# FAULT DIAGONOSIS BY VIBRATION ANALYSIS OF SYNCHRONOUS GENERATORS

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# Abstract

All machinery with moving parts generates mechanical forces during their normal operation As mechanical condition of machine changes because of wear, changes in operating environment, load variations etc., so do these forces. Generator has one or more machine elements that turn with the shaft - e.g. bearings, rotors. In a perfectly balanced machine, all rotors run on their true centre-line and forces are equal.

Rotor imbalance will generally be present due to uneven weight distribution or due to the imbalance between generated lift and gravity. Combination of these forces with stiffness of rotor-support system will determine the vibration level. Vibration profile that results from motion is the result of a force imbalance - there is always some imbalance in real-world applications. All mechanical equipment in motion generates a vibration profile, or signature, that reflect sits operating condition.

Many vibrations are normal for rotating or moving machinery, e.g. normal rotation of shafts and other rotors, contact with bearings etc.

Synchronous Generator faults such as mechanical misalignments, rotor imbalance, loose bolts, bearing faults and incipient metal fatigues cause to generate abnormal identifiable vibrations.

In the research,
First, the relationship between the generator mechanical faults and the vibration harmonic magnitudes are studied for particular machine problems occur previously and for that analysis the critical frequencies in the frequency spectrum of the synchronous generators are identified by using the Microlog instrument CMVA 60, which is a property of the Mahaweli Complex of Ceylon Electricity Board. Then, the magnitude ratios of the harmonics at critical frequencies to the fundamental component of the vibration profiles are determined from Experiment with using

single phase motor with load coupled which had been used with originated mechanical faults, is used for the vibration analysis.

Next, the results obtained from the case studies and the experiment are compared with the standards that have been evolved from the past studies and the researches in order to determine the feasibility of setting defective levels or standard on the vibrations harmonics at critical frequencies of generator faults. Finally, the possibility of developing a condition monitoring system to identify mechanical faults is investigated for synchronous generators in Ceylon Electricity Board. The results can then be extended to indicate the faults at early stage to minimize the unwanted long outages, minimize costly rotating failures & reduce maintenance inventory cost.

Thus it helps to provide the necessary lead-time to schedule maintenance to suit the needs of the plant management.

# Declaration

I hereby declare that the work presented in this report is my own work and not has been submitted earlier or concurrently for any other degree.

***UOM Verified Signature***

Signature : .....

Name : S. H. Ediriweera

Date : 08th February 2010

I certify that this work was supervised by me and the above declaration is true.

***UOM Verified Signature***

Signature : .....

Name : Dr. J. P. Karunadasa

Date : 08th February 2010

# Preface



Since this condition monitoring system is not much longer used in the CEB and there is little number of literature found in the University Library, it was little difficult for me to decide where to start at the beginning. The condition-monitoring tool purchased from the SKF Condition Monitoring Inc. was helpful in this concept and I could gather more details from the Internet.

I express my sincere gratitude to Dr. J P Karunadasa for all the encouragement, guidance and support given throughout my Engineering Carrier to make this task a success and directing towards the research towards the realization of the ultimate goal.

I sincerely thank Mr. A.K.Samarasinghe, DGM (AMHE), Thilakasiri Vijayananda EE (Controls & Instrumentation) and the technical staff at Canyon Power station for providing me with the details of the vibration monitoring systems, other required literature, and support for builds a machine model for the experiment and for their comments on some difficulties encounter during the project.

Finally A big thanks go to my wife Iroshini and my parents for finding me free time and free mind taking my responsibilities to do the research.

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