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MECHANICAL BEHAVIOR PERFORMANCE OF BORING TOOL USING COMPOSITE MATERIALS

I.Jeyakumar[1], L.Narayanan [2], R.Mohammad Giyahudeen [3]
[1]Associate professor, M.E (Manufacturing Engineering), Department of Mechanical Engineering, Maha Barathi Engineering College, Chinna Salem, Tamilnadu, India.
[2]Assistant professor, M.E (Manufacturing Engineering), Department of Mechanical Engineering, Maha Barathi Engineering College, Chinna Salem, Tamilnadu, India.
[3]Associate professor, M.E (Design Engineering), Department of Mechanical Engineering, Maha Barathi Engineering College, Chinna Salem, Tamilnadu, India.
Email:ijkmptc@gmail.com

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Abstract

This project deals with the study of the structural stability of Boring tool using finite element analysis techniques. The aim of the 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 damping materials are aloevera root, papaya stum and bitter gourd stum used, Boring tool 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.

Modal analysis is used to find the natural frequencies and mode shapes. And the values are compared with Experimental values.

Keywords: Dampers, boring bar, vibrometer, Accelerometer, aloeveraroot, bittergourd stum, papaya stum and finite element analysis.

1. Introduction

Machining and measuring operations are invariably accompanied by relative vibration between work piece and tool. These vibrations are due to one or more of the following causes:

(1) In homogeneities in the work piece material; (2) Variation of chip cross section; (3) Disturbances in the work piece or tool drives; (4) Dynamic loads generated by acceleration/deceleration of massive moving components;

(5) Vibration transmitted from the environment; (6) Self-excited vibration generated by the cutting process or by friction (machine-tool chatter).

The tolerable level of relative vibration between tool and work piece, i.e., the maximum amplitude and to some extent the 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.

This paper describes 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.

2. Existing Systm

2.1 Vibration

Vibration refers to mechanical oscillations about an equilibrium point. The oscillations may be periodic such as the motion of a pendulum or randomsuch as the movement of a tire on a gravel road. Vibration is occasionally "desirable".

For example the motion of a tuningfork, the reed in a woodwind instrument or the cone of a loudspeaker are the desirable vibrations, necessary for the correct functioning of the various devices. More often, vibration is undesirable, wasting energy and creating unwanted sound – noise. For example, the vibrational motions of engines, electric motors, or any mechanical device in operation are typically unwanted. Such vibrations can be 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 structures (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. In our project is analyzing vibrations of boring tool 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 impart small shocks to the tool and work piece, as a result of which 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 Workpiece 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 can be important sources of vibration caused by 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 Modeling:

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

3.2 Modeling 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 2000i^{2,} 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, define 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 name of the results file depends on the analysis discipline.

5.3.1 Displaying Results Graphically: Graphics display is perhaps 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 Proposed System

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. Many types of natural fibre have beeninvestigated flax, hemp, jute, staw, wood ricehusk, wheat, barley, oats, bamboo, sugarcane, needs, ramie, sisal, coir, bananafibre 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.

5.5 Composite Material Properties

The following mechanical properties are considered

Tensile

Compressive

Flexural

Flexural breaking point

Impact

Hardness, etc.

5.6 Comparison of Existing Andprosed System

The existing method of vibration control is difficult to insert the damping material and dambing material cost is high butthe proposed method is simble and matrial cost is low

6. Design Analysis

6.1Boring tool with Damper Material

(ALOEVERA ROOT&PAPAYASTUM)

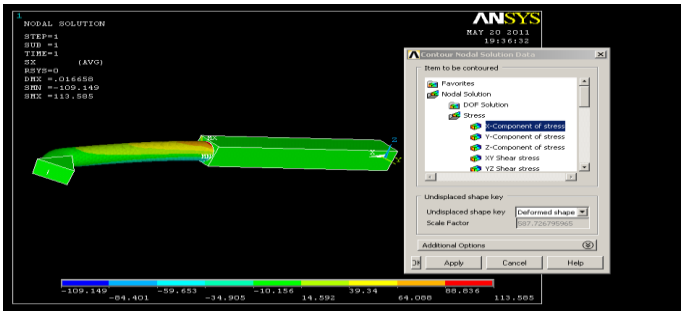

Figure 1

6.2 FEA Model of Boring Tool

6.2.1 Nodal Analysis (without damper)

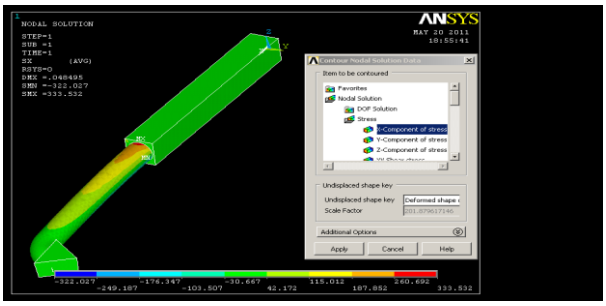

Figure 2

6.2.2 Nodal Analysis (ALOEVERA ROOT)

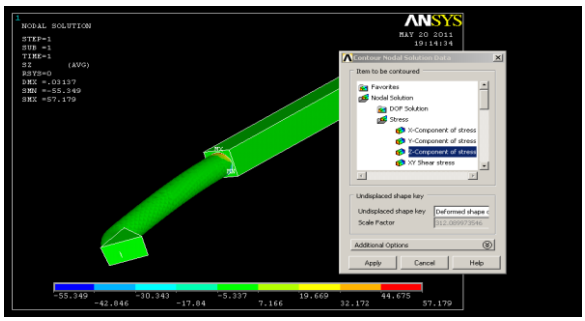

Figure 3

6.2.3 Nodal Analysis (PAPAYASTUM)

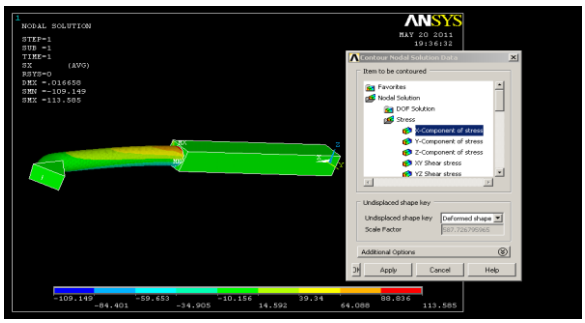

Figure 4

6.3 Vonmises:

6.3.1WithoutDamper

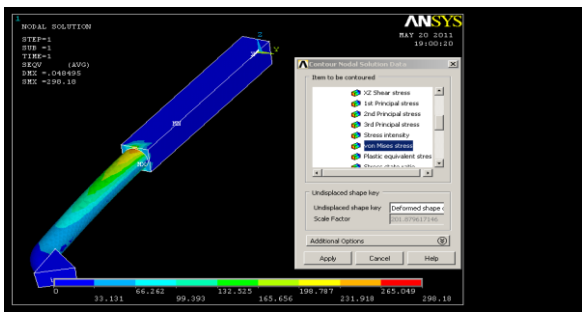

Figure 5

6.3.2 **With Damper(ALOEVERA ROOT)**

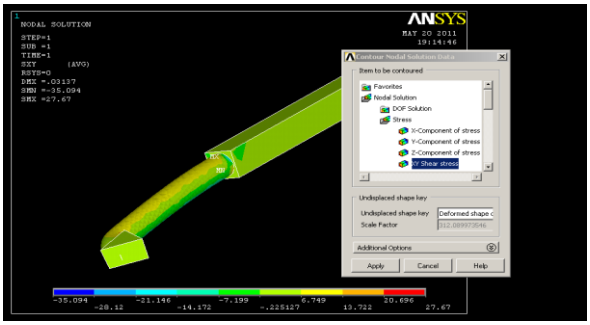

Figure 6

6.3.3 With Damper(PAPAYASTUM)

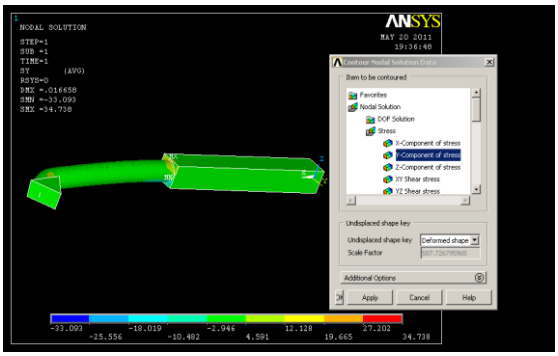

Figure 7

7. Result

S. No	Stresses	Without Damper	With aloevera root	With papayastum
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/mm^2, with ALOEVERA ROOT damper is 5390 N/mm^2, with PAPAYASTUM damper is 4891 N/mm^2 and the corresponding mode shapes for these are horizontal bending. In PAPAYASTUM damper is minimized the stresses comparing that damper ALOEVERA ROOT and without damper. So the boring tool vibration will be reduced in PAPAYASTUM 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 PAPAYASTUM damped boring tool amplitude of vibration has been reduced when compared with undammed boring tool and damper ALOEVERA ROOT.

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