

Condition Monitoring and Maintenance Management for Precision Component Manufacturing Machines

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Abstract - Running precision components manufacturing machines with accuracy throughout its life is quite challenging. Minor deviation can affect its performance; it may produce defective components. Maintenance of precision components manufacturing machines is relatively difficult and challenging than the other manufacturing machines. Adequate condition monitoring (CM) must be adopted to predict the health of machines. Maintenance management is also very essential for components manufacturing machines due to several reasons such as maintain process capability, availability, reducing downtime and maintenance cost, etc. This research investigates the significance of CM and maintenance management for precision components manufacturing machines.

Key Words: Maintenance, Condition Monitoring, Maintenance Management, Precision Component Manufacturing Machines, Process Capability, Availability etc.

1. INTRODUCTION

Proper maintenance of precision components manufacturing machines is essential to produce component within specified design tolerances. To run the machines at specified performance limits and produce precision components at specified tolerances; for this machine maintenance must be precise and restore machine at specified capability. Condition monitoring is very useful tool to predict the condition of precision components manufacturing machines. To predict the deviation or symptoms of failure condition monitoring tool gives alarm before to failure, on the basis of the symptoms necessary maintenance action taken [1]. Also, CM is most important suitable tool for precision machines to identify or predict the potential failures [2]. Management of maintenance activities and maintenance operations is very complex task. Also, which parameters can affect the machine performance and which factor of maintenance operation can affect machine performance; identification of these is very difficult. Thus, Maintenance management is also play crucial role to run the precision machines at specified manufacturing parameters. CM is also support in the management of maintenance of large scale precision machines [3]. Both CM and maintenance management are play important role to run precision components manufacturing machines at specified production limits.

2. CONDITION MONITORING

Now a day's CM is very important and essential tool for diagnosis of machine faults before its failure. Precision manufacturing machine must be run under specified design parameters during the manufacturing of components. For the CM of precision machine first identify the critical parameters or critical components which can affect the machine performance, then after apply the suitable condition monitoring technique to identify the parameter signature. Forecasting of the failure from the symptoms identified only if maintenance personal trained or differentiate between normal signature and deviated one or fully computerised monitoring system is enable for the condition monitoring of the precision machine. Condition Based Maintenance (CBM) has capability of cost reduction in critical units or precision machines, because if there is signature of catastrophic failure; it can be alarmed by CM techniques before breakdown. Therefore, CM is known as heart of CBM which continuously provide signals that show health of machines [4]. The main advantages of CBM is that it provides the signals to assess the health of machines in real time with the help of CM techniques, which enable to make maintenance decisions and reduce its cost [5]. CM provides twofold advantages; one; it continuously provides information or signal of the health of machines and second; it provides the failure pattern of any component or assembly of machine. Online or offline CM techniques can be apply on precision machines or critical component. Online techniques carried out during the running state and applied where failure of machine is hazardous or more production loss [6]. For online CM first identify critical machine component and parameter of that component is monitored continuously like vibration monitoring of bearings. Vibration monitoring is most helpful practice to reveal the health of the critical component (bearing) of rotating machine because of its reliability and sensitivity [7]. Offline techniques carried out in shut off state of machines and applied where failure of machine is less hazardous or less production loss. To apply CM techniques on precision component manufacturing machines firstly identify the critical components and key parameters for monitoring. On the basis of revealed signals; CBM is done, to rectify the problem and reset machine again at specified running performance. Application of CM technique for precision machines extended to distinct ways: First; related to the monitoring of quality of product for which measurement and analysis of key process parameters, Second; monitoring of high status machine parameters to identify the failure

signature and avoidance of failure. These two way monitoring not only enable the precision machines to run at specified manufacturing limits to produce quality products but it also ensure that the machine run successfully without failure or with minimum downtime/production loss [8].

3. MAINTENANCE MANAGEMENT

Maintenance management for precision component manufacturing machine is most essential job because of managing/maintaining their manufacturing capabilities as time passes. Precision machine must be come in machine capability after maintenance. In this extremely competitive environment, to produce world class quality products successfully, manufacturing organization must have efficient maintenance strategies as well as effective manufacturing strategies [9]. Maintenance management is also play crucial role because it has ability of effective maintenance as well as reduction of production & maintenance cost. In past, researcher has reported that 15% to 70% of total production cost is incurred on maintenance only [10] and 25% share of overall operating cost related to maintenance [11]. Salonen and Deleryd reported that 30% of total maintenance costs are expensed on unnecessary because of poor planning or overtime or on useless preventive maintenance [12]. Maintenance is key concentration in business sector because of competition and huge pressure on manufacturing organizations to fulfil the corporate and customers' demands as well as increase availability and maintains machine performance or capabilities [13]. Therefore, maintenance has become crucial to manufacturing firms because of its activities, planning, measurement, management, spare parts management etc. [11]. Maintenance management system (MMS) is key success point for any precision component manufacturing firm; this system ensures that their production facilities capable even if complexity of product increases. Unplanned breakdowns always lead to production loss and lengthy downtime. So, the MMS strategy must avoid unplanned breakdown using CM or proactive approach as well as eliminate or reduce downtime and maximize availability. Maintain process capability of precision component manufacturing machine is most important and difficult task for maintenance department. Fix a schedule to inspect the process capability of precision machines because as time passes the capability of every machine decreases due to many of reasons such as wear and tear, maintenance, workers operating skills etc. identification of each factor and its effect is crucial. To know the variation in process capability monitor the key parameters like vibration, noise, temperature etc. and identify the critical component or assembly of precision machines which lead to deviation in key parameters. In this modern time automation will play significant role in all aspect of business. Many of manufacturing firms now enabling their firm with new concept of maintenance management is known as computerised maintenance management system (CMMS). CMMS is powerful tool; it has capability to resolve issues related to maintenance management such as productivity,

availability, quality, spare parts management, maintenance costs, maintenance records etc. Maintenance management of precision component manufacturing machines without CMMS is quite difficult. CMMS provides all tracking history, past maintenance reports, performance status, data related to process capability etc. which are very useful. CMMS has drastically change maintenance philosophy due to its overall potential like reduce overall costs, increase availability and equipment life, maximize productivity and simplify the maintenance process. BAE systems world's leading manufacturers of aerospace has implemented maintenance management system for effective and optimize maintenance. Requirement of CMMS for military aircraft during production and deployment is very crucial reported by S.K.Shukla et al., 2014 [14]. Muyengwa and Marowa conducted case studies on six companies to know the impact(s) of maintenance strategies on companies operations and performance. They have reported that the organizations concentrate on planning and management of maintenance (CMMS) with continuous improvement can reduce maintenance cost. Also, spare part management have its own importance; unavailability of spare parts is expensive as compared to maintain their stock. They concluded in their study; maintenance support manufacturing organization in modern competitive environment if management of maintenance is done properly [15].

4. CONCLUSION

To run the precision component manufacturing machines as per their defined process capability is very challenging task. Due to very tight tolerances of precision components little deviation in machine performance can affect the product quality. A well planned and effective maintenance is only solution for the precision component manufacturing machines to produce products in specified limits. An appropriate maintenance strategy must be adopted with adequate CM technique for the reliable specified performance of precision component manufacturing machines. To ensure availability and performance of machines is quite difficult without proper maintenance management. A proper MMS not only reduces downtime and maintenance cost or avoids unplanned breakdowns but increases availability and maintains process capability. In present scenario of automation and integrated manufacturing only CMMS can fully support and manage overall maintenance activities of precision component manufacturing machines. Both CM and maintenance management is play vital role to run the precision component manufacturing machines in process capabilities during its life.

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BIOGRAPHIES



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