

# Resonance Analysis of a Hydraulic Surface Grinder Machine

**Munish Kumar**

*M.Tech, Mechanical Dept., D.C.R.U.S.T., Murthal, India*

## ABSTRACT

The structure of a surface grinder comprises of a base, all the other machine members like column, the reciprocating table, the grinding wheel, spindle and spindle motor are all supported on the base. In the plan of one such surface processor waviness was seen on the ground surface. It has turned out to be important to explore into the conduct of the machine under working conditions. Examination demonstrated that some machine segments are getting into inordinate vibrations. This waviness could emerge because of vibrations of the machine structure while working. It is watched that the reason for such waviness is because of reverberation which prompts sudden vibrations that understudy influence the surface complete and the structure itself. The present task centers around upgrading of the surface processor display which has greatest working velocity of 3000 rpm. With a specific end goal to stay away from reverberation the measurements are changed such that the normal frequency of the model is either diminished or expanded. One technique for examination is through the test approach. Anyway this approach is costly and requires great measure of lead time. The present task utilizes Finite component technique for exploring into the vibration normal for the machine. Utilizing the FEM, surface processor is displayed and investigated to discover the feeble connections causing vibrations by modular examination technique. The outline of the powerless connections is enhanced and the investigation is rehashed to cut down the vibration to allowable level. The symphonious examination is additionally completed to discover the vibration adequacy and speed. Explanatory strategy is utilized to affirm the anticipated FEM comes about.

*Keywords: Surface grinder, Resonance, Vibrations, Frequency, Harmonic analysis, etc.*

## I.INTRODUCTION

The phenomenon of mechanical vibration is encountered by everyone in course of their daily life. The impact isn't generally disagreeable, as each individual who endeavors to focus while street drills are being worked will concur. Vibration isn't just physically charming however may likewise debilitate a structure. It should hence be viewed as a most unfortunate condition, which must be wiped out for both solace and security. As mechanical vibration is discovered so as often as possible in regular day to day existence, its investigation is accepted to

interest each one of us. Most Engineering machines and structures encounter vibration to some degree or other [1].

A machine can't be separated from vibrations totally. In typical conditions the vibration levels in numerous frameworks are little, yet once in a while another machine when put into activity indicate fierce vibrations, the reason could be flawed plan bringing about exorbitant vibrations. This vibration level, if broke down, could prompt decision ahead of time, with respect to a conceivable disappointment of the machine in future [2].

Free Vibration is the movement of a molecule or a body or framework under go just because of starting unsettling influence and uprooted from a place of harmony. A large portion of vibrations are unwanted in machines and structures since they deliver expanded burdens, vitality misfortunes, cause more wear, increment bearing burdens, initiate weariness quality, make traveler distress in vehicles and ingest vitality from the framework, it likewise causes poor surface complete in any processor. Turning machine parts require watchful powerful adjusting with a specific end goal to forestall harm because of vibrations. Here single level of free damped vibration framework considered. It happens when a framework is dislodged from a place of stable harmony. The framework tends to come back to this harmony position under the activity of reestablishing powers, (for example, a flexible power emerge from a machine considered as a structure, damping power from sliding parts of machine and damping power of balance moreover) [3].

The framework continues moving forward and backward over its situation of harmony. A framework is a mix of components proposed to act together to achieve a target. Reacting to, affecting and turning gear make stun and free or constrained vibration which is actuate in machine and further transmitted into their emotionally supportive networks. Pivoting machines and hardware that are not appropriately adjusted deliver unbalance outward powers making vibration. Machines producing heartbeats or effects, for example, surface granulating machine, manufacturing squeezes, infusion forming, affect analyzers, hammers, divergent pumps and blowers are the most prevail wellsprings of stun and vibration. In metal cutting procedure vibration can cause gab, which prompts a poor surface wrap up [4].

## **II.LITERATURE REVIEW**

Through this, emphasis on the different diaries papers on consider done on the idea of pressure driven surface pounding machine. The greater part of writing covers the related parameters, for example, crushing wheel determinations, RPM of granulating wheel, profundity of cut, feed, materials to be machined there impacts on surface complete and in addition vibration. This theme covers the yank, drive cause vibration while switching the table of water powered surface pounding machine [5].

Y.X.Jiang, W.X.Tang, G.L.Zhang, Q.H. Melody, B.B.Li and B.Du [2007] [6],conducted an Experiment of Investigation for Dynamics Characteristics of Grinding Machine, in this article, modular tests were utilized to examination the flow qualities of the pounding machine. This test established a framework to upgrade the structure parameter to enhance the dynamic character of the crushing machine.

Simranjit Singh, Amandeep Singh introduced a paper on free vibration investigation on cantilever pillar. They have done vibration examination on count of characteristic frequency and damping proportion on cantilever bar on various material under free vibration. The point of their investigation was to ascertain the vibration idea of different materials. They additionally consider the impact splits on vibration esteems [7].

Z.Y. Weng, probed Grinding Chatter and Ground Surface Waviness in Surface Grinding Process. The outcomes demonstrate that cutting profundity is the main factor in granulating gab and ground surface waviness in surface pounding process.

AVS Ganeshraja, T. Dheenathayalan consider constrained vibration and self-energized vibration happened in granulating machine. The constrained vibration because of unbalance of pounding wheel. Self energized vibration because of cutting task. They characterize the surface harshness in various classifications that are a) decent b) adequate c) screen nearly d) inadmissible [8].

Zeyu Weng, Bo Lu, Hongwu You, Honggang Ding, Yong Cai, Guanchen Xu and Nannan Zhang[2009], probed the Influence of the Grinding Wheel Topography on Grinding Chatter and Grinding Surface Waviness. The exploratory research comes about demonstrate that the pounding profundity is a primary factor which influences crushing babble and granulating surface waviness on the pounding surface. In this manner a further investigation has been made in the developmental component of granulating gab and crushing surface waviness.

Raj Reddy introduced the paper on examination of reverberation of a surface processor. The vibration of structure relies upon reaction of structure to the excitation (outer source) connected. The vibration parameters may change either adjustment in structure or excitation or both. It is important to control the vibration to get required surface wrap up. The common frequency of structure and frequency of excitation ought not the same to keep away from reverberation [9].

A.H.Koevoets [2003], directed time viable transient investigation utilizing ANSYS mechanical and Matlab Simulink. The execution of the Elite® progressed resounding force toothbrush is estimated as far as oral biofilm expulsion and enhancements in oral wellbeing after some time. These are unequivocally identified with the mechanical execution of the brush head and swarms situated on it.

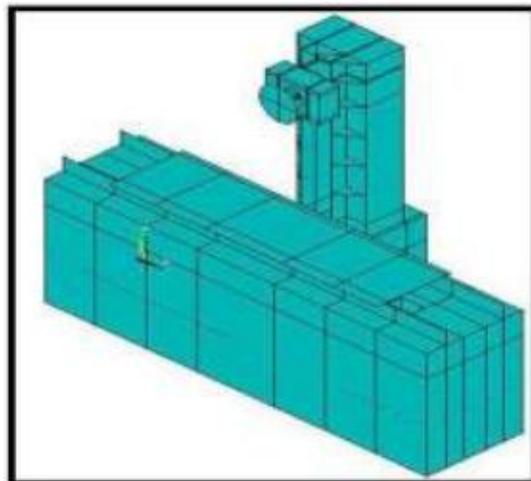
Kamaldeep Singh, DR. Beant Singh, Mandeep Kumar have done investigations on machining attributes of surface crushing machine with AISI D3 instrument steel. They have done examinations to get great surface wrap up by changing different working parameters. They arranged outlines for working parameters with surface wrap up. Lastly arrive at the conclusion that profundity of cut and vibration brought about is main consideration of surface wrap up [10].

### **III.METHODOLOGY**

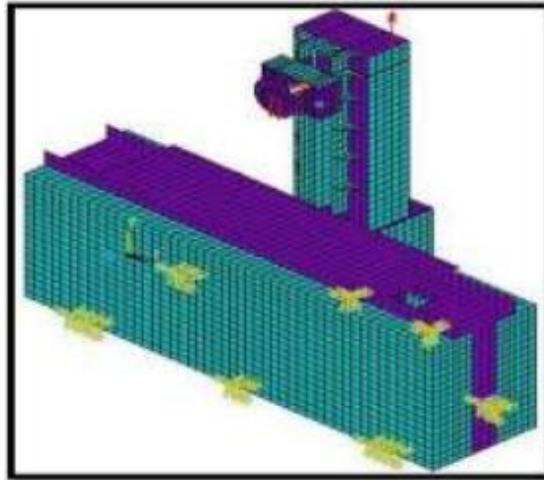
The hydraulic surface grinding machine of model HYD 208 means its magnetic bed size 20'X 08' taken for experiments. Its total weight approx. 900 kg. and height is 6' with table weight 90-100 kg. The table is moving with velocity 0.167 m/s. The vibration measurement instrument FFT analyzer is accustomed to investigating the vibration in frequency versus uprooting structure. We will consider the surface crushing machine as vertical section structure and is consider symmetric about vertical hub its focal point of gravity act at one point from the base [11]. The vibration calculation of responding tables with customary pressure driven framework. The twitch or vibration caused because of shameful pressure driven liquid controlled table developments toward the finish of strokes. The more weight created because of pounding of water driven liquid and deliver jolt. The extent control water driven valve or electro pressure driven valve can directs the overabundance weight created because of pounding. The primary measures to control vibrations is endeavor to change the sources (e.g. pounding of pressure driven liquid, focus of gravity of machine here consider as structure, resistance between the moving parts, oiling between the moving parts, damping materials and so forth.) caused to vibration with the goal that it creates less vibration. This system could possibly be practical. Then again, certain source, for example, unbalance in pivoting can be changed to lessen the vibrations [12].

#### **Surface Grinder Geometric Model**

Figure 1 and (2) demonstrates the geometric model and fit model of surface processor. The surface processor display is fit and the base is compelled in the entire course. The heaps are connected on the processor shell. The powers are connected on the processor shell at the finishes. The powers are connected in Y pivot at the closures inverse way to each other [13].



**Figure 1: Surface Grinder Geometric Model**



**Figure 2: Meshed Model**

The Static and harmonic analysis are carried out with change in dimensions of the weak links and the results are reviewed.

### **Harmonic Response Analysis for Model 1**

Any sustained cyclic load will produce a sustained cyclic response (a harmonic response) in structural system. Harmonic response analysis gives the ability to predict sustained dynamic behavior of the structure, accordingly empowering to check regardless of whether the plans will effectively beat the reverberation, exhaustion and other destructive impacts of power vibrations. Symphonious reaction investigation is a strategy used to decide the consistent state reaction of a straight structure to the heaps that differ sinusoidal with time. The thought is to ascertain the structures reaction at a few frequencies and acquire a diagram of some reaction amount (typically relocations) Vs frequency. The consonant reaction examination is discovered with plentifulness chart and vibration speed diagram. The Fig 3 demonstrates the adequacy V/s frequency chart and the Fig 4 indicates diagram between speed vibration V/s frequency [14].

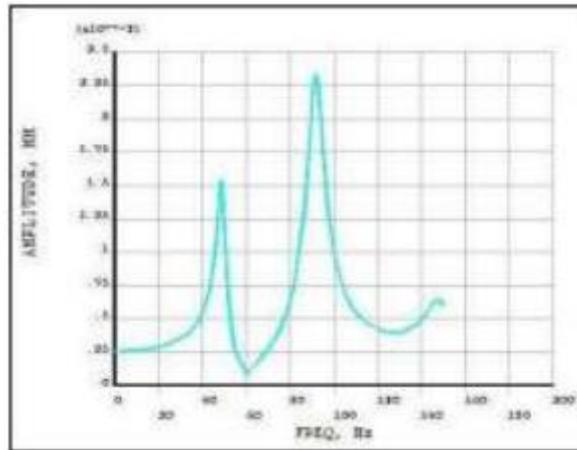


Figure 3: Amplitude V/s Frequency

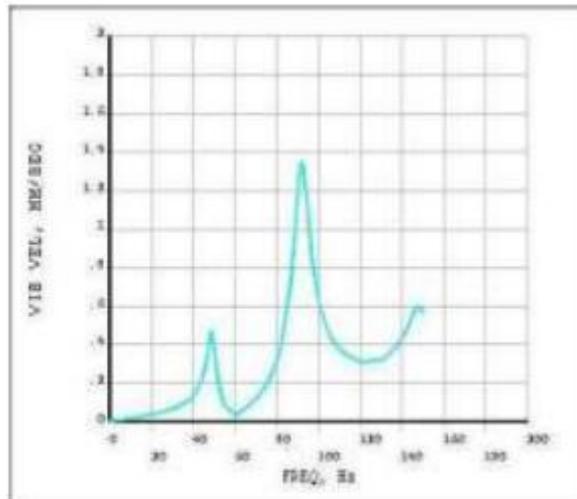


Figure 4: Vibration velocity V/s Frequency

The Fig 3 shows that the maximum amplitude is  $1.5 \times 10^{-3}$  mm and  $2.3 \times 10^{-3}$  mm and the Fig 4 shows that the maximum vibration velocity is 0.5 mm/sec and 1.3 mm/sec. We consider the first maximum amplitude because it is in the range of working frequency i.e. near to 50 Hz. Thus our aim is to reduce the first vibration velocity to the manufacturing standards [15].

#### IV.CONCLUSION

The dynamic characteristic such as the natural frequencies and mode shapes of the surface grinder was determined. The structural modification of the surface grinder was accomplished. It is found that the structural modification carried out from model updating is quite useful reducing the surface waviness of the surface grinder. The surface processor display has the working pace of 3000 rpm i.e 50 Hz. The measurement of the model is changed and different emphasess are completed. The modular examination demonstrates that the

frequency is expanded at the every cycle. The frequency has expanded from 48.977 Hz to 79.968 Hz. The consonant investigation demonstrates that the plentifulness is diminished at the every cycle. The sufficiency was lessened to the assembling benchmarks. The sufficiency is diminished from  $1.5 \times 10^{-3}$  mm to  $5.6 \times 10^{-4}$  mm. The symphonious examination likewise demonstrates that the vibration speed is diminished to assembling guidelines i.e from 0.5 mm/sec to 0.28 mm/sec. As a conclusion the center target of the task has been accomplished, the waviness caused by vibration of the surface processor is limited to acceptable levels.

The entire arrangement of vibration of water driven surface granulating machine isn't possible. The vibration happens by the responding table as well as by moving the table in feed while switching. It intends to control the vibrations while switching the table, to think about the vibrations in the two headings. In this point this paper center around the vibration just along the table is moving. Here we compute the frequency and sufficiency one way just and think about the particular measures to limit the vibration. The principle objective is to decrease the plentifulness and the length of time of wave with the goal that the granulating time will be less and the surface complete of the activity would be in resilience.

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