International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06 | June 2021 www.irjet.net p-ISSN: 2395-0072

Analysis of Bandsaw Swing Frame by Vibrometer and FFT

S. V. Dhanal[1], Sonam Balighate[2], Appasaheb N. Pandav[3]

[1,3]Assistant Professor, Sanjay Ghodawat university, Kolhapur, Maharashtra, India
[2]M.E. (Mechanical), Sanjay Ghodawat Institutions, Kolhapur, Maharashtra, India

---

Abstract - *A bandsaw machine has a saw with a long, sharp blade and a continuous band of toothed metal stretched between two or more wheels to cut material. They are used mainly in wood-working, metal-working, and lumbering, but possibly cut a variety of materials to cut curves, even in thick lumber, such as in creating cabriole legs, to rip lumber and to crosscut short pieces. In this work, velocity and acceleration measurements of bandsaw swing frame of existing conventional bandsaw is taken by vibrometer. The Fast Fourier Transform (FFT) spectrum analyzer is used to analyze signal waveforms of bandsaw machine swing frame of conventional bandsaw as well as developed bandsaw. It is observed that the conventional bandsaw frame has dangerous but still permissible vibrations. So, it is required to reduce these vibrations. From the graphs generated by FFT analyzer it is clear that the resonance level of conventional bandsaw frame is less than the new developed bandsaw swing frame.*

Key Words: Bandsaw, Bandsaw frame, Vibrometer, FFT analyser, Waveforms

1. INTRODUCTION

The rewards of bandsaw machine comprise uniform cutting action as a result of an evenly distributed tooth load and the ability to cut irregular/curved shapes like a jigsaw. The minimum radius of a curve is determined by the width of the band and its kerf. Most band saws have two wheels rotating in the same plane, one of which is powered, although some may have three or four to distribute the load. The blades are available in a variety of sizes and tooth pitches (teeth per inch, or TPI), which enables the machine to be highly adaptable and able to cut a wide variety of materials including wood, metal and plastic.

Practically all bandsaws today are powered by an electric motor. Line shaft types were once common but are now antiques. A bandsaw can be used to cut curves, even in thick lumber, such as in creating cabriole legs, to rip lumber and to crosscut short pieces. The most common use for the bandsaw, however, is in cutting irregular shapes [1]. The second most common use is in resawing or ripping lumber into thinner slabs. A bandsaw also makes the smoothest cuts and, with the suitable blade, can be used to cut materials other than wood, including metal [2]. Today these machines are preferred for manufacturing of parts in modern automobile, aircraft and ship industries [3].

There are some limitations of conventional bandsaws still using in many factories. Due to less accuracy and speed, they are subjected to more vibrations [4-7]. Hence, it is required to develop new bandsaws to reduce the vibrations and increase the life of blade.

The first American bandsaw patent was granted to Benjamin Barker of Ellsworth, Maine, in January 1836. The first factory produced and commercially available bandsaw in the U.S. was by a design of Paul Prybil. Power hacksaws (with reciprocating blades) were once common in the metalworking industries, but band saws and cold saws have mostly displaced them.

In this work, the geometry of bandsaw swing frame of existing conventional bandsaw and developed bandsaw (at Aniket Machines, Ichalkaranji, Maharashtra, India) was studied. The velocity and acceleration measurements were taken by vibrometer. The FFT spectrum analyzer is used to analyze signal waveforms of bandsaw swing frame of conventional bandsaw as well as developed bandsaw.

2. Experimental

The existing conventional bandsaw machine is horizontal type. It consists of driving wheel and driven wheel. The blade is rapped on driving wheel and driven wheel. When it comes near the job holding attachment it gets tilted and become straight. The motor of one H.P. is used. The blade tension adjusting knob is provided which keeps proper tension between driving wheel, driven wheel and belt. The hydraulic cylinder is used for speed adjustment. The coolant is continuously provided for cooling purpose. Its right end is fixed and left end is getting vertically up and down. This is manual machine and the operator has to feed job manually.

The dimensions of existing bandsaw frame are length 1200 mm, breadth 400 mm and thickness 10 mm. The bandsaw swing frame is made up of cast iron Grade-25. Table 1 shows Mechanical composition of grey cast iron ASTM 25. The geometrical study of existing bandsaw machine frame was done. The middle thin section was selected for analysis, having more stress concentration. The velocity and acceleration measurements were taken by vibrometer VB-8203, which have capacities as, acceleration- 200 m/s^2, velocity- 200 mm/s and displacement 2 mm.

Table -1: Mechanical composition of Gray cast iron ASTM-25

Tensile strength (MPa)	179
Compressive strength (MPa)	668
Modulus of elasticity (MPa)	100
Endurance limit	79
Brinell hardness number	174
Fatigue stress concentration factor	1.05

Fig -1: Conventional Bandsaw machine

Fig. 1 shows the existing conventional bandsaw machine. Fig. 2 shows the block diagram of experimental set-up used to analyze signal waveforms of bandsaw swing frame of conventional bandsaw as well as developed bandsaw.

The FFT spectrum analyzer uses digital signal processing techniques to analyze a waveform with Fourier transforms to provide in depth analysis of signal waveform spectra. The FFT analyzer is able to provide facilities that cannot be provided by swept frequency analyzers. In view of the fact that the waveform is analyzed digitally, the waveform can be captured in a relatively short time, and then the subsequently analyzed.

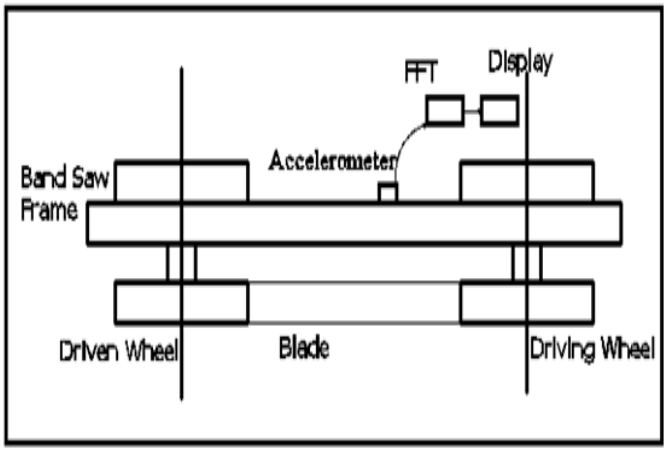

Fig -2: Experimental set-up

3. Results

Table -2: Results of vibrometer testing

Parameters	Free end	Fixed end
Velocity	4 mm/s	0.8 mm/s
Acceleration	2 mm/s^2	2 mm/s^2
Displacement	0.080 mm	0.040 mm

Velocity (mm/s)	Class-1
	28.00
	11.00
	18.00
	7.00
	4.50
	2.00
	1.80
	1.10
	0.70
	0.50
	0.30
	Unacceptable

	Unsatisfactory
	Satisfactory
	Good

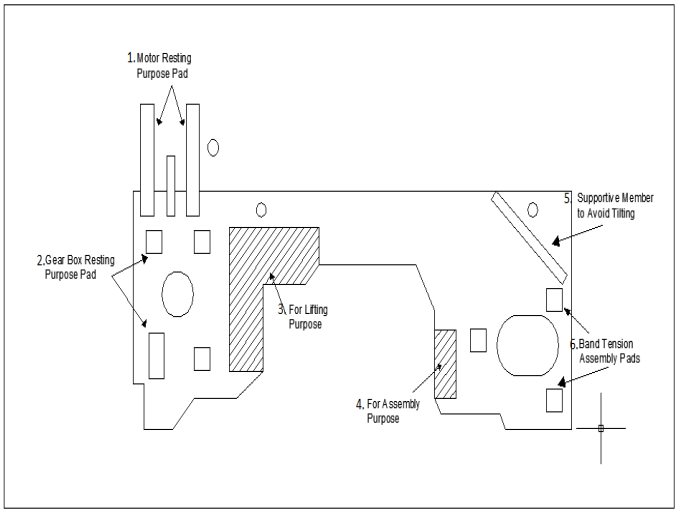

Fig -3: Developed bandsaw swing frame

The following graphs are generated by using FFT analyzer of conventional and developed bandsaw swing frame:

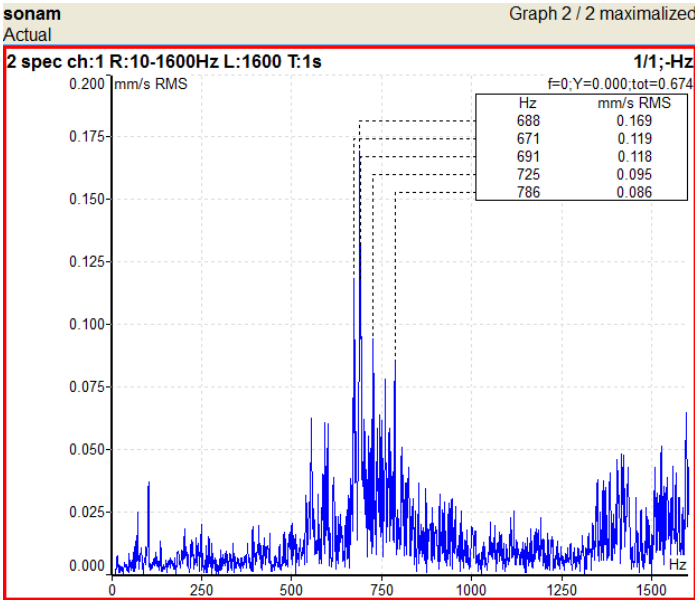

Fig -4: Waveforms of conventional bandsaw swing frame

4. Conclusion

From the information provided with the vibrometer and the readings it is clear that the conventional bandsaw swing frame has dangerous but still permissible vibrations. So, it is required to reduce the vibrations. From the FFT analyzer waveform graphs, it is clear that the resonance level of conventional machine is less than the developed bandsaw frame. Thus, with the developed bandsaw it is possible to cut material with higher cutting speed. It has less vibrations than conventional bandsaw.

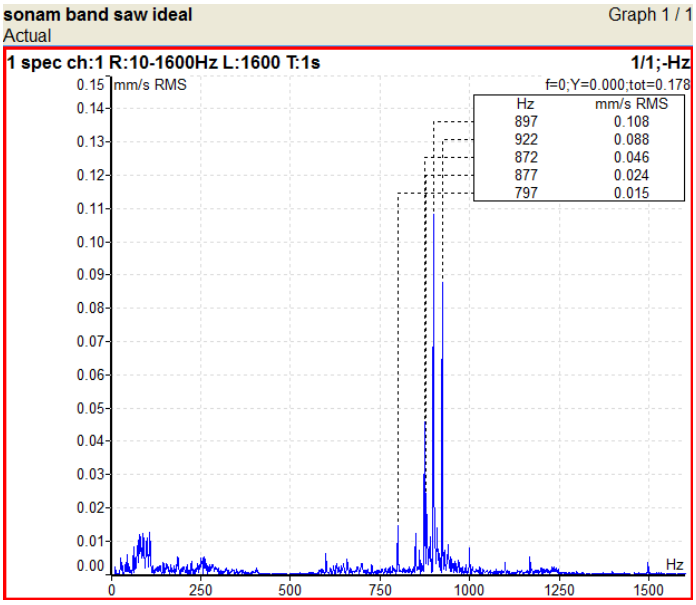

Fig -5: Waveforms of developed bandsaw swing frame

ACKNOWLEDGEMENT

The authors would like to thank Mr. Ravasaheb Patil, Aniket Machines, Shahapur Ichalkaranji, Maharashtra, India for providing experimental support.

REFERENCES

[1] C. C. Wei et al., The Study of Band Sawing Vibration and Cutting Performance, Key Engineering Materials, Vol. 642, pp. 236-241, 2015.

[2] J. Junz Wang, Sung-Hua Wu, Rong-Shean Lee, Chip fractal geometry and loading characteristics of sinusoidal multi-cutters in hack-sawing process, International Journal of Machine Tools and Manufacture, Volume 59, pp. 65–80, 2012.

[3] G. J. Chen, J. Ni, T.T. Liu, H.P. Chen, Y.P. Gong, Study on Optimizing the Process Parameters for the Bandsaw Equipment", Applied Mechanics and Materials, Vol. 328, pp. 208-212, 2013.

[4] P. J. Thompson, "A theoretical study of the cutting action of power hacksaw blades", Int. J. Mach. Tool Des. Res. Vol. 14, pp 199–209, 1974.

[5] P. J. Thomson & R.W. Taylor, "An investigation into factors influencing the wear rate of power hacksaw blades using dimensional analysis" (1976).

[6] Experimental studies on band saw blade vibration, C. Tanaka, Y. Shiota, A. Takahashi and M. Nakamura, Wood Science and Technology volume 15, pp.145–159, 1981.

[7] P. Gendraud, J. -C. Roux, J. -M. Bergheau, Vibrations and stresses in band saws: A review of literature for application to the case of aluminium-cutting high-speed band saws, Journal of Materials Processing Technology, Volume 135, pp 109–116, 2003.