covers each hole in the chuck and prevents the tool from damaging the chuck. With the invention of the jig drill, the drill jig was forgotten. The need for drill jigs (and the work of drill operators using them) is much less, as CNC machine tools that can automatically move tools to the right place through servo control are pervasive in the manufacturing industry. like before.

1) Abdulhamid, A., Sumaila, M., Yawas, D. S., Kaisan, M. U., 1Shaaba, M. M "Design and Construction of Drilling Jig for Drilling Operations" page:329-336 JOURNAL OF SCIENCE TECHNOLOGY AND EDUCATION.

RESEARCH OBJECTIVE

The intention of this examination work is to transmit out the design examination of a drilling jig used for drilling processes.
Design Deliberations
The issues that were measured in the project of the jig are:
1. Material selection : It depends on accessibility and functionality of the material.

A. Availability : After finding that the material which is continuously accessible in the market is mild steel. It is consequently used for the building of the jig.

B. Functionality : As it has already been specified that mild steel was selected as a physical for building of jigs because of its good wear resistance and it can also withstand feelings.

2. Cost effectiveness: Cost effectiveness is very significant in any design work which has to be carried out. Hence, it is helpful to know the total cost that will occur during the building of the jig.
Size: A dense size has been constant in this work for ease and reproducibility. It also have an significant role in having the knowledge of the shapes of work pieces to which the jig can grip onto.

FORCES SUBJECTED
For the jig's proper functioning , All of its mechanisms must be able to endure all the forces that will be exposed to them throughout usage. The mechanisms have to allow such militaries without any unwarranted stress, distortion or strain. The jig is subjected to the main forces which are:
i. The Vertical sliding thrust of the drill
ii. The Clamping force
iii. The Torque produced due to the rotation of drill in work piece

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The thrust and torque greatness can be strongminded by the usage of experiential formulas or tool dynamometer, but for this examination to be performed empirical formulations stage and a appropriate expedient have to be selected to encounter the supplies.

RESULT

The results of the design analysis show that the fixture component can withstand much more than the normal load it receives during operation. This suggests that detailed stress analysis is not required or required in the design and construction of these types of units. After construction and assembly, the device was drill tested. The results were upto the mark as the drilled back plate was within the desired specifications. Useful for drilling of cylindrical workpieces of 60 mm or less. Yet, it was found that the workpiece was strengthened with clamp screws while continuously performing the drilling process.

CONCLUSION

This concludes that during testing, the jig was found to be able to drill work pieces of various shapes and work properly. There is no influence of vibration due to the existing jig legs. Clamp screws and knock pins also acted as a support to hold the workpiece in place during the drilling process. However, the presence of the bushing helps maintain the useful life of the jig and also helps in proper placement of the workpiece. The swivel plate was designed to further adjust the workpiece

1) K.Rama Subba Reddy1,S.Ramesh Kumar Babu2,A.V. Hari Babu3 “Design and Analysis of Drill Jig at Variable Materials” page:2022-2029 International Research Journal of Engineering and Technology (IRJET)

The main objective of this paper is to choose the most effective material under different loading conditions using static structural analysis and modal analysis.

FACTORS TO BE TAUGHT ABOUT DESIGN OF JIGS

- The various parts of the work-piece.
- Capabilities of the machine & Production needs.
- Location and the Loading and unloading of arrangements.
- Clamp arrangements.
- Clearance between jigs and parts.
- Ejectors and Base or body constructions.
- Tools guidance and cutter settings.
- Vibration, Safety, Rigidity and Cost.
- Materials list and bills of fabric used.

DESIGN PROCEDURE

1. Building the Model: - First create a model, enter the task’s name, title of the analysis, and then form a sketch of the component variants, pure mathematics of the model, properties of materials, and actual component constants. Structural parts are mostly linear or nonlinear. Material properties are mostly linear or nonlinear, constant or temperature, dependent equal or written. In addition, Young's modulus also needs to be outlined.

2. Applying the required load gets the solution: - This necessary step outlines the analysis choices and types, applies specific loads, states load level choices, and starts solving finite components. The loads which are applied in secondary measurements are : freedom of the movement, limitations usually provided at modal limits for sketch rigid body support points.

3. Review of the results: - Results of a static analysis contain the nodal and component stresses, component forces, nodal reaction forces, nodal and component strains, nodal displacements etc.

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STATIC STRUCTURAL ANALYSIS

- THIS ANALYSIS DEALS WITH THE DEFORMATION, EQUIVALENT STRESS,EQUIVALENT ELASTIC STRAIN

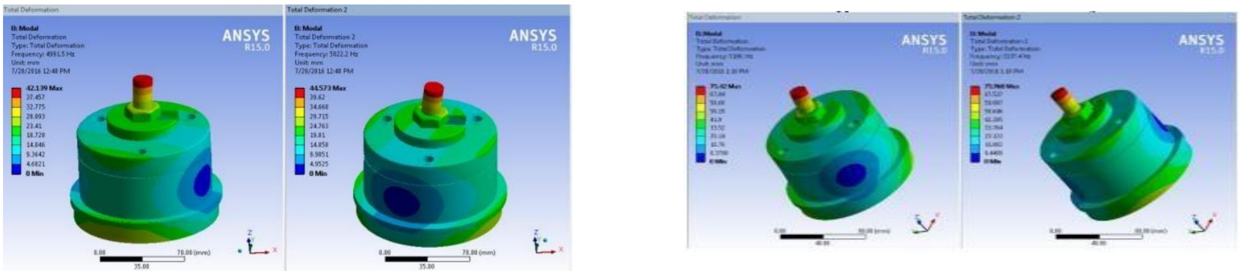

FIG- MODAL ANALYSIS OF STRUCTURED STEEL

RESULT

Table 1: Modal Analysis

S.No	Material	Total Deformation (mm)					
		1	2	3	4	5	6
1	Steel	42.14	44.57	24.82	74.69	74.70	93.71
2	Al Alloy	75.42	75.96	39.50	184.91	135.57	75.30
3	Cast Iron	46.97	47.36	24.49	123.85	89.84	46.01

STATIC STRUCTURAL ANALYSIS

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fig- structured steel alloy jig

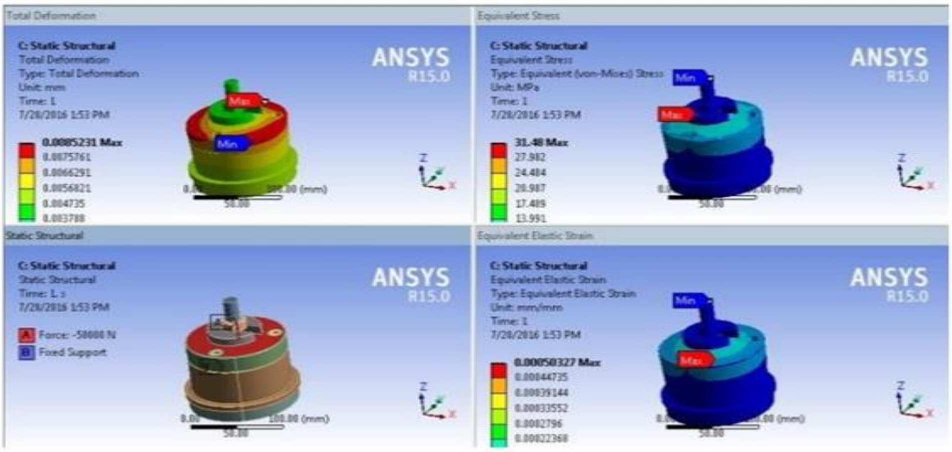

fig- aluminum alloy jig

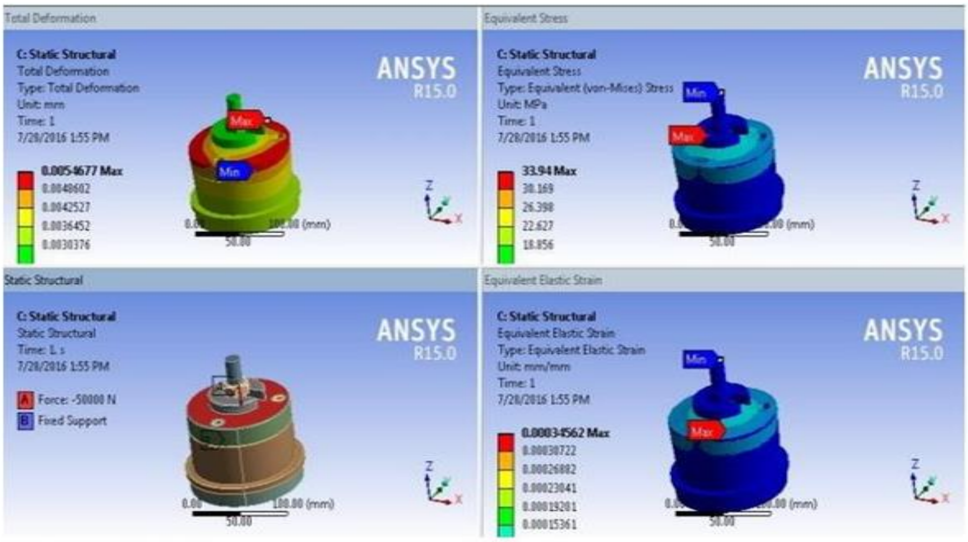

fig- cast iron jig

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RESULT

Table 2: Static Structural Analysis: F= 50 KN

S.No	Material	Total Deformation x 10^{-3} mm	Equivalent Stress M.Pa	Equivalent Strain x 10^{-4}
1	Steel	3.016	32.98	1.857
2	Al Alloy	8.5231	31.48	5.032
3	Cast Iron	5.4677	33.94	3.456

3) **Smit Patel1, Sahil Vasoya2, Ankur Joshi3 "DESIGN AND MANUFACTURING OF JIGS FOR DRILLING MACHINE" page:1739-1743 International Research Journal of Engineering and Technology (IRJET).**

1) Research Objective

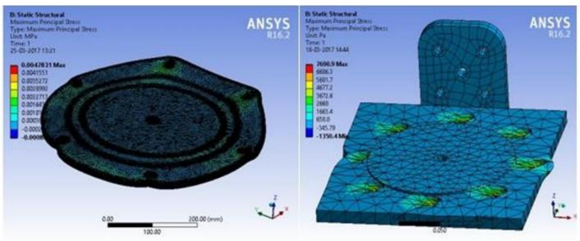
Earlier the jigs were made from MS, ALUMINUM ETC, which were very heavy and large in size.which can cause some health related issues to the workers. So, our main objective is to find a material with sufficient stress bearing capacity and reduced weight.

2) PROBLEM SOLUTIONS

- Manufactured a jig made of acrylic solid.
- Manufactured a jig of two stages, which can be used for boring of two separate diameter faces.
- Manufactured a jig by which a hole can be made in two perpendicular instructions.
- Manufactured a jig that can fitting the desired work part and the jig does not originated out while boring.

CONCLUSIONS

Mass production lowers the unit price for high productivity and makes it compatible and easy to assemble. This can be achieved by using a device. The device is equipped with tool guide elements such as drill bushings. This project attempts to build a drill jig plate. Basically, this project shows a drill jig plate manufactured for this analysis. This project manufactures such devices for accurate and accurate drilling operations for drilling operations at various angles and positions. Drill jigs increase productivity by eliminating the need for individual positioning, marking and frequent checks. The device itself also takes over the task of locating, clamping, and guiding the tool, reducing the number of iterations required when drilling.
Research Objective



Maximum principle stress of first jig Maximum principle stress of second jig

For first jig

Minimum	0mm	-8.6845e-004 MPa	6.8957e-015 mm/mm
Maximum	1.0452e-006 mm	4.7831e-003 MPa	2.5685e-008 mm/mm

For second jig

Minimum	0mm	-1.3504e-003 MPa	3.3232e-013 mm/mm
maximum	4.162e-007 mm	7.6909e-003 MPa	4.6962e-008 mm/mm

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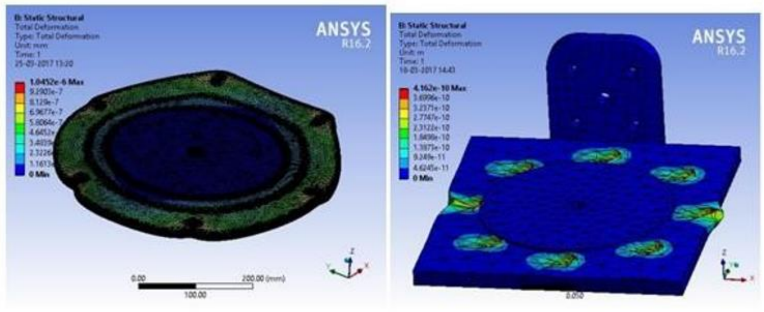

Total deformation analysis of first jig | | Total deformation of second jig

4) **Shubham Misal, Kalpesh Tatar and Amol Vyavahare "Design and Analysis of a Jig and Fixture for Drilling an inclined hole in a TEE Plain Adapter" page:72-75 International Journal of Trend in Research and Development**.

Research Objective

Our main objective is to calculate the thrust force required for drilling an inclined hole at 45 degrees which will result in increased rate of production.

THEORETICAL CALCULATIONS FOR DRILLING FORCE

Cutting speed = V

$$V = \frac{(\pi \times d \times N)}{60}$$

$$= \frac{(3.1415 \times 14 \times 500)}{60}$$

$$= 22 \ {}^{m}/_{min}$$

Feed rate (s) = 0.165 $^{mm}/_{rev}$

Material Factor (k) = 1.07

Power of Spindle (P)

$$= \frac{1.25 \times d^2 \times k \times N \times (0.056 + 1.5 \times s)}{10^5}$$

$$= 1.31075(0.056 + 1.5 \times 0.165)$$

$$= 0.3978 \text{ kW}$$

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Transmission efficiency $(\eta) = 80\%$

Power of motor (P')

$$P' = \frac{P}{\eta}$$

$$= \frac{0.3978}{0.8}$$

$$= 0.4972 \text{ kW}$$

$$\text{Torque}(T) = \frac{975 \times P}{N}$$

$$= \frac{975 \times 0.3978}{500}$$

$$\boxed{T = 775.7 \text{ Nm}}$$

$$\text{Thrust}(F) = 1.16 \times k \times d \times (100 \times s)^{0.85}$$

$$\boxed{F = 1846.49413 \text{ N}}$$

THEORETICAL CALCULATIONS FOR DRILLING FORCE

Finite element analysis is performed by specifying appropriate boundary conditions and applying force. Here, on the device and the device, the base plate remains fixed and therefore receives a permanent boundary condition, but when calculated from the equation, the thrust force was = 1839.49413N and the torque was = 780.7Nm drilled into the workpiece. Added. Performed during excavation work. The maximum von Mises 75 stress generated in the field block is 13.821 N mm2 and the max distortion got is 0.000339 mm. The maximum von Mises stress generated on the clamp plate is 18.582 N mm2 and the max distortion got is 0.000344 mm. The max von Mises stress on the backing plate is 11.535N mm2 and the maximum deformation obtained is 0.000348mm. The greatest von Mises stress generated by the TEE plane adapter is 25.263 N mm2 and the max deformation obtained is 0.00131 mm. The torque and thrust applied during experimentation were found to be 7611 N / mm and 1839.4941 N, correspondingly. The “total stress value” is 21.79MPa and the total deformation is 0.0001396mm. Since the “total stress value” and distortion are appreciably smaller, we can accomplish that the structure of the device is harmless.

5) S. Rajesh, B. Vijaya Ramnath, C. Parswajinan, K. Vishnu, R. Sridhar“MULTICOMPONENT DRILL JIG FOR BRAKE LINING SYSTEM” PAGE- 1 TO 4 ELVISER

● RESEARCH OBJECTIVE- TO MAKE A DRILL JIG WHICH CAN BE USED TO MAKE BRAKE LINING COMPONENTS FOR DIFFERENT DIMENSIONS integrated with the feeder system

PROCEDURE USED

- Product analysis
- Selection of drill jig to be designed
- . Measuring the brake liner

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- Location of the brake lining

- Mechanical feeders are devices designed to quickly load brake linings into fixtures and reduce the time it takes to load each component.

- The sliding bed on the back has an additional 11.5mm overhang compared to the drill jig. This is done to set up profile slot plywood. That is, only one component can enter the device at a time.

- The bottom of the feeder is 500x200mm and the thickness is ½ inch. This length provides ample space for riser support plywood, front support layers, profile slots, and sliding beds. To align the pressure holes approximately in the center of the layer, the layer is 130 mm high and 3/4 inch thick, 29 mm more than the slide bed. Pressure holes are created by pulling the sliding bed profile into the layer, then a 32x13 mm rectangular hole is created.

Our review on the reference papers

- From the results of the design examination, it was found that the fixture component can cope with greater than the normal load received during operation. The consequences were appreciable as the drilled back plate was in the reach of the required specifications. However, this paper does not say anything about which materials should be used and which materials can withstand much higher loads.

- We performed static structure and MODAL analysis with DRILL JIG on three entirely distinct materials and obtained results. Consistent with the results, the stress is almost closed in the three materials, but the deformation of the steel is lower than that of the alloy of aluminum or gray forged iron. Therefore, steel is the optimal material for making devices.

- By manufacturing these devices, you can reduce the time it takes to set up raw materials on your machine. The weight of the equipment after manufacturing is 3.5 kg, which is lighter than the 25 kg mild steel plate. This inexpensive solid can be substituted with “polypropylene (PP”) solid. Additional materials may be used instead of the acrylic material. You can save more weight by drilling holes in the instrument in unwanted places.

- The simulation determined the load of “Von Mises stress” and the overall distortion of all the mechanisms. Finite element analysis has shown that just small stresses and deformations occur inside device bodies and workpieces that are within limits. The stress distribution of the work is also uniform. This not only increases production speed, but also reduces the effort required to set the workpiece for traditional drilling operations.

- At last we reviewed the paper in which the main task was to achieve automation through a mechanical feeder system. We felt that instead of this they could have used a pneumatic cylinder actuator for automatic feed .

Conclusions

First, the author designed a traditional multipurpose drill jig that could be created in any simple workshop using simple calculations and tools. Next, the author selected some of the most widely used materials for making drilling jigs in the industry. Steel has proved to be the best material for the workers facing it to withstand more stress compared to other problems. Alternatively, the device is made of an acrylic material. Mass production lowers the unit price for high productivity and makes it compatible and easy to assemble. When mass producing a variety of materials, plenty of time was being wasted setting up and clamping the device, so we optimized the jig to drill diagonal holes at a 45 ° angle. This will improve production rates. .. Mechanical supply systems can now be used to achieve true mass production of specific products. This reduces unloading and loading times.

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5) Shivanand Vathare1 , Shrinivas L Gombi2 , Darshan M Katgeri "Design and Analysis of Drill Jig for Head and Cover Part of the Actuator" page: 184-191 International Journal of Engineering Research & Technology (IJERT).