VIBRATION ANALYSISON THE PRODUCTION LINE THROUGH MATLAB: A REVIEW

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Abstract: In a machining operation, vibration is frequent problem, which affects the machining performance and in particular, the surface finish and tool life. Severe vibration occurs in the machining environment due to a dynamic motion between the production line and the work piece. In all the running operations like turning, boring and milling, vibrations are induced due to the deformation of the work piece, machine structure and running tool. In a machining operation, forced vibration and self-excited vibration are identified as machining vibrations. Main objective of the research work is to monitor the vibration level of running tool. So it is assumed that the condition of the machine and its components is good in all other aspects such as foundation of the machine, rigidity of the machine components (such as bed, spindle, tail stock etc.) and so on. The simplest vibration analysis is conducted through collecting the "overall" vibration amplitude Root Mean Square (RMS) value and plotting the vibration data in time domain and frequency domain. The vibration phenomenon for various running conditions has been analyzed using MATLAB software. The plan of the experiment was developed to assess the effect of running speed, feed rate and depth of the vibration on the Production Line vibration. Research Area: vibration analysis, RMS Value of vibration, Production line, MATLAB
Objective: Thesis objective of the research work is to monitor the vibration level of running tool. It has graphical analysis over the MATLAB.So simulating the whole production line in MATLAB as real work.

I. INTRODUCTION

1.1 Basic of Vibration

Vibration is a mechanical phenomenon whereby oscillations occur about an equilibrium point. The word comes from Latin vibrationem ("shaking, brandishing"). The oscillations may be periodic, such as the motion of a pendulum or random, such as the movement of a tire on a gravel road. Vibration Analysis (VA), applied in an industrial or maintenance environment aims to reduce maintenance costs and equipment downtime by detecting equipment faults.VA is a key component of a Condition Monitoring (CM) program, and is often referred to as Predictive Maintenance (PdM) Most commonly VA is used to detect faults in rotating equipment (Fans, Motors, Pumps, and Gearboxes etc.) such as Unbalance, Misalignment, rolling element bearing faults and resonance conditions. VA can use the units of Displacement, Velocity and Acceleration displayed as a Time Waveform (TWF), but most commonly the spectrum is used, derived from a Fast Fourier Transform of the TWF. The vibration spectrum provides important frequency information that can pinpoint the faulty component. [16]

1.2 Vibration Testing Principles

Vibration measurements are not like temperature or voltage measurements. Using electrical test equipment, you might expect to read a number that is repeatable time after time. Using a piezoelectric accelerometer to measure vibration from a dynamic machine train is a different story. You aren't measuring the vibration at the source of vibration (from the rotating shaft), but instead are measuring from the bearing housing of the machine. This means that you are really measuring the response of the machine's structure to the vibration from the rotating shaft inside, the components on the shaft, the bearings, the covers and the foundation. There are many random vibrations mixed in with the vibrations from the rotating shaft. Even the repeatable vibration from the rotating shaft has many variables – resonances, speed and load, location, sensor mounting, environment, operational, noise, excitation, and other machine influences.

II. LITERATURE SURVEY

[1] Thanh-Phong Dao and Shyh-Chour Huangproposed a new design concerning a parallel compliant vibrating mechanism for high precision production lines and enforce dynamic simulating analysis. The conventional mechanism for separating fine particles has based on advantages of spring to make vibrating motion to separate out various particles with radius ranges from 7 mm to 20 mm. But it also has a few defects such as additional weights of the springs, the wear between the kinematic joints. To overcome these limitations, this paper applies the conception of compliant mechanism to design novel model. First, using the principle of compliant mechanism, a parallel compliant vibrating mechanism is developed. The use of ANSYS, finite element analysis (FEA) is performed to explore the results of dynamic analysis concerning both angular velocity of mechanism and both angular acceleration and both equivalent stress and total deformation of compliant segments. The results show that a proposed mechanism can be used in high precision manipulators, actuators, and production line chain. Future work will conclude an investigation into the vibration frequency.

[2] Aditi B. Patil, Jitendra A. Gaikwad and Jayant V. Kulkarni suggested that Rotating machinery has vast industrial applications in fields of petroleum, automotive, HVAC and food processing. Rotating machineries use

bearings to perform rotational or linear movement of various subcomponents while reducing friction and stress. Compared other types of bearing, REBs offer a good balance of key attributes like friction, lifetime, stiffness, speed and cost. Hence, real-time monitoring and diagnosis of bearings is crucial to prevent failures, improve safety, avoid unforeseen downtime of production assembly lines and lower cost. We propose an approach based on Wavelet Transform and ANN for analysis of vibration signals from a rolling element bearing to identify and multi-classify its component defects. The vibration signals from the REB being analyzed are passed over to the software setup consisting of Wavelet Transform and ANN. To remove noise and extract the relevant features from this signal, we pass the vibration signal through a Wavelet transform. These features are retrieved using time domain parameters like Skewness, Kurtosis, RMS and Crest Factor and they are used as an input for ANN classifier. The role of the ANN is to classify the bearing fault features produced by the Wavelet Transform and identify bearing faults, if any. To this end, we have designed a feed forward topology ANN using the sigmoid transfer function. The ANN training methodology uses three learning paradigms - namely, Levenberg- Marquardt, Resilient Back-propagation and Scaled Conjugate method. The learning models generated by eachalgorithm are tested to find the one which gives better accuracy. The outcome of this experiment indicates that DWT and ANN can together achieve good accuracy and reliability in detection and classification of bearing faults.

[3] S. S. Chavan and M. M. Joshi suggested that As we all know that vibration and composite material are two main growing research topics these days. Almost all the structural components subjected to dynamic loading in their working life and vibration affects the working life of the structure so it is very important in designing a structure to know in advance its response and to take necessary steps to control the structural vibration and its amplitude. Composite material gives chances to designers and engineers to increase material efficiency, therefore resulting in cost reduction and better utilization of resources. Composites materials applications are wide in aerospace industries, automobile sector, manufacturing industries etc.The present study involves extensive experimental works to investigate the free vibration of woven E-fiber Glass/Epoxy composite plates in fix-free boundary conditions. The specimens of woven E-glass fiber and epoxy matrix composite plates are manufactured by the hand-lay-up technique which is most suitable and efficient manufacturing technique for composite manufacturing. Elastic properties of the plate are also determined experimentally by tensile testing of specimens using computerized universal testing machine TUE-C-400. ASTM standard was used to test the material. An experimental investigation is carried out using modal analysis technique with VA4Pro FFT Analyzer, impact hammer and contact accelerometer obtain the Frequency Response Functions. Also, this experiment issued to validate the results obtained from the ANSYS 15.0 and theoretical calculations based on governing equation of vibration. The effects of different geometrical parameters including number of layers, aspect ratio of woven E-glass fiber composite plates are studied in fix-free boundary conditions in details. This study provides valuable information for researchers and engineers in design applications. Index Terms— Composite material, vibration, Modal analysis, finite element analysis, FFT analyzer, Fixed-free Boundary condition.

[4] ClaudiuBisuand MironZapciu suggested that Vibration analysis has long been used for detection and identification of the machine tool condition. Considering the current importance of machining process regarding the quality and the productivity imposed by the market, the appearance of vibration is inevi-table, more so in the milling process. This paper proposes a method to monitoring and diagnosis for milling process and also for spindle bearings condition. The method used refers to an advanced three-dimensional vibration analysis to obtain the answer on quality of the milling process and to identify various defects. In order to reach to objec-tive, an experimental device designed to obtain dynamic information provided by the dynamic system machine-tool/tool/work piece. The focus will be on Synchronous Enve-lope Vibration Analysis (SEVA) in order to obtain a frequency spectrum in direct connection with the quantity and the uniformity of each tooth own energy and how it is transmitted to the workpiece. During the cutting process the vibration level of bearings and the appearance of defects are take in account and processed to the predictive maintenance process.

[5] Johan Wandell suggested that vibration based techniques for detection of localised surface damages in multistage gearboxes are presented and evaluated. A modern vehicle gearbox is a complex system and the number of potential errors is large. For instance, surface damages can be caused by rough handling during assembly. Large savings can be made in the production industry by assuring the quality of products such as gearboxes. An automated quality test as a final step in the production line is one way to achieve this. A brief review of available methods for vibration based condition monitoring of gearboxes is given in the opening summary. In the appended papers, a selection of these methods is used to design signal processing procedures for detection of localized surface damages in gearboxes. The procedures include the Synchronous signal averaging technique (SSAT), residual calculation, filtering with a prediction error filter (PEF) based on an AR-model and the use of crest factor and kurtosis as state features. The procedures are fully automatic and require no manual input during calibration or testing. This makes them easy to adapt to new test objects. A numerical model, generating simulated gearbox vibration signals, is used to systematically evaluate the proposed procedures. The model originates from an existing model which is extended to include contributions from several gear stages as well as measurement noise. This enables simulation of difficulties likely to arise in quality testing such as varying background noise and modulation due to test rig misalignment. Without the numerical model, the evaluation would require extensive measurements. The

numerical model is experimentally validated by comparing the simulated vibration signals to signals measured of a real gearbox.

III. VIBRATION MEASUREMENT FOR ROTATORY MACHINES

This work has been carried out by Rolando Tatis at Hamk University of applied science in the of Year2012. His thesis work was done in cooperation with Hi-Tekno Engineering and consulting office. The purpose of this thesis was to demonstrate the importance of vibration measurements in modern day production systems. The aim was to explain how vibration measurements are performed in the field and what kind of machinery diagnosis can be achieved. Effective maintenance services in the production systems of today are vital for any company as to the profitability figures. Vibration measurements give the user a clear picture of the machines condition, by this is easier to plan the maintenance schedule, focusing the resources only on those machines that have signs of failures. A vibration analysis is about the art of looking for changes in the vibration pattern, and then relating those changes back to the machines mechanical design. The level of vibration and the pattern of the vibration tell us some-thing about the internal condition of the rotating component. The vibration pattern can tell us if the machine is out of balance or out of alignment. Al-so faults with the rolling elements and coupling problems can be detected. The practical work in this project was conducted in Karkkila at the heating system plant of the municipality. I measured the vibration levels for the flue gas fan. The flue gas fan removes the gases generated in the combustion boilers, after which they have passed through a filter and are directed back into the atmosphere. The outcome demonstrated that there was a bearing problem in the flue gas fan and it was starting to develop.

IV. PROPOSED WORK

This thesis investigates the analysis of vibration on production line. This is the extension of earlier work which was on rotatory machines. The Tata Motors Limited production line located Jamshedpur, India is designed for special spear parts of trucks. This material is used to manufacture trucks. The production line is 30m high, 10m wide and 150m long and employs more than 4000 people. Plant's production line structures have been modified and production speed has been affected due to uncontrolled vibration. These recent changes have consequently generated vibration issues. Machining is a complex process in which many variables can deleterious the desired results. Among them, Production Line vibration is the most critical phenomenon which influences dimensional precision of the components machined, functional behavior of the machine tools and life of the running tool.

In a machining operation, the Production Line vibrations are mainly influenced by running parameters like running speed, depth of vibration and tool feed rate. In this work, the Production Line vibrations are controlled using a damping pad made of Neoprene. Experiments were conducted in a machine where the tool holder is supported with and without damping pad. The Production Line vibration signals were collected through a data acquisition system supported by Mat Lab. To increase the buoyancy and reliability of the experiments, a full factorial experimental design was used. Experimental data collected were tested with analysis of variance (Matlab Vibration Tools) to understand the influences of the running parameters. Empirical models have been developed using analysis of variance (Matlab Vibration Tools). Experimental studies and data analysis have been performed to validate the proposed damping system. The onsite tests show that the proposed system reduces the vibration of Production Line to a greater extend.

V. EXPECTED RESULT & CONCLUSIONS

Experiments will conduct on production line using comparator function for machinery vibration & noise testing for Production Line vibration in tangential and axial direction were measured in AD-3552 machining processes based on the vibration signal collected through a MATLAB and controlled by using viscoelastic material (VEM) neoprene. The effect of running parameters such as running speed, depth of vibration and feed rate on machining variables is evaluated. An analysis of variance (MATLAB VIBRATION TOOLS) was made and it was found that the depth of vibrationrunning speed and Feed rate has greater influence on Production Line vibration. From the experimental results the proposed simulation will demonstrate that the depth of vibration and running speed are the main parameters among the three controllable factors (depth of vibration, running speed and feed rate) that influence the vibration of Production Line in fine boring Al alloy. Further study could consider more running parameters, tool geometries and different work piece materials, lubricant and cooling strategy in the research to see how the factors would affect vibration level.

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