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Design and Analysis of Lathe Machine Chuck

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ABSTRACT-Design and analysis of lathe machine chucks is that the results of an excellent deal of labor and therefore the development of technical thought. Thanks to the progress and also the possibility of accelerating efficiency and at the identical time relieving people from work that needs plenty of effort, especially physical effort, the utilization of higher and more efficient production methods may be a target that ought to be pursued nowadays. In the manufacturing process, these objectives may be achieved with the utilization of dedicated equipment. The subsequent work will present an example of a lathe chuck. This could eliminate the requirement of time-consuming changeovers. Additionally, it's assumed that the handle must meet the conditions imposed by the limited number of tools and also the working dimensions of the machine. The machining process itself was also important, where the foremost advantageous solution was to perform most of the operations in one clamping.

KEYWORDS: Lathe chuck, Equipment.

I. INTRODUCTION

MODELLING:

Modeling is the process of turning 2D drawings, sketches, or conceptions into actual 3D models. India, the front runner in mechanical engineering services, can turn your goods or designs into 3D mechanical animations that are tailored to your particular needs aside from significant cost reductions, outsourcing 3D mechanical modeling to India may provide you with access to skilled 3D modelers, drafters, and engineers India mechanical engineers are not only skilled in 3D modeling but also have a broad understanding of how to use the software.

TYPES OF MODELLING:

PRODUCT MODELLING

MACHINE MODELLING

The static analysis of mechanical parts is intended to calculate the effects of constant loads on the structure ignoring the effects of inertia and shock that are commonly found when the applied loads change rapidly. Nevertheless, a static analysis may include constant inertia loads such as gravity, as well as loads that vary with time but which can be approximated to a static equivalent, as is the case of loads resulting from the wind which are defined by construction codes.

Likewise, this analysis allows designers to verify the quality, performance and the safety of the mechanical part, in this case based on the geometrical changes that can be noticed when specific load conditions are established.

ANALYSIS:

Analysis can solve a good range of development problems. Engineers can use design analysis to predict the physical behavior of almost any part or assembly under any loading conditions: from a straightforward beam under a bending load to car crash simulations and vibration analysis of aircraft. verity power of design analysis is that the ability to perform any of those kinds of studies accurately without building one thing. All that's needed may be a CAD model.



FORMS OF ANALYSIS:

FORMS OF ANALYSIS:

It is concerned with which components are in an exceedingly given sample or compound.
Example: Precipitation reaction.

QUANTITATIVE ANALYSIS:

It is to see the number of individual component present in an exceedingly given sample or compound.
Example: to search out concentration by uv-spectrophotometer.

THERMAL ANALYSIS:

In this analysis, the engineer is able to study how the part would react to the possible temperature variations it may experience during operation. In this case, the thermal expansion coefficient of the material plays an important role, as it will determine how much deformation, if any, will occur on the part due to temperature changes.

II. LITERATURE SURVEY

In 1984, Department of science applied, IIT, New Delhi, has taken research on development of recent manufacturing technology, Flexible Manufacturing Systems became key equipment in factory automation. In 2013, V. Roy & S. Kumar from J institute Engineering, India published development of Lathe machine attachment for CNC machine. The CNC machine operates on mechatronic controls and a computer interface called CAMSOFT. In 2013, M. Moses & Dr. Denis Ashok research on Development of a brand new machining setup for energy efficient turning process. Design and Development of Conventional Lathe Machine. In 2014, Mr. Prakash N. Parmar et all published Review on Advance Automation of Conventional Lathe Machine. In 2009, R. Lizarralde et all research on New Developments in Lathes. In 2013, M. Minhat et all research on Retrofitting a traditional lathe to a digital intelligence system. For a manufacturing company to compete in today's market they must produce a quality product at the highest possible efficiency, productivity and less maintenance cost. Vibration during machining can affect the quality of manufactured parts, precision, life of tool, performance of lathe machine and cutting rates. Different types of chuck used in the lathe machine .1) Three jaw chuck 2) Four jaw chuck. Three jaw chuck have advantage of self centering and limitation is that it not recommended for high-speed load condition. Four Jaw Chucks are critical units of the high-speed horizontal lathe, while the interference fit between the chuck and spindle is one of most important factors influencing the performance of the high-speed horizontal lathe. It is very important to monitor the chucking condition of the power chucks for safety consideration in Lathes, especially high-speed lathes. They can be used to hold irregularly shaped parts. Multiple gripping method is one of the advantages of three jaw chuck. They used three jaw chuck lathe machines for internal and external threading of the cast iron double flange (CIDF) pipe. It has been observed that because of three jaws chuck the company did not get very quality pipes. So, in this project, I am going to analysis the three jaws chuck by modeling and FEM analysis. High speed cutting is used more and more widely because of high efficiency and perfect quality. For ensuring human safety and avoiding damages to expensive machine tools, real-time condition monitoring to spindle units, clamping devices and feeding units is becoming increasingly important.

Chucking condition of the power chuck. Cheng Zhou et.al in his paper defined it is very important to monitor the chucking condition of the power chucks for safety consideration in CNC Lathes, especially high-speed lathes. Measuring the pressure of the oil supplied to the rotary cylinder is a widely used method to monitor the input force of the power chuck. This paper proposes a direct input force measuring method for real time monitoring with more reliability compared to traditional methods. An input force sensor is developed and tested in the experiment, which monitors the variation of the input force of the power chuck accurately and promptly. The sensor is less likely to be polluted by the cooling water and scrap iron.

Reduction remedies for aerodynamic noise. Y. Konda et. Al in this paper he reveals that the air flow around the three jaws scroll chuck is observed by means of the tuft and smoke wire methods to establish the reduction remedies for the aerodynamic noise by chuck itself. The axial flow becomes duly propelling-like at the front of the chuck body, especially when the chuck has the protruded components, e.g., jaw and cylindrical work piece. In this case, two major flows are prominent, i.e., radial flow blowing out from the jaw area and axial flow merging with the radial flow, and both of which can be considered as a major cause of aerodynamic noise.



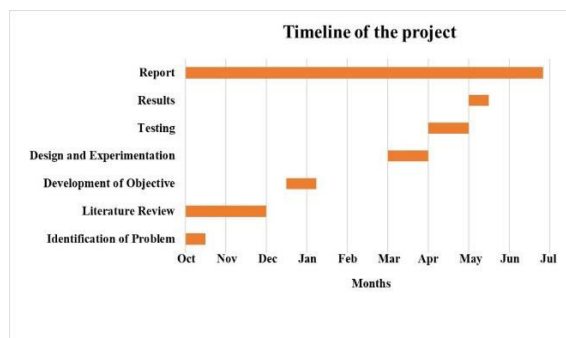
III. PROBLEM STATEMENT

A three jaws chuck set from a lathe machine tool failed whilst in use. At some prior point in time the case-hardened chuck jaw set had sustained damage to its gripping serrations, thus requiring refurbishment of the jaws. Shortly after re-entering service, the refurbished jaw number one (of three) failed traumatically. Sudden loss of grip allowed a large rapidly rotating work piece to be thrown free, hitting and inflicting seriously injury to the machine tool operator. Analysis of the broken jaw revealed sub-surface case-cracking, initiated as a result of metallurgical changes induced by thermal processing undertaken as part of the refurbishment cycle.

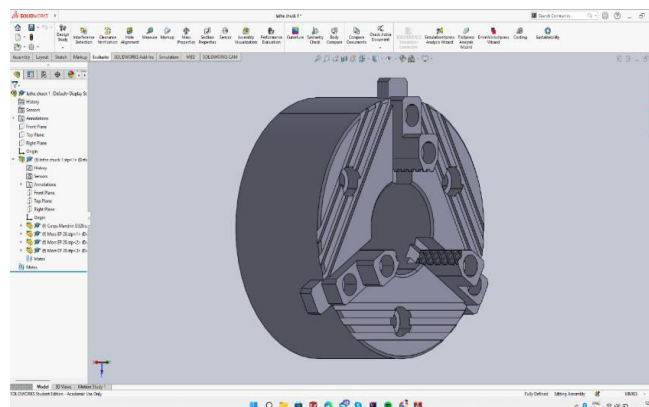
Fatigue propagation of a case-crack had then ensued, driving the crack to final traumatic failure. Further analysis revealed stress raising features on a second jaw. This particular jaw had initiated a longitudinal crack that, at the time of observation, had not propagated to failure. Therefore, both thermal processing and design shortcomings were found to be at issue with this incident. When considering the safety critical nature of lathe chuck jaws, a question to consider is whether a more prudent route of action is required for the future.

Rather than attempting refurbishment, it would be reasonable simply to scrap worn jaws. This is considered a sensible course of future action, rather than running the risk of being overtaken by a similar failure. Finally, the issue of ineffective or non-existent machine tool guarding was considered, with the outcomes effectively reducing injury compensation awarded to the machine tool operator.

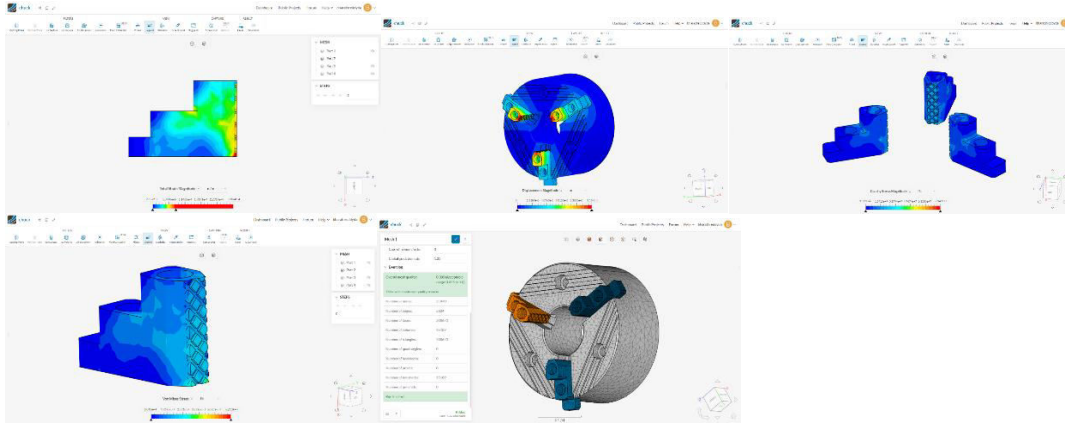
IV. TIMELINE OF PROJECT



V. DESIGN OF THREE JAW CHUCK



VI. EXPERIMENTAL RESULTS



VII. CONCLUSION

The paper has shown how to extend the current model in order to include general purpose work holding devices like three jaw chuck. In all cases, the model assumes that the workpiece acts as rigid part and errors due to deformation during clamping are assume to be negligible in comparison with future and datum-induced errors. Unlike previous extensions of the model, the proposed extension let practitioners apply zero defect strategies in multistage machining processes where three jaw chucks are used and it can also be used for estimating manufacturing process capability under specific work holding devices.

- In the total strain magnitude result, we have got maximum total strain magnitude of $2.864e-4$ m/m and the minimum total strain magnitude $2.152e-7$ m/m.
- In the total displacement magnitude result, we have got minimum total displacement magnitude of 0 m and the maximum total displacement magnitude $1.169e-5$ m.
- In the total Cauchy stress magnitude result, we have got maximum total Cauchy stress magnitude of $7.943e+7$ Pa and the minimum total displacement magnitude $3.592e+4$ Pa.
- In the above total Von Mises stress result, we have got maximum total Von mises stress of $6.293e+7$ Pa and the minimum total Von mises stress $6.043e+4$ Pa.

VIII. FUTURE SCOPE

The project is improved material design and improve the material strength in order to hold the workpiece. We need to improve the design of chuck used. From the above analysis we consider the material to determine cost and strength we found that cast iron is good for the design and in cost purpose. Future study is used to improve the quality of design with minimum parameters and shape of the model in design and also more amount of the study is needed to improve the strength by using design parameters and optimization of design.

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