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Effect of Number of Teeth & Various Parameter on Natural Frequency of Circular Saw Cutter

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Abstract

The circular Saw is most common of Sawing machine & used all over world. The results of the measuring the natural frequency of two structurally different circular saw blades are presented in this paper. The types of the circular saw blades with 40 teeth& 48 teeth are used here. The diameters of the circular-saw blades were 290 mm thickness 2.15mm,inner diameter 25mm.Along with this effect of variable aspect ratio, different types of slits,holes,slots on natural Frequency find out by Ansysis.The objective of this paper is to find out effect of different parameter on vibration characteristics as natural frequency, mode shapes . The influence of the number of teeth on natural frequency of cutter. An object has always more than one natural frequency. Each frequency experiences different number of nodes and modes. Comparing the results of frequency with the working conditions of the saw blade. The information thus obtained is of great use for designer

Keywords **-** Circular Saw Cutter,vibration,Natural frequency, FFT Analyser,Ansys

I. INTRODUCTION

Now a day's wood became one important aspect of our daily activities. Wood industries in quite demand, the main part are circular saw cutter as tool which is used in wood industry for carrying out various operations. so it is necessary to study vibration of circular cutter .When natural frequency of circular cutter is equal to rotating speed of saw resonance takes place & cutter vibrates more for small change, it may fail or cause accident Circular cutters are extensively used so knowledge of natural frequencies of components is of great interest in the study of response of structures to various excitations. Hence a circular saw cutter with hole at centre, free at outer edge and fixed in inner edge, with outer slots is chosen and its dynamic response is investigated. Knowing the value of the natural frequencies of the saw blade help the saw manufacturers incorporate these modifications into their future designs for better saw blades Everything has a natural frequency for instance a guitar. When a force is applied to a string a sound develops. The frequency of this sound is the same as that strings natural frequency. If the tension in the string increases a higher sound will be heard due to higher natural frequency and a direct relationship between tension and natural frequency can therefore be established.

II. EXPERIMENT

Two Circular Saw cutter of S.S. are chosen for testing. Following are the material properties for the cutter. Young's modulus (E) = 2.1 X 1011 N/m2, Poisson's ratio (μ) = 0 .3, Density of material = 7850 N/m3. The structure is isotropic homogeneous elastic material. Three dimensional parameters represent the cutter radius , outer radius and thickness respectively. Specimens with variable thickness, different aspect ratios, different slot shape, variable no.of teeth of cutter, are chosen for test. These specimen sizes are chosen to facilitate the measurements by using the same fixture for all the specimens. As boundary conditions for cutter are inner edge fixed and outer edge free. The FEA analysis is done on the ANSYS software and following results were obtain which are tabulated as following

Fig 1.Meshing of cutter

Fig2. Circular saw cutter

III. RESULTS

By Ansys Some of results are given below for cirular saw cutter.

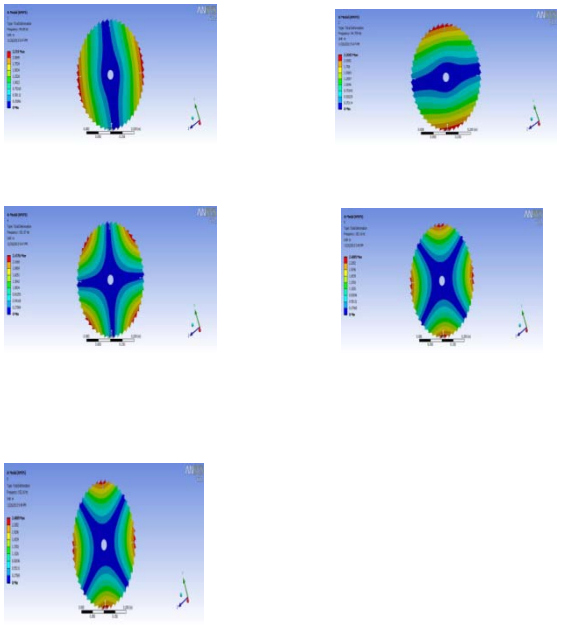


Fig 3.Mode Shape & Natural Frequency for variable teeth

Natural frequency For variable number of teeth	Mode1	Mode1	Mode2	Mode1
For 40 Teeth	92.184	92.302	113.31	148.85
For 48 Teeth	94.65	94.705	115.51	151.67

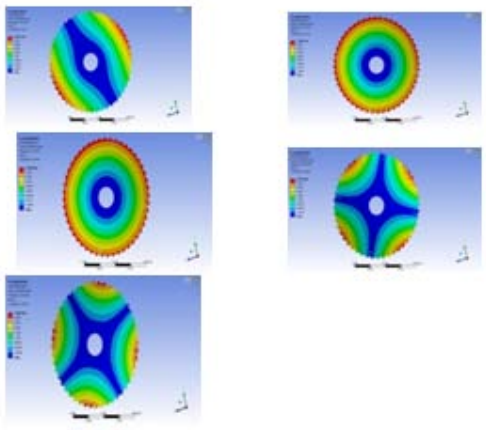
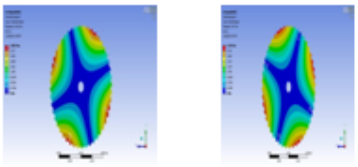


Fig 4: Variable Aspect Ratio

Variable Aspect ratio Natural requency	Mode -1	Mode -2	Mode -3	Mode -4	Mode -5
CB2-48-Teeth 25mm imner diameter	94.65	94.705	115.51	151.67	152.16
CB2-48-Teeth 50mm imner diameter	124.69	125.17	135.9	167.67	168.29



For different shape of slot	Mode -1	Mode -2	Mode -3	Mode -4	Mode -5
CB2 48 Teeth	94.65	94.705	115.51	151.67	152.16
CB2 48 Teeth	93.433	93.701	114.76	149.77	150.23

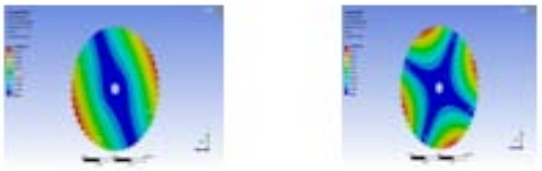


Fig 5: Natural Frequency For Different Slots

Natural frequency Hz	Mode-1	Mode-2	Mode-3	Mode-4	Mode-5
CBT 40 radial linear slit	73.779	74.019	74.342	126.87	127.41
CBT 40 Teeth circular concentric slit	89.822	90.264	108.06	142.29	142.49

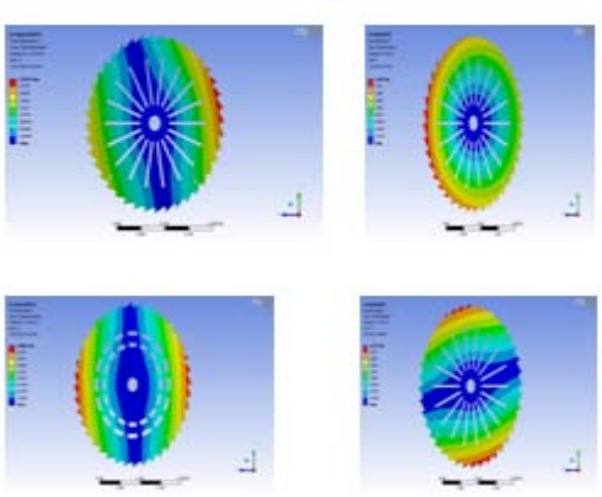
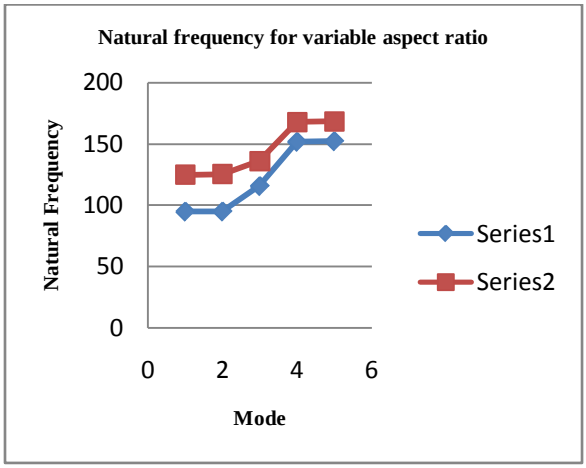


Fig 6: Radial slit



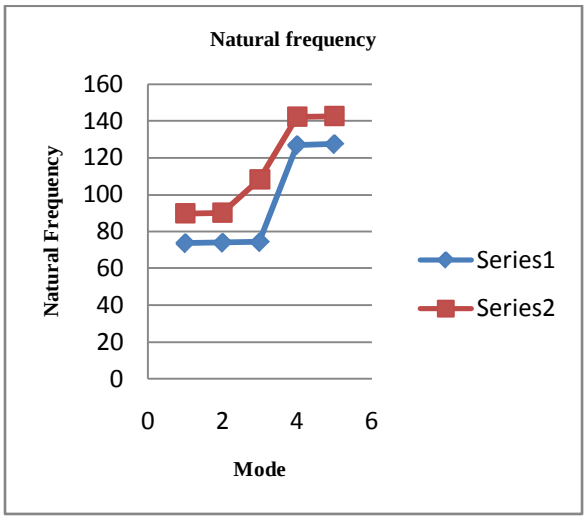


Fig 7: Natural Frequency for radial slit.

I V. INSTRUMENTION USED FOR EXPERIMENT

A)FFT Analyzer

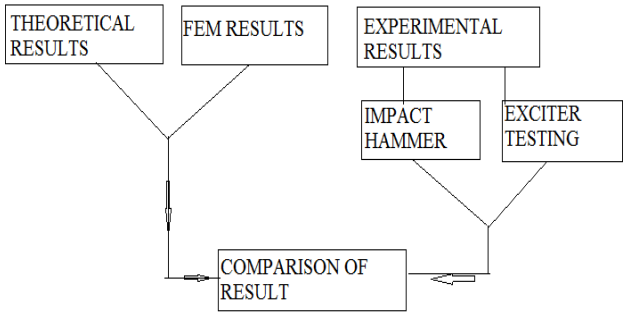
B)Accelerometer

C)Exciter

D) Impact Hammer

V. EXPERIMENTAL SETUP

The circular saw cutter of thickness 2.16 mm. The inner diameter of the cutter is 25 mm and outer diameter is variable with same boundary condition. Specimens prepared were rigidly fixed in fixture to obtain correct boundary conditions. Analysis is done experimentally with the help of FFT analyzer, accelerometer, impact hammer . Natural frequencies are detected by hitting the plate with hammer; the response at a point of a plate is measured by using an accelerometer. FFT analyzer analyzed the output of accelerometer



VI. CONCLUSION

Hence a circular saw cutter with variable central hole, inner edge is fixed and outer edge free with outer slots is chosen and its response is investigated, For increase in aspect ratio natural frequency also increase, for increase in number of Teeth natural frequency also increases, Natural frequency increases in case of circular slit & decreases in case of radial linear slit. Natural frequency decreases for change in shape of slot .

VII. FUTURE WORK

Experimental validation of all can be done by FFT analyzer. Effect of noise can be find by using noise measurement device.

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