MECHANICAL BEHAVIOR PERFORMANCE IN BORING TOOL USING COMPOSITE MATERIAL

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ABSTRACT:- This project is based on the study of structural stability of Boring tool by using the finite element analysis techniques. The aim of this project is: 1) To do Vibration analysis. 2) To do the fatigue analysis on the Boring tool and to compare the results with experimental values. 3) To estimate the best suitable location of damper in boring tools.

The materials used for damping are aloevera root, papaya stum and bitter gourd stum used, The tools that are used for boring holder was designed to achieve the objectives of having maximum desirable structural properties.

Both The boring tool and damping materials is modeled using Pro-Engineer and analyzed using ANSYS. The modeling assumptions used and the final results based on FE analysis (modal analysis) are presented. By the help of modal analysis we could find the natural frequencies and mode shapes. And also the values that are compared with Experimental values.

Key Words: Dampers, boring bar, vibrometer, aloeveraroot bitter gourd stum,papaya stum and finite element analysis)…

1. INTRODUCTION

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2. INTRODUCTION

Machining and measuring operations are accompanied by invariably relative vibration between tool and work piece. The reason for the vibration is due to one or more following causes:

(1) In homogeneities the work piece material; (2) Variation of chip cross section; (3) Disturbances in the work piece or tool drives; (4) The loads of dynamic are generated by acceleration/deceleration of massive moving components; (5)The environment transmits the vibration; (6) Self-excited vibration generated by the cutting process or by friction (machine-tool chatter).

The level used to tolerate the relative vibration between tool and work piece, i.e., the maximum amplitude and some of the extent frequency is determined by the required surface finish and machining accuracy as well as by detrimental effects of the vibration on tool life and by the noise which is frequently generated.

It describes the preliminary work to optimize the use of boring tool with reduced vibrations and wear and tear. In this paper the boring tool was designed and analyzed using Finite Element Software with the help commercial values available. And the Finite Element Analysis values are compared with the practical value.

This Paper describes how to vibration is reduced with the help of Damper. In this paper we locate various types of composite dampers in same place of the tool otherwise any one type of damper is to be fixed in various places and to be checked the tool vibration. This Analysis was done by Finite Analysis Software and by practical method also necessary for the correct functioning of the various devices.

Mostly, the vibrations are undesirable, wasting energy and creating unwanted sound – noise. For example, the vibrational motions of an engines, electric motors, or any device of mechanicaly in operation are typically unwanted. Such vibrations are caused by imbalances in the rotating parts, uneven friction, the meshing of gear teeth, etc. Careful designs usually minimize unwanted vibrations.

The study of sound and vibration are closely related. Sound, or "pressure waves", are generated by vibrating structure`s (e.g. vocal cords); these pressure waves can also induce the vibration of structures (e.g. ear drum). Hence, when trying to reduce noise it is often a problem in trying to reduce vibration.

The project is based on analyzing the vibrations of boring tool which tends to reduce wear and tear and accuracy of machining.

2.2 Vibration Due to in homogeneities in the Work piece

Hard spots or a crust in the material being machined impact small shocks to the tool and work piece, as a result in which the free vibrations are set up. If these transients are rapidly damped out, their effect is usually not serious; they simply form part of the general "background noise" encountered in making vibration measurements on machine tools.

2.3 Vibration due to Cross-Sectional Variation of Removed Material

Variation in the cross-sectional area of the removed material may be due to the shape of the machined surface.

2.4 Disturbances in the Work piece and Tool Drives

Forced vibrations result from rotating unbalanced masses; gear, belt, and chain drives; bearing irregularities; unbalanced electromagnetic forces in electric motors; pressure oscillations in hydraulic drives; etc.

2.5 Vibration Caused by Rotating Unbalanced Members

Forced vibration induced by rotation of some unbalanced member may affect both surface finish and tool life, especially when its rotational speed falls near one of the natural frequencies of the machine-tool structure. This vibration can be eliminated by careful balancing.

2.6 Drives

Spindle and feed drives are the important sources of vibration that are caused by the motors, power transmission elements (gears, traction drives, belts, screws, etc.), bearings, and guide ways.

3. METHODOLOGY

Methodology mainly consists of 3 steps.

(a)Modeling

(b)Loading

(c)Analysis

3.1 Modelling

The boring bar consists of Boring Head and Boring Tool. This component will be modeled using Pro-E Software.

3.2 Modelling Procedure

The process of design is a long and time consuming one. The model of boring tool, comprise of various sections. Modeling of boring tool using CADD packages looks quite complex as the geometry was not a uniform geometry. Various CAD software's are available but we tried a Higher End Software named ProE which is used for most of solid modeling works. The modeling is actually done in part file and assembled in Assembly.

By means of various approaches, the boring tool was tried to model as:

1) Modeling in to split components and then assembling.

2) One by one importing of various boring tool parts and assembled.

3.3Loading

The following loading will occur on the boring tool while machining.

Twisting moment & Bending moment.

4. Introduction to Pro-Engineer

Pro-Engineer is a powerful application. It is ideal for capturing the design intent of your models because at its foundation is a practical philosophy. Founder of this Pro-Engineer is Parametric Technology Corporation. After this version they are released Pro-E 2000i2, Pro-E 2001, Pro-e Wildfire, and Pro-e Wildfire2.

5. INTRODUCTION TO ANSYS

The ANSYS program has many finite element analysis capabilities, ranging from a simple, linear, static analysis to a complex non – linear, transient dynamic analysis.

5.1 A typical ANSYS analysis has three distinct steps:

Building the model

Applying loads and obtains the solution

Review the results.

5.1.1 Building the model:

Building a finite element model requires a more of an ANSYS user's time than any other part of the analysis. First you specify the job name and analysis title. Then we have to identify the element types, real constants, and material properties, and the model geometry

5.2 How to apply loads:

You can apply loads most loads either on the solid model (on key points, line, areas) or on the finite element model (On nodes and elements). For example, you can specify forces at a key point or a node. Similarly, you can specify convections (and other surface loads) on lines and areas or nodes and element faces.

No matter how you specify loads, the solver expects all loads to be in term of finite element model. Therefore if your specify loads on the solid model, the program automatically transfers them to the nodes and element at the beginning of the solution.

5.3 The result files:

The ANSYS solver writes results of an analysis to the results file during solution. The results file depends on the analysis discipline.

5.3.1displaying results graphically:

Graphics display may be the most effective way to review results. You can display the following types of graphics in post1:

Contour displays

Deformed shape displays

Vector displays

Path plots

Reaction force displays

Particle flow traces.

5.4 INTRODUCTION TO COMPOSITE MATERIAL

Composite material is made by combining two or more matrials mixed and bonded.generally a composite matrial is composed of reinforcement.composite material wide application in many field,such as,industrial,miltary,space graft,automobiles,civil work and bio medical application.

5.5 AVAILABILITY OF COMPOSITE MATERIAL

Many types of natural fibre have been investigated flax, hemp, jute, staw, wood ricehusk, wheat, barley, oats, bamboo, sugarcane, needs, ramie, sisal, coir, banana fibre etc. investigated aloevera root fibre reinforced polyster composites and found that the optimum content of aloe vera root fibre composite has good flexural strength. It is easy available in India, low cost.

COMPOSITE MATERIAL PROPERTIES

The following mechanical properties are considered

Tensile

Compressive

Flexural

Flexural breaking point

Impact

Hardness, etc.

6.DESIGN ANALYSIS

6.1Boring tool with Damper Material

(ALOEVERA ROOT&PAPAYASTEM)

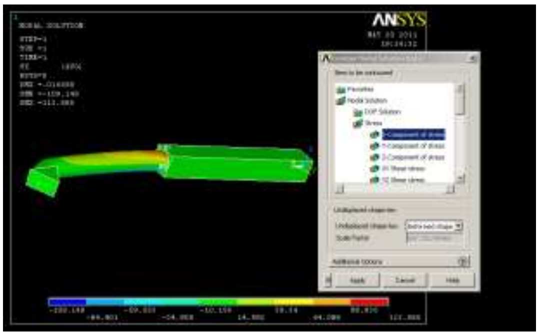

Figure 1

6.2FEA MODEL OF BORING TOOL

6.2.1 Nodal Analysis (without damper)

1)

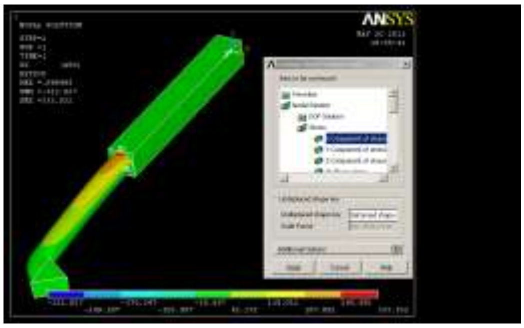

Figure 2

2) 6.2.2 Nodal Analysis (ALOEVERA ROOT)

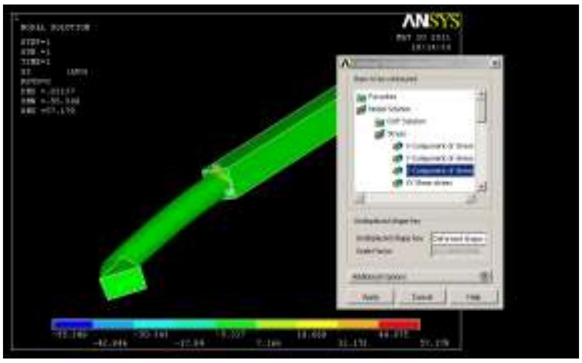

Figure 3

3) 6.2.3 Nodal Analysis (PAPAYASTEM)

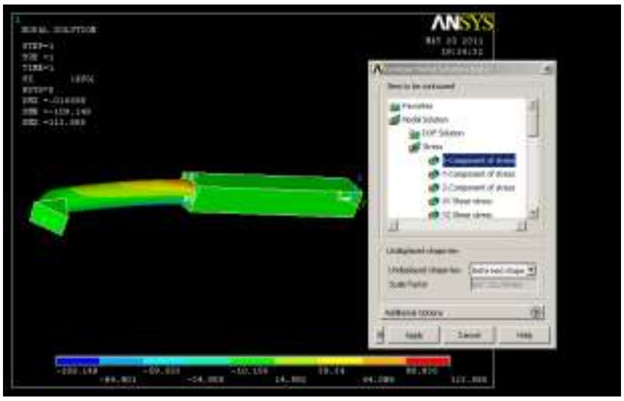

Figure 4

6.3 VONMISES:

6.3.1Without Damper

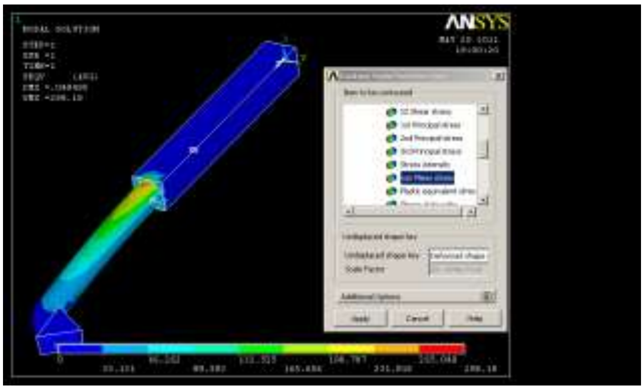

Figure 5

4) 6.3.2 With Damper(ALOEVERA ROOT)

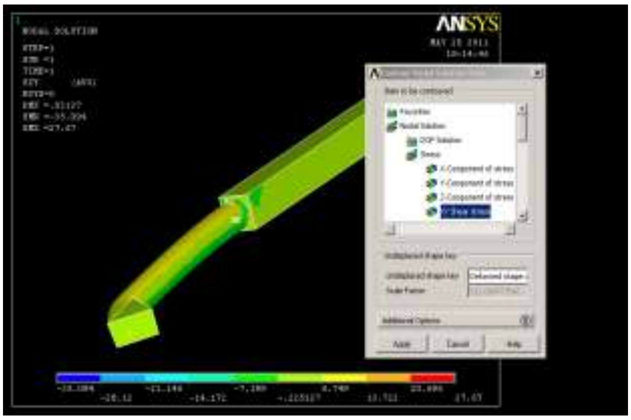

Figure 6

6.3.3 With Damper (PAPAYASTEM)

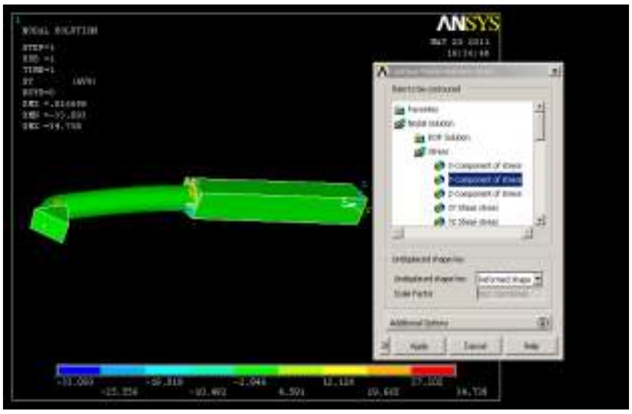

Figure 7

7. RESULT

Node	Stresses	Without Damper	With aloevera root	With papayastem
1	X	6238	5390	4891
2	Y	14599	12614	11446
3	Z	6238	5390	4891
4	Vonmises	12775	11038	10016

Table 1

7.1 Discussion on Nodal Analysis:

Natural frequency of the boring tool X- component stress without damping material is 6238 N/mm2, with ALOEVERA ROOT damper is 5390 N/mm2, with PAPAYASTEM damper is 4891 N/mm2 and the corresponding mode shapes for these are horizontal bending.

In PAPAYASTEM damper is minimized the stresses comparing that damper ALOEVERA ROOT and without damper. So the boring tool vibration will be reduced in PAPAYASTEM damper.

8. CONCLUSION

The results were obtained from the nodal analysis of boring tool with and without dampers. It is observed that the natural frequency of boring tool has been enhanced with damping materials. From the FEA analysis, it is observed that amplitude of the vibration has been reduced with damping materials. In that analysis PAPAYASTEM damped boring tool amplitude of vibration has been reduced when compared with undammed boring tool and damper ALOEVERA ROOT amplitude of the vibration has been reduced with damping materials. In that analysis PAPAYASTEM damped boring tool amplitude of vibration has been reduced when compared with undammed boring tool and damper ALOEVERA ROOT

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BIOGRAPHIES

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