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Development of an Algorithm for Identification and Confirmation of Fault in Thermal Power Plant Equipment Using Condition Monitoring Technique

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Abstract

Thermal Power plant (TPP) is biggest source of power in India. About 65% of electricity is generated by using thermal power plant. The equipment of TPP runs for 24x7 days through the year. The fault of TPP equipment needs to identify at early stage before the breakdown of system or unit. The maintenance functions of TPP should be optimized carefully by selecting suitable maintenance strategy at least cost. Identification and confirmation of fault in TPP equipment is very important step for decision making. It helps to optimize the maintenance activity. This paper proposes an algorithm for use of co-ordinated condition monitoring approach for identification and confirmation of fault. The objective of this study is to improve the availability and heath of critical equipment of Dahanu Thermal Power Station (DTPS) located in western region of India.

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Keywords: Thermal Power Plant Condition Monitoring Technique, Maintenance Strategy.

1. Introduction

Thermal power is the largest source of power in India. About 65% of electricity consumed in India is generated by thermal power plants. In order to make thermal power plants (TPPs) economical, the maintenance functions should be optimized carefully by selecting and planning the maintenance strategies that will address the maintenance needs of the plant at the least cost. Identification and confirmation of fault in TPP equipment is major and important step for defining maintenance strategy and making decisions. In this regard, condition monitoring techniques helps

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to monitor measurable parameter of TPP equipment in order to identify a significant change which is indicative of a development fault. In recent years, it has been an immense development of various effective condition monitoring techniques for machine monitoring and fault diagnosis. The contemporary condition monitoring techniques are Vibration Analysis, Acoustic Emission Monitoring, Wear Debris analysis, Temperature Analysis, Ultrasonic Monitoring, Thermography, Non Destructive Testing, Visual inspection, Motor Condition Monitoring and Motor Current Signature Analysis [1]. The Performance related parameters of machine such as vibration, acoustic emission, thermograph, wear debris in oil, temperature etc. are useful indicators of machinery condition. The thermal power plant in general uses same/similar type of equipment [2] which runs constantly. The condition monitoring technique used for identification of fault for various equipment may be different. At present, the major condition monitoring method used in thermal power plant is vibration analysis [3]. The algorithm used for fault detection in thermal power plant equipment with one condition monitoring method has several limitations. The earlier researchers majorly attempted the integration of two condition monitoring techniques for early detection of machinery faults in the variety of application areas, which advocates the use of co-ordinated condition monitoring approach in case of thermal power plant. The major objectives of adopting co-ordinated condition monitoring approach in thermal power plant are accessing the condition of equipment without stopping them, eliminating failures and identify the root cause(s) of any irregularity and extension of component life. Therefore, use of co-ordinated condition monitoring approach is selected for this research work to ensure high plant availability [4] at Dahanu Thermal Power Station (DTPS).

This study presents review of published literature for thermal power plant, which includes algorithm applied by earlier researchers, condition monitoring methods and soft computing tools used in thermal power plant. This paper enlighten the existing condition monitoring method used for maintenance scheduling of major equipment at Dahanu Thermal Power Station (DTPS) [5,6]. In this respect, an interaction with domain expert at Dahanu Thermal Power Station (DTPS), an attempt has been made to propose an algorithm for early detection of fault of Dahanu Thermal Power Plant (DTPS) equipment, in turn helps to improve the availability and health of critical equipment of thermal power plant using co-ordinated condition monitoring approach.

The related relevant published literature is reviewed by referring different research database viz. Science Direct, Elsevier, IEEE, Springer research Journals which is discussed next.

2. Review of Literature

This study is an attempt to address the issues related to machines health condition and the problems associated with it. The relevant selected published literature is reviewed. The objectives of literature reviews are a) Review of algorithm applied in power plant. b) Review of algorithm used by earlier researchers in thermal power plant. c) Review of condition monitoring methods used in thermal power plant d) Review of technique or soft computing tool used for thermal power plant. The selected references have been categorized which is tabulated from Table 1 to Table 4 as follows. The review of literature for algorithms used by earlier researchers for monitoring equipment in power plant has-been categorized in Table 1 as discussed next.

Table 1. Literature review of algorithm used for condition monitoring of equipment in power plant

S.N.	Author (Year)	Algorithm Used	Application	Findings
1	V. Muralidharan , V. Sugumaran (2013)	Wavelets And Decision Tree Algorithm	Mono-Block Centrifugal Pump	Analyzes vibration based fault diagnosis of monoblock centrifugal pump by wavelet analysis and J48 algorithm.
2	V. Sugumaran, G.R. Sabareesh, (2013)	Multi-Class Support Vector Machine based Algorithm	Roller Bearing	Addresses the feature selection process using decision tree and multi-class support vector machine (MSVM) for classification
3	N.R. Sakthivela,b, Binoy. etc. al (2012)	Maintenance Algorithm	Centrifugal Pump	Applies four soft computing techniques, namely GEP, Wavelet-GEP, SVM, PSVM are applied to the fault classification of centrifugal pump.
4	Fangji Wua,Tianyi Wang (2010)	Condition-Based maintenance Algorithm	Mechanical Systems	Proposes an online adaptive condition based maintenance method with pattern discovery and fault learning capabilities for mechanical systems.