MODELLING AND SIMULATION OF RECIPROCATING VIBRO SEPARATOR

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Abstract: In this paper, Model of reciprocating vibro separator is prepared on CREO parametric software further it is analyzed on ANSYS software. The motion of reciprocating vibro separator model & experiment is observed by Poincare, Fast Fourier Transit (FFT) & Time data graphs. The computational modal of reciprocating vibro separator is observed for different material property& validated for particular elasticity. The experimental data indicated that the vibro separator is having elliptical motion with periodic motion. Also motion behavior of reciprocating vibro separator is observed & concluded that the experiment is matching with computational model. The motor angle of vibro separator is varies from 25 degree to 35 degree for constant motor speed at 1000 rpm.

***Index Terms* - Motion analysis, Model validation, Material property.**

I. INTRODUCTION

Generally, any product is not available in pure form. There are always some impurities are there in required final product to remove that impurities vibro separator is used as separating machine. The machine has vast area of application like food industries, Minerals, Paper mill, mining, agro industries etc. This can work for both solid and liquid type raw material for separating material. The reciprocating vibro separator is separating the final product & impurities by using basic vibration motion. Like the motion of shacking the separator box will give the output. The Reciprocating Vibro Separator is made based on how much amplitude is required to achieve desired output product.

Lala Zhao, Yuemin Zhao, Chunyong Bao, Qinfu Hou, Aibing Yu (2016) They have noticed that the average velocities of simulations with both spherical and non-spherical particle models in each case show similar trends with the tests. for most cases, the velocities of spherical particles are more highly over-predicted than those of non-spherical particles because of the simplification of particle shapes.

Changlong Du, Kuidong Gao, Jianping Li, and Hao Jiang(2012) They have used the Separator which has unbalanced mass rotor at center & after that they said that by analysing the screening process of three different vibration screens, it proves that the variable linear vibration screen has better power distribution and screen surface movement the flexible screen surface can increase the amplitude of the screen surface and reduce the material blocking phenomenon. Xiaohao Li, Mingxu Ma (2012). The research results which carried out in the paper showed that, about the nonlinear vibration system which supported by the soft nonlinear characteristics spring, the amplitude value of the nonlinear system can be automatically compensated when the vibrating mass of the vibrating system fluctuating in small-scope, which make the amplitude approximate remaining Dong Hailin, Liu Chusheng , Zhao Yuemin, Zhao LalaThe (2011) they studied on linear, circular & elliptical motion of screen they said that travel velocity of the particles during linear screening is the fastest. The circular mode gives the lowest particle velocity along the screen but the highest screening efficiency. In this case, the material layer is thick but the interaction between particles and the penetration effect are enhanced.

Liu Chusheng , Wang Hong a, Zhao Yuemin , Zhao Lala , Dong Hailin (2011) have tried to get the optimum angle between base line & separator box bottom layer line β & conclude that the increment of screen deck has a same effect on banana screening process as inclination of discharge end And when the values of inclination of discharge and increment of screen deck inclination are 10 degree to5 degree the banana screening process get a good screening performance in the simulation. HE Xiao-mei, LIU Chu-sheng (2008) have Studied on vibro separator & told that the motion of vibro separator is following the elliptical trace.A theoretical kinematic analysis of the vibrating screen was done to study how varying different parameters affects the motion of the screen. Kinematics parameters of the vibrating screen that motion traces are linear, circular or elliptical are obtained. Their work also concludes that the position of the exciter axle center relative to the center of gravity of the vibrating screen is extremely important for screening efficient Thus; we can design a vibrating screen with higher processing capacity without increasing power consumption by adjusting the relative position of the axle center.

The present work is to investigate the dynamic motion behavior of Reciprocating vibro separator by using ANSYS software besides using DEM simulation method. In the past, The set up for experimental work is done on the placement of motor at the up side center place of vibro separator box whereas in present work the motor is connected at two side center place of separator box.

II. COMPUTATIONAL MODEL AND ANALYSIS

The reciprocating vibro separator has different parts which are modeled out in CRE-O 3.0 Software and the analysis is done on ANSYS 14.5. Main part of Reciprocating Vibro separator are Motor, Connecting plate, Rubber pad, Separator box, Unbalanced mass. The parts with their Dimensions are made in CRE-O software. Based on half power bandwidth equation value the damping ratio is calculated. For the rubber pad the damping ratio is as Natural frequency is0.0017. As discussed earlier in this paper the dynamic motion behavior of vibro separator is observed. Taking different input parameters like motor angle (α), motor speed & properties of Foundation rubber as varying parameters that dynamic motion behavior of vibro separator is observed. In the setup of reciprocating vibro separator angle between motor axis & vertical line of separator box is taken as α and Angle between position of separator box & base line is taken as β.

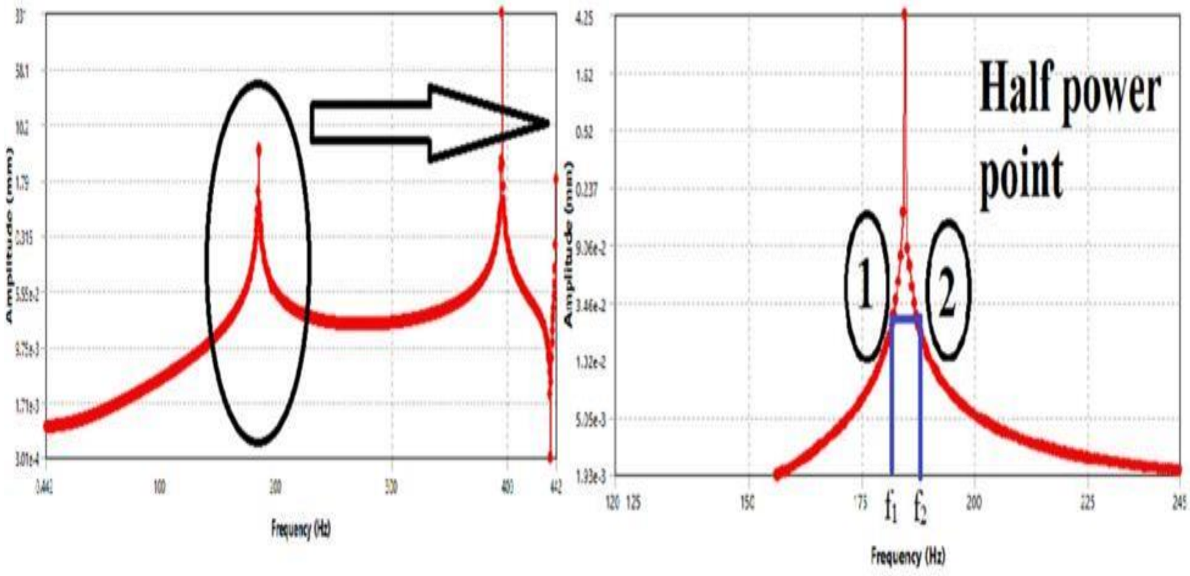


Figure 1: Frequency Response Graph

III. EXPERIMENTA WORK

The experimental work is performed at **GAJANAND** industries at **UNJHA**. The setup was prepared as per the computational work. Here the two vibro motors are running at 1000 rpm. The variation in motor speed is ± 20 rpm. Each vibro motor is having 0.5 Hp power. The Experimental Setup is running in between 980 to 1020 rpm motor speed with 30-degree motor angle. Here the separator box has two motor connected at two side wall at the middle point of separator box height. Four unbalanced masses are connected to each motor, which has weight of 3.34 kg each. The unbalanced masses are connected to each motor, which has weight of 3.34 kg each. The remaining two points are at top side end position of separator box as shown in figure 2.a. The piezoelectric accelerometers sensor (uni-axial) is used for picking up the vibration signals from the point on separator box. These special piezoelectric pickup type sensors are used with a frequency of range from 1-10kHz.The sensitivity of sensor 107 mV/(m/s2) with integral electronics piezoelectric accelerometer (IEPE) input mode of sensor. The analyzer used to measure the acceleration data is made by **Crystal Corporation**. The modal of analyzer is **CoCo-80** as shown in figure 2.b.

(a) (b)

Figure 2: (a) Experimental Setup in GAJANAND Industry (b) Vibro Analyzer CoCo 80

IV. RESULT AND DISCUSSION

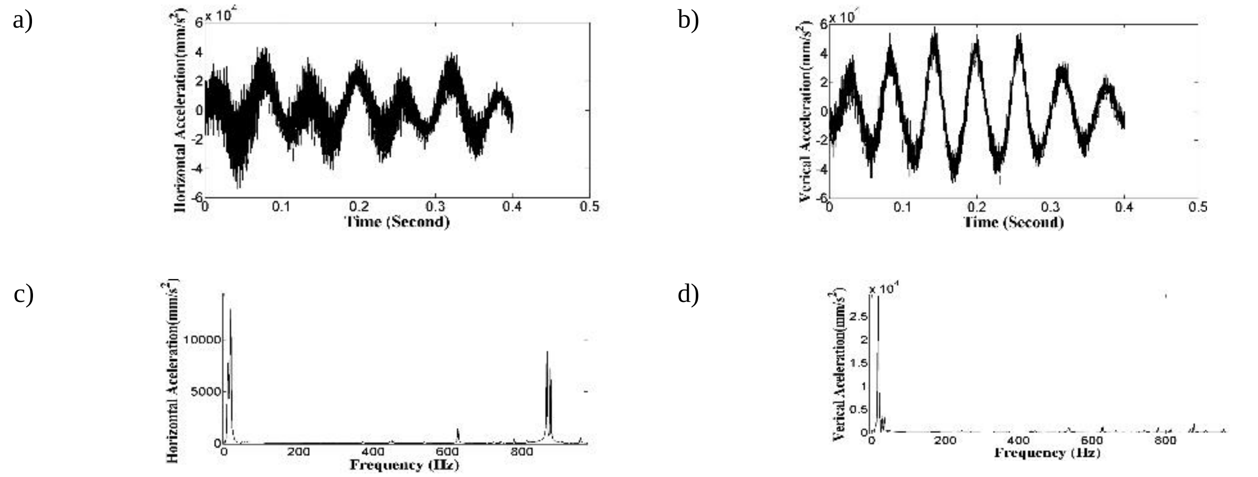


Figure 3: Computational Dynamic motion analysis at 30 degree & 1000 rpm with 40MPa elasticity

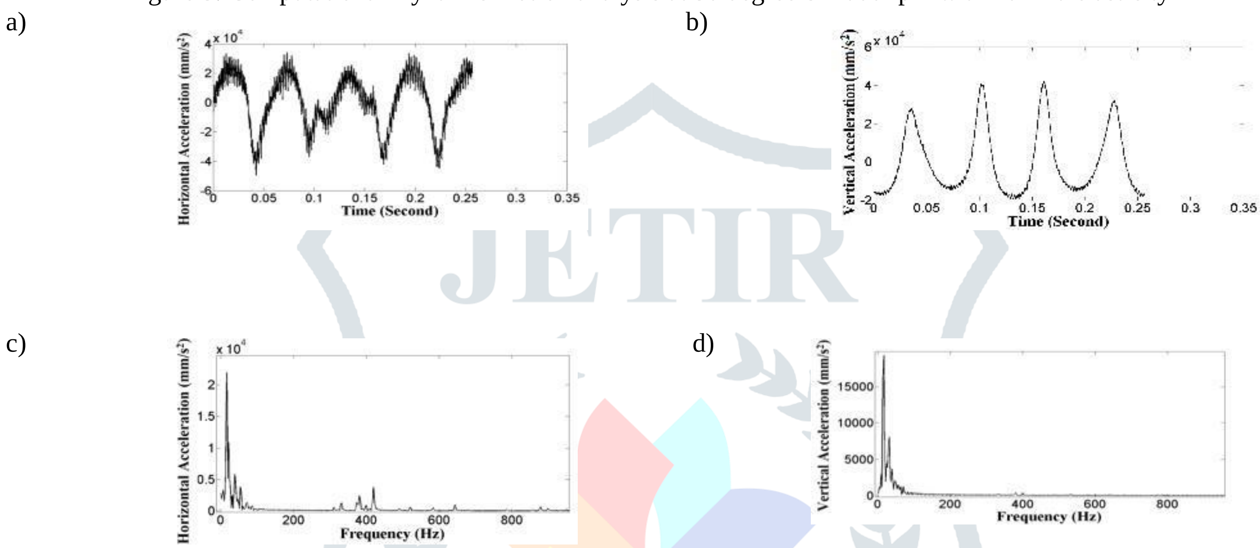


Figure 4: Computational Dynamic motion analysis at 30 degree & 1000 rpm with 25MPa elasticity

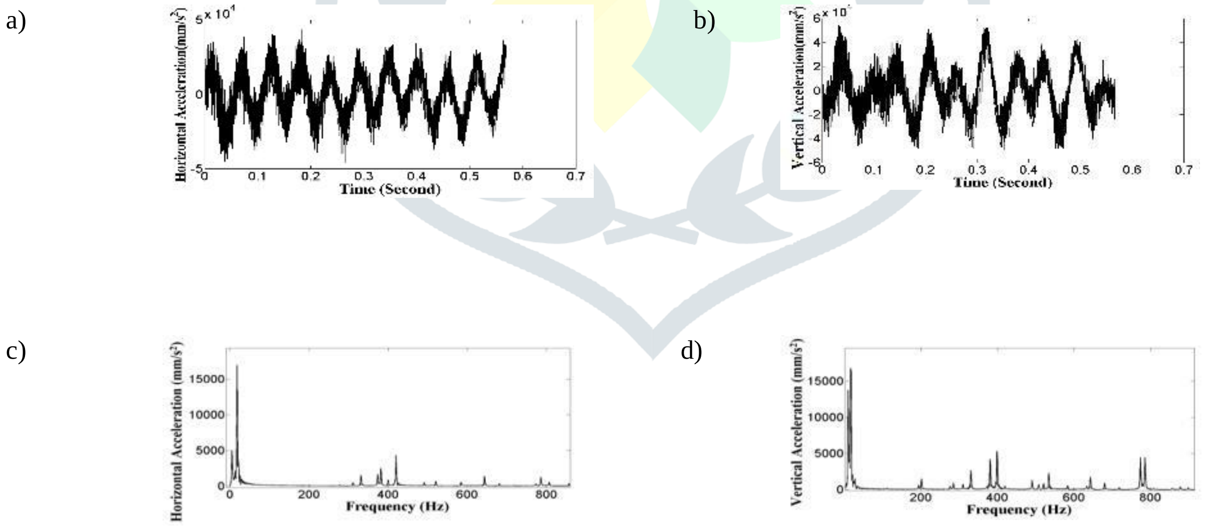
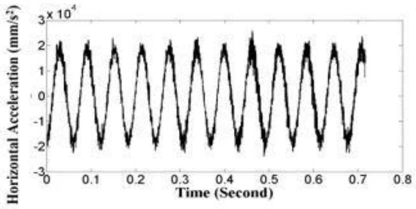


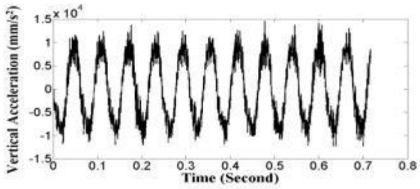
Figure 5: Computational dynamic motion analysis at 30 degree and 1000 rpm with 10MPa elasticity

Figure (a-b) are shows that the value of acceleration in horizontal direction is nearly doubled than in vertical direction. Figure 5(c-d) are the FFT plot that indicate that the motion is periodic with no vibration.

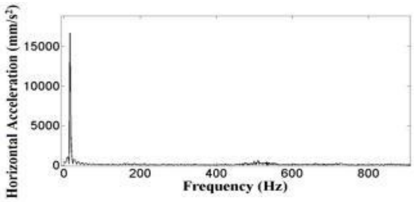
a)



b)



c)



d)

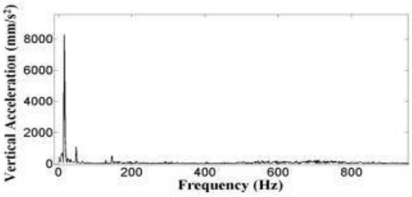


Figure 6: Experiment Dynamic motion analysis at 30 degree & speed is varying between 980 rpm to 1020 rpm

We also observe that from Acceleration figure 6(a-b) that experiment acceleration value for the vertical direction should be lower than horizontal direction to get the required output. By plotting the graph for different elasticity of foundation rubber in as shown in figure 6(a-b) we observed that in vertical & horizontal direction the elasticity of 25MPa for foundation rubber has the acceleration value in vertical direction is less & in horizontal direction acceleration value is more.

V. CONCLUSION

In present work the dynamic motion behavior is observed for horizontal and vertical direction using dynamic analyzer.

1. From Experimental Figure 5(a-b) it is clearly indicated that the acceleration value should be more in Horizontal direction. The acceleration value must be lower in vertical direction compare to horizontal direction.
2. Figure 6 (a-b) shows that the rubber pad with 25 MPa elasticity having the same acceleration pattern as experimental word.

The current work shows that the vibro separator can be used for multi-purpose products in many fields. As the different sizes products can be separated by different rate of vibration and the vibration rate can be changed from different elasticity of rubber.

VI. ACKNOWELEDGEMENT

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