



MONITOR

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From President's Desk.. 



CoVID-19 and Condition Based Maintenance

The world is passing through an unprecedented CoVID-19 crisis for the last few months throwing the whole economy out of gear with terrible loss of precious life. The grim situation is not going to change immediately despite the best efforts of our government. Each one of us have to take care of us, our families, our friends and our neighbours. Despite these challenging times, our utility departments like power, and water, worked efficiently round the clock. Imagine the scary situation if these services were not available. That is to say that Condition based maintenance has proven its importance once again during crisis moments like this. These days almost all power plants, T&D Systems, Transformers, and pumping systems deploy one or two kinds of CBM systems.

Despite CoVID-19 shock, the silver line is that the Condition Monitoring market is poised to grow from US\$2.64 billion in 2019 to US\$ 3.92 billion by 2027 as reported in a recent global market survey. It shows the strength of leadership in many of the manufacturing companies who are putting every effort to sustain this business activity against many current odds. USA and Canada take maximum share of this equipment manufacture followed by Europe and Asia Pacific. India does not figure well, a fact which we should think and act upon. The bottom line is we lack experts in this field despite a huge country having large number of Engineering colleges. CMSI has to create interest across the industry on Life Cycle Asset Management (LCAM) as an integrated approach to optimizing the life cycle of industry assets commencing at conceptual design, continuing through shut down and decommissioning. Some of the universities in USA, UK, Japan etc have such academic programmes to impart training for the interested students and industry. It is worthwhile to mention here that many experts think that IIoT as a critical technology means in times of crises especially when companies have to maintain operations when operators are restrained from working on-site by monitoring and controlling the equipment remotely.

CMSI Monitor wish all of you and your families stay active, healthy and safe.

-- Dr. V. Bhujanga Rao

Main Features of this Issue...

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- *Fundamentals of Vibration Phase*
- *Latest Condition Monitoring of Plant Machinery/ Mine Machinery*
- *Some Highlight of CMSI Student Chapter Activites -NMAMIT*
- *News about CMSI Activites*
- *Upcoming Conferences*
- *Welcome to New CMSI Members*
- *New Addition to CM literature*

Announcement: ICCM-2020

CMSI is glad to announce that web based International Conference on Condition Monitoring (ICCM-2020) will be organised at by Tata Steel, Jamshedpur with theme "**Agile and sustainable advances in Equipment Reliability through Condition Monitoring**" in the month of January 2021. The conference is proposed to be organise for two days.

Further details will be announced on CMSI Website.

<http://www.comsoi.org>

**Enroll as a member of our society & advertise your products in News Letter 'MONITOR' and
Website: www.comsoi.org**

Fundamentals of Vibration Phase

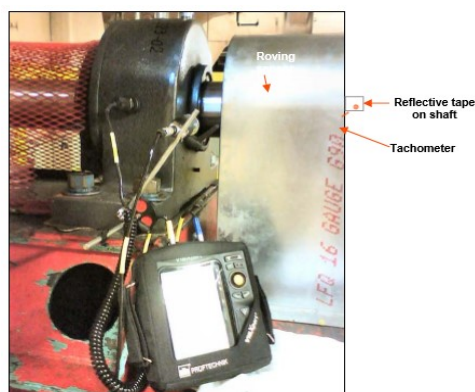
Basics of Vibration Phase

- ❑ Phase is the position of a rotating part at any instant with respect to a fixed point.
- ❑ Phase describes relative timing between two signals.
- ❑ Phase is the angle difference between a measured point and a reference point.
- ❑ Phase is how machine member vibrating w.r.t. other member or reference point
- ❑ Phase gives us the vibration direction
- ❑ A Phase study is a collection of phase measurements made on a machine or structure and evaluated to reveal information about relative motion between components.

In vibration analysis, phase is measured using Absolute or Relative techniques.

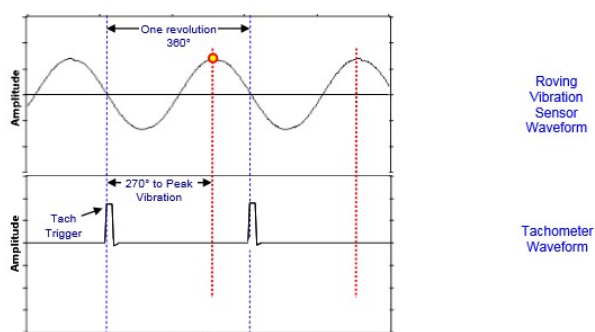
Absolute Phase

Absolute phase is measured with one sensor and one tachometer referencing a mark on the rotating shaft. At each measurement point, the analyzer calculates the time between the tachometer trigger and the next positive waveform peak vibration.



Absolute Phase Measurement

This time interval is converted to degrees and displayed as the absolute phase can be measured at shaft rotational frequency or any whole number multiple of shaft speed (synchronous frequencies). Absolute phase is required for rotor balancing.



Absolute phase is calculated between the tach signal and vibration waveform.

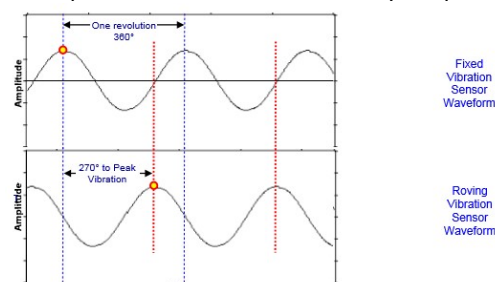
Relative Phase

Relative phase is measured on a multi-channel vibration analyzer using two or more (similar type) vibration sensors. The analyzer must be able to measure cross-channel phase. One single-axis sensor serves as the fixed reference and is placed somewhere on the machine (typically on bearing housing). Another single-axis or triaxial sensor is moved sequentially to all of other test points.



Relative Phase Measurement

At each test point, the analyzer compares waveforms between the fixed and roving sensors. Relative phase is the time difference between the waveforms at a specific frequency converted to degrees. Relative phase does not require a tachometer so phase can be measured at any frequency.



Relative Phase Calculated Between Two Vibration Waveforms

When to measure Phase ?

A phase study should be made on problem machines when the source of the vibration is not clear or when it is necessary to confirm suspected sources of vibration.

Phase is measured in following conditions:-

- Machines Have Multiple Faults
- Cause and Effect of Vibration
- Many Fault Types Have Similar Patterns

Need of Phase

- Detection of soft foot
- Cocked Bearing & Shaft
- Confirming Unbalance
- Finding Looseness, bending & Twist
- Shaft Mis-alignment
- Detecting Shaft operational Deflection shape

By Hemant Bari

All images source google link

https://www.google.com/search?q=vibration+absolute+phase&rlz=1C1GCEU_en-gbIN819IN819&hl=en-US&source=lnms&tbm=isch&sa=X&ved=2ahUKewjA9-zK7r_qAhWHEqYKHVoZAsgQ_AUoAnoECA8QBA&biw=1024&bih=657

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Latest Condition Monitoring of Plant Machinery

With reference to seminar on **Latest Trend in Reliability & Condition Monitoring** organized by Predict Technologies & SPM Instruments at Navi Mumbai dated 26 September 2019

Motion Amplification Technology

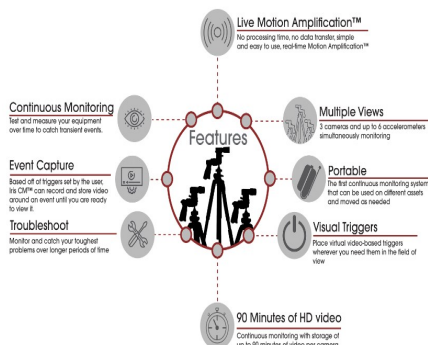
Motion amplification helps to visualize the complex vibration problems that may be invisible to the naked eye. This tool can save time and costs in vibration spectrum analysis, routine condition monitoring programs, troubleshooting and the root cause analysis. RDI Technologies enables you to quickly and easily see and analyze what is invisible to the naked eye and move to root-cause problem-solving. RDI's comprehensive industrial solution is driven by proprietary software that turns millions of pixels in today's modern cameras into millions of individual data points that can be monitored, read and analyzed.



RDI's patented technology measures deflection, displacement, movement and vibration not visible to the human eye. Video camera technology is used in conjunction with software and processing algorithms to extract meaningful data. This vibration monitoring technology turns every pixel in the camera's view into a sensor capable of measuring vibration or movement with high levels of accuracy. <https://rditechnologies.com/>

How does it work?

Motion Amplification® is a proprietary video processing algorithm that detects subtle movement then increases that movement to a level visible to the naked eye which enhances the understanding of the components and interrelationships creating the motion. It is a state-of-the-art Condition Monitoring instrument with extreme sensitivity to developing faults.



Case Study reviews



For more Case Studies related to this, please visit Youtube.

Sensing and Monitoring Technologies for Mines and Hazardous Areas by S.K. Chaulya, G.M. Prasad

Condition Monitoring of Mine Machinery

Mining machinery often work under nonstationary and time-varying load conditions. The concept of condition monitoring (CM) is an evolution of diagnostic and prognostic systems. The goal of CM of mining machinery is to examine its functional health. Real-time components/operation and thereby improving performance of equipment. For CM of mine machinery variety of transducers such as accelerometers, acoustic emission sensors, tachometers, thermocouples, etc., are subsequently segmented into discrete and coherent analysis intervals to extract feature vectors that are fed into pattern-recognition algorithms and post processing including diagnosis, prognosis, sensor-failure detection, and reporting (Fig.1 and Fig.2).

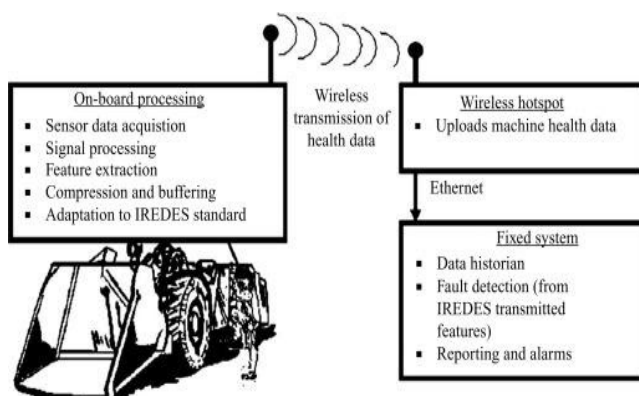


Fig. 1. Schematic of mine machinery monitoring system.

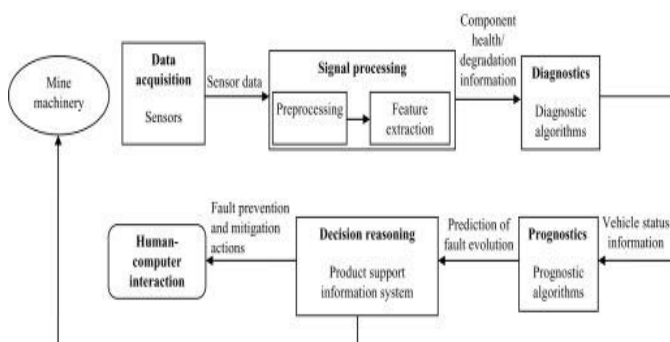


Fig.2. Data flow diagram for data acquisition from mine machinery (Benedettini et al., 2009).

Monitoring and tracking of mining machinery using IoT provides a more convenient and secure management platform. IoT focuses on real-time monitoring of all measuring points of mechanical and electrical machinery. Each machine or equipment is equipped with sensors, RFID, controller, etc. Various information can be collected, stored, and processed. In addition, graphics and real-time data can be displayed. This work status of various types of underground mine equipment can be sent to the monitoring center on the ground in order to better control of equipment's operation remotely for tracking, maintenance, troubleshooting, etc.

<https://www.sciencedirect.com/topics/engineering/condition-monitoring>



Some Highlights of NMAMIT – CMSI Student Chapter Activities 2019-20

Report – CMSI Student Members Visit to Bell O Seal Valves Pvt Ltd, on 11th of January 2020.

An Industrial visit was arranged to Bell O Seal Valves Pvt Ltd, Santhekatte, Udupi on 11th January 2020 by Condition Monitoring Society of India (CMSI), NMAMIT student chapter. 18 CMSI student members of UG Mechanical Engineering and M. Tech - Machine Design along with four faculty of Mechanical Department visited the plant. The demonstration on the process of bellow seal valve manufacturing, machining, inspection, maintenance of machines at company was given by Mr. Ashok Kumar, Director-Technical & Operations. The internship and project opportunities to the PG students were discussed in various trouble shooting areas. The challenges of valve sealing in nuclear power plant were put up in front of students for the future study.

Guest Lecture - Eagle Electricals, Bangalore on Usage of FLIR make thermal imagers in different applications, test and measuring instruments (FLIR& EXTECH make)for industries

Condition Monitoring Society of India (CMSI-Vishakhapatnam) NMAMIT Chapter organized a Guest Lecture on Usage of FLIR make thermal imagers in different applications, test and measuring instruments (FLIR & EXTECH make) for industries / R&D centres by Eagle Electricals, Bangalore on 07th February 2020, in the Phalguni seminar hall at 10.30 AM. The Head of the Mechanical Engineering Department Dr. Shashikantha Karinka addressed the faculty members, research scholars and student members and highlighted the importance of thermal imagers in today's industrial world and research scope in this area. The resource persons from Eagle electricals gave a technical talk about different applications; test and measuring instruments of FLIR make thermal imagers. Dr. Muralidhara, PG Coordinator, NMAMIT Nitte, Research scholars and Faculty from the Electrical Engineering and Mechanical Engineering Department and about 20 student members were present. Mr Rajeev Prabhu K, the student member of CMSI Chapter was the master of ceremony. Mr Dilip Kumar K, Faculty Coordinator of the CMSI Chapter, coordinated the programme.

Guest Lecture - "Role of Plastic Deformation to Improve Tribological Properties of a variety of Engineering Materials", by Dr. Uday Bhat K, NMAMIT- CMSI Student Chapter on 28th February 2020.

Condition Monitoring Society of India (CMSI-Vishakhapatnam) NMAMIT Chapter organized a Guest Lecture on Role of Plastic Deformation to Improve Tribological Properties of a variety of Engineering Materials" by Dr Udaya Bhat K, Professor, Department of Metallurgical and Materials Engineering, NITK Surathkal, on 28th February 2020, in the Phalguni seminar hall at 3.00 PM. The resource person Dr. Udaya Bhat K, discussed the use of plastic deformation as a means to increase the life of the component. He also presented the use of ECAP pressing on cast A-Zn-Mg alloys and shot peening process to produce a hard and wear resistant layer on stainless steels. Dr. Muralidhara, PG Coordinator, NMAMIT Nitte, Dr. Srinivasa Pai P, Advisor, CMSI NMAMIT Chapter, Research scholars and Faculty from the Mechanical Engineering Department and about 20 UG and 5 PG student members were present. Mr Vineet Shetty, the student member of CMSI Chapter was the master of ceremony. Mr Dilip Kumar K, Faculty Coordinator of the CMSI Chapter, coordinated the programme.



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NEWS ABOUT CMSI ACTIVITIES

Executive Committee meeting (Online) of CMSI Held On 06-06-2020

Executive Committee meeting of Condition Monitoring Society of India (CMSI) was held on 06-06-2020 at 1900hrs through Online under Chairmanship of Dr.V. Bhujanga Rao, President, CMSI.

Following Members Attended the Meeting:

- i. Er. PVS Ganesh Kumar, Sr.Vice-President
- ii. Dr. Edwin Vijay Kumar, Vice-President
- iii. Prof. MRS Satyanarayana, General Secretary
- iv. Dr. T. Venkata Ratnam, Secretary
- v. Er. G R P Singh, Jt. Secretary
- vi. Dr. VVS Bhaskara Raju, Treasurer
- vii. Dr. D. Dinakaran, EC Member
- viii. Prof. P. Srinivas Rao, EC Member
- ix. Dr. Ranadutta, EC Member
- x. Er. VV Rajsekhar, EC Member
- xi. Er. Hemanth Bari, EC Member
- xii. Er. Shivnath Ram, EC Member
- xiii. Dr. (Ms.) Sidra Khanam, EC Member

2. Chairman welcomed all EC members. He conveyed that for the first time online meeting of Executive Committee is being held due to prevailing Covid-19 situation.

3. Er. GRP Singh of Tata Steel, Jamshedpur conveyed willingness to conduct online International Conference on Condition Monitoring during November or December 2020. EC unanimously agreed for online conference proposed and requested Tata Steel to workout modalities at the earliest.

4. Dr.T. Venkata Ratnam briefed about the status of new website under development. Chairman addressed that the website be developed fast as it is the face of society and also as conference announcements are to be placed soon on the website. Executive Committee unanimously consented to proceed with development of website as envisaged.

5. Er. PVS Ganesh Kumar requested the members to contribute articles to Monitor to bring out work that is happening in industries and academia.

6. Er. PVS Ganesh Kumar stated that membership drive is required to be enhanced to spread awareness among industry & academia about Condition Monitoring and its importance. He also added that Dr. O. R Nandagopan, Outstanding Scientist & Director, NSTL, joined as a member of CMSI recently. He requested all EC members to put in efforts to encourage their colleagues and acquaintances to join CMSI. Chairman and EC members agreed with the proposal unanimously.

7. Er. PVS Ganesh Kumar stated that Dr. V .Bhujanga Rao mooted the idea of one day student webinar. Dr. V. Bhujanga Rao added that this is to encourage students and generate awareness. The idea was accepted by Executive Committee.

8. Dr. T. Venkata Ratnam sought to know modalities for obtaining signature on membership certificates.

Chairman suggested that digital signature option to be adopted and feasibility be examined on priority by Sr. Vice President.

9. Prof. MRS Satyanarayana indicated that Dr. V. Bhujanga Rao's Endowment lecture is likely to be schedule in November 2020.

10. All Executive Committee members participated enthusiastically and provided useful suggestions.



Seminar Lecture by CMSI member Er. Subba Rao Ganti



CMSI delivered a lecture during a Half day seminar on 09th January 2020 organised by Centre of Excellence Maritime and Ship Building for the target audience of R&D Engineers (BEML) on topic "Introduction to Vibration Monitoring of Industrial Rotating Equipment".



Workshop/Lecture by CMSI member Er. Hemant Bari

Er. Hemant Bari delivered "Two Day Condition Monitoring workshop with Basics & Hands-on Practice for Vibration Measurement " at YBP Diploma College, Sawantwadi, Goaduring 29 Feb to 01 March 2020 for 100 students.

Some Highlights of the Events



He also conducted 05 online webinars on 'Condition based Maintenance & Basics of vibration' on 14,17,24 & 31 May 2020 for Karad Engg. College & Rajkiya Engg. Azamgarh, UP, KBT Engg. college Nasik, RSCoE Engg, college Pune Imperial College of Engg and Pune & MIT institute Pune.



Condition Monitoring Society of India (CMSI)



Er. Subba Rao Ganti , CMSI Life member has donated valuable Technical Literature/ Text Books/ various course material on Condition Monitoring subject to CMSI Library.

CMSI is Indeed very much thankful to Er.Subba Rao Ganti for donating valuable literature on Condition Monitoring to the Society !!



Future Conference & Workshops

Ph.D programmes available which gives us an idea the direction of research going on in this field

<https://www.findaphd.com/phds/united-kingdom/?g0w900&Keywords=condition+monitoring>



CMSI Welcomes New Members!!

LIFE MEMBERS:

- Mr. GAURAV KUMAR PRAJAPATI
- Mr. D. R.S RAGHU RAMAN
- Dr. O R NANDAGOPAN
- Mr. PADMANABHAM MADATHALA

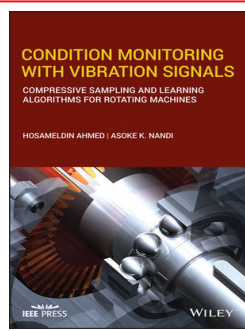


Editorial Board :

Dr. V. Bhujanga Rao
Er. P.V.S. Ganesh Kumar
Dr. T. Venkata Ratnam
Er. Hemant M. Bari

Condition Monitoring with Vibration Signals: Compressive Sampling and Learning Algorithms for Rotating Machines by AsokeNandi, Hosameldin Ahmed (Author)

This book is the first to be wholly devoted to the field of condition monitoring for rotating machines using vibration signals. It covers various feature extraction, feature selection, and classification methods as well as their applications to machine vibration datasets. It also presents new methods including machine learning and compressive sampling, which help to improve safety, reliability, and performance. Compressive Sampling and learning Algorithms for Rotating Machines starts by introducing readers to Vibration Analysis Techniques and Machine Condition Monitoring (MCM). Readers will learn signal processing in the time-frequency domain, methods for linear subspace learning, and the basic principles of the learning method Artificial Neural Network (ANN). They will also discover recent trends of deep learning in the field of machine condition monitoring, new feature learning frameworks based on compressive sampling, subspace learning techniques for machine condition monitoring, and much more.



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Any Technical Articles, Latest CM Products/ Courses/ Conferences, significant Achievements/Awards/Honours by our CMSI members may please be intimated through our CMSI e-mail: cmsi.hq@gmail.com.

-- Editor

For Membership Enrollment please Contact:

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