



# MONITOR

A Publication of Condition Monitoring Society of India

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## From President's Desk...



Time has come to see increasing number of areas in which CM can be deployed profitably where criticality or human safety is paramount. Of late, Defence forces are deploying CM at all levels. It is understood US DoD has introduced CM in a big way in all its three services namely Army, Airforce and the Navy. Over 30% of Army's aircrafts have been equipped with digital source connectors. The aircraft have been deployed to Operation 'Enduring Freedom' and 'Operation Iraqi Freedom' respectively with CM sensors and DAS to wirelessly transmit daily from the aircraft logbook to a home base for the first time ever. These technologies have been accredited for averting Apaches and Blackhawks from critical failures. Soldiers in the field are using CBM technologies to save lives and equipment. Platforms fitted with CBM equipment are experiencing a 5% increase in readiness. It is enabling soldiers to be more productive, reduce maintenance services and providing leaders the visibility of equipment status. Same way, US Navy has deployed CM on a large scale in all their ships & submarines to identify and predict functional failures in advance of the event and provide the ability to take appropriate action.



**CMSI Wishes A Happy & Prosperous New Year to all its Members!!**



### Flash News !!

**CMSI & Andhra University  
Signed MoU on Conducting  
Course on**

**PG Diploma on Condition  
Monitoring (PG DCM)**

**Duration: 1 Year**

**Eligibility:**

**BE/ BTech/ Equivalent**

**For further details**

**Contact e-mail:**

[administrator@comsoi.org](mailto:administrator@comsoi.org)

**website:**

<http://www.comsoi.org>

## Vibration Transmitters & Process Control – 80% of Diagnostic Data Can be Lost!

Vibration Engineers are from Venus, and Measurement & Control Engineers are from Mars. No, this is not a gender issue but a serious misunderstanding that is facing the industry today; the conversion of AC vibration to DC signals. Let us better appreciate this subject so we may work towards the mutual objective of lower maintenance costs with greater plant uptime.

C&I or Control and Instrumentation engineers are usually happiest when any sensor output, flow, pressure, temperature etc offers the ubiquitous 4-20mA signal or equivalent digital data such as MODBUS, Profibus or Field bus. As long as it is a DC signal or digital data the C&I engineers can manage and control it. However, they cannot do the same with the raw vibration AC signal unless it too is dumber down to 4-20mA. Unfortunately few C&I engineers appreciate that by simply converting a vibration signal to 4-20mA is like making a concert piano operate like a simple car horn. In reality it means that when a vibration signal is converted to DC up to 80% of the crucial machinery information can be lost.

When an overall vibration signal is monitored on rotating machinery the 1xRPM signal produces high energy signals at low frequencies associated with shaft speed, unbalance, looseness and alignment. However, the low energy higher frequency signals that emanate from the deterioration of gear meshing or bearings, are often swamped by the low frequency higher energy signals. This is why machines continue to fail when they have vibration 4-20mA transmitters or even the cheap simple vibration switch because these only alarm when damage is at the advanced stage. The **Figure 1** illustrates that the overall level of vibrations is the sum of the energies at all frequencies measured. Imagine if the bearing level increased from 0.2 to 0.4mm/sec, the overall level would increase to 7.2mm/sec. This is unlikely to be cause for concern even though the bearing had deteriorated by 100%.

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**Enroll as a member of our society**

Check Website for details: [www.comsoi.org](http://www.comsoi.org)

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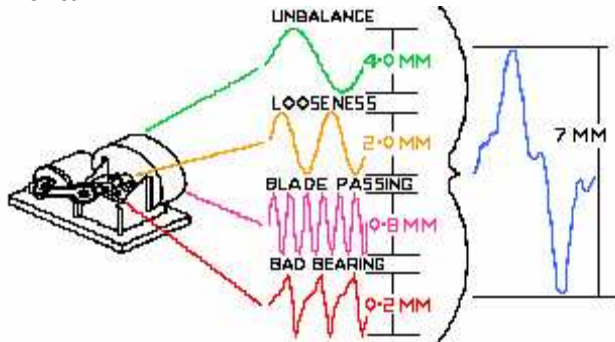


Figure 1

In recent times and as a result of active marketing, the Loop Powered Accelerometer (LPA), seems like the perfect solution for the C&I design engineer. Unfortunately for heavy industry the LPA has gained purchase as it is easy to integrate in C&I systems without the apparent need for vibration specialists. Few engineers appreciate that these sensors were originally intended for low duty applications like hotel aircon systems and swimming pool pumps! A further aspect is that we often find a proven technology. Ultimately the LPA pervasion in industry will damage the expected benefits from an effective vibration condition monitoring strategy. Predicting machinery health based solely on overall signal levels is pre 1970 technology. The LPA DC signal cannot be used for vibration analysis nor can it be effectively calibrated. Over time sensors age, due to inbuilt electronics, giving a signal error of > 15%. Surely for C&I applications (< 5% accuracy standard) this must be unacceptable.

There is however a relatively simple solution that is generally lower cost or at least similar. Vibration transmitters come in many options: the Protection Transmitter that incorporates relays; the Signal Transmitter is locally powered with connectivity to PLCs who manage the alarms and then the Loop Powered Transmitter that is powered from the DCS. **All these vibration transmitters should be specified with dual outputs.** In addition to the 4-20mA DC signal, there should be a BNC socket with an isolated Time Wave Form (TWF) buffered output at 1:1 of the actual measured signal. The TWF signal socket must be easily accessible by the vibration condition monitoring engineer to evaluate increasing overall vibration levels with a FFT frequency analyser. In addition, the transmitter must have a sensor sensitivity adjustment. After periodic or statutory ISO 9000 sensor calibration checks, the change in sensor sensitivity must be compensated in the transmitter thus ensuring continued accurate vibration measurements. If this practice is followed both C&I and Vibration Engineers will achieve their common objective of providing reliable and meaningful vibration protection and predictive machinery maintenance to Indian Industry.

Contributed by:

**Peter W. Hills, Dipl. Man, MBA, F Inst NDT, M Inst M&C,  
Managing Director & CEO, Mechanalysis India Ltd.**

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## How to identify and correct a resonance condition!!

*Alain Pellegrino, Laurentide Controls Ltd.*

**Resonance** is a very common cause of excessive machine vibration. Resonance is the result of an external force vibrating at the same frequency as the natural frequency of a system. Often, resonance can be confused with the natural frequency or critical frequency. If equipment is operating in a state of resonance, the vibration levels will be amplified significantly, which can cause equipment failure and plant downtime. It is, therefore, important that the running speed of equipment be out of the resonance range.

Many techniques can be used to identify and/or confirm a high vibration level caused by a resonance frequency. It is very important to confirm a resonance phenomenon by at least two different types of tests before trying to correct it. A few techniques commonly used in the industry to confirm a resonance as given below:

**Impact test** is one of the most commonly used methods for measuring a system's natural frequency is to strike it with a mass and measure the response. This method is effective because the impact inputs a small amount of force in the equipment over a large frequency range. When performing this technique, it is important to try impacting different locations on the structure since all of a structure's resonant frequencies will always be measurable by impacting at one location and measuring at the same location. Both drive point and transfer point measurements should be taken when attempting to identify machine resonances.

This type of test must be performed with the equipment off. This way one can easily identify the natural frequencies of the equipment as shown in Figure 1.

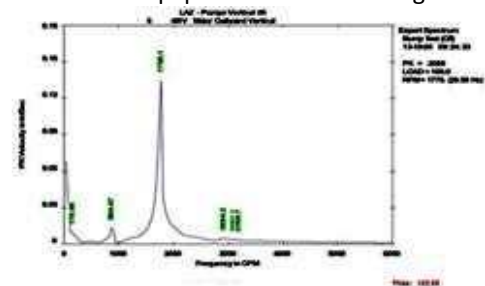


Figure 1. Impact Test, Equipment Off

**An instrumented hammer** is also used to excite the system. This hammer, equipped with an accelerometer at one end, is used in tandem with the sensor used to measure the vibration. A two-channel vibration analyzer is needed, in which one channel is connected to the instrumented hammer and the other to the vibration sensor. Using this technique, you can effectively measure the force induced to the system by the instrumented hammer and the response at different frequencies. When the phase shifts by 90 degrees, the frequency at which it occurs is a natural frequency as shown in Figure 2.

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**M/s. Structural Solutions Private Limited (SSPL)**

For MEMS Accelerometers, Thermovision Cameras, Piezo Electric Transducers, Electro Dynamic Shakers, etc  
Email: [sales@stsol.com](mailto:sales@stsol.com), URL: [www.stsols.com](http://www.stsols.com), Phone: 040-27636433

## Inauguration of CMSI Jamshedpur Local Chapter

Condition Monitoring Society of India (CMSI) started another local chapter at Jamshedpur on 7<sup>th</sup> September, 2010. CMSI President Dr. V. Bhujanga Rao and Tata Steel Vice President (TQM & Shared Services) Sri. Anand Sen inaugurated the Jamshedpur Chapter at Tata Steel premises. This was followed by keynote lectures delivered by condition monitoring experts drawn from Vizag steel and Electro Steel Castings.

During the inaugural function, CMSI President Dr. V. Bhujanga Rao mentioned that condition monitoring systems (CMS) in the production of steel industry could save as much as 8% of their annual maintenance cost while the power industry could save as much as 10% in terms of transmission and distribution (T&D) losses.

According to the CMSI president, of the 1,20,00 MW power generation taking place in the country, as much as 20 -25% was being lost on account of T&D losses, which was substantially higher than 8% T&D loss norm fixed by the US-based Electric Power Research Institute (EPRI).

Dr. Rao said bringing down T&D losses in the country to 15% could result in a saving of around Rs. 10,000 crore, which would be sufficient to put up **at least one additional 1000MW power plant** anywhere in the country.

He congratulated the Tata Steel fraternity in helping start a local chapter of Condition Monitoring Society of India, said in years to come benefits supposed to accrue from it would go to all industries located in the area in terms of increased productivity, less downtime and increased bottom line.

According to CMSI President, if condition monitoring was not giving returns to any industry today, it was not due to unavailability of technology "which will not let you down at all" but because of failure on the part of management in implementing condition monitoring tools in the right way.

Tata Steel Vice President (TQM & shared services) Anand Sen said that apart from "waste prevention", CM helped build "cohesiveness" in the monitoring team while also supporting good daily management practices, resulting in improved reliability and hence improved performance of the plant.

"A full set of standards developed through condition monitoring experience can result in good decision making down the organization, resulting in an empowered organization where decisions are taken more on data and not because the boss said so", said Sen.

In his Welcome address, Mr. B. K. Das, Chairman of the Jamshedpur local chapter of the CMSI, said condition monitoring was the 'Art and Science' of picking up the right signals from equipment and processes, analyzing them and taking corrective action, the purpose finally to give longevity to equipments, attaining higher productivity with a lower down time.

The executive committee of Jamshedpur Local Chapter was constituted with the following office bearers:

**Chairman:**

Mr. B. Das

**Vice Chairman:**

Mr. P.S. Mitra

Mr. Arvind Kr. Sinha

Mr. Sanjay Kedia

**Secretary:**

Mr. G.R.P. Singh

**Jt. Secretary:**

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**Treasurer:**

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Mr. Navin Verma

Mr. Gyan Ratna

Mr. Anurag Saxena

Mr. Falguni Mitra

**Convener:**

Mr. Rohit Kumar

## Product News



SKF Multilog WMx, a compact, eight-channel, field-mounted monitoring device, collects acceleration, velocity, temperature and bearing condition data in hazardous locations with ease, safety and accuracy.

This newest model is certified to ATEX 2/IEC Zone 2, allowing it to be used in most areas in the hydrocarbon processing industries where non-certified systems are not allowed. The device, which can be powered by batteries, is compatible with standard hazardous-area certified sensors. In addition, the Multilog WMx supports WEP, WPA or WPA2 encryption for increased security.

Web site: [www.skf.com](http://www.skf.com)

**All feed back, comments and contributions to the news letter are most Welcome.**

**- Editor**



# Inauguration of Jamshedpur Local Chapter

## Jamshedpur

### 07 September 2010



Executive Body of Jamshedpur Chapter



## Launch of PG Diploma Course in Condition Monitoring



## CMSI - AU Signs MoU



## Release of ICCM-2011 Brochure and Launch of Website At GITAM UNIVERSITY



## PG Diploma Course in Condition Monitoring: MoU between Andhra University and CMSI

The School of Distance Education, Andhra University in collaboration with Condition Monitoring Society of India (CMSI) is offering an exclusive one year PG Diploma on Condition Monitoring (PG DCM) in distance education mode. Prof. B. Satyanarayana, Honorable Vice Chancellor of Andhra University and Dr. V. Bhujanga Rao, Distinguished Scientist, Director NSTL & President CMSI signed the MoU to this effect on 01<sup>st</sup> Nov '10.

PG DCM is intended for the benefit of practicing maintenance Engineers of various industries and academia. Faculty from Andhra University and experts drawn from CMSI will deliver lectures on the subjects. A number of centers spread all over India has been identified to train the students of the course in practical hands on experience.

Shortly, Applications will be made available from website: [www.andhrauniversity.info/sde](http://www.andhrauniversity.info/sde) and [www.comsoi.org](http://www.comsoi.org).

Brief course details are given below:

**Scheme & Syllabus :** The scheme relating to this course and the detailed syllabi for each subject are given in the prospectus.

**No. of Theory Subjects :** Six

**No. of Practical Exams:** Two

**Project Work:** Minimum period of 3 months at certified Industrial/ Research/ Training Institutes.

Candidates residing in India only can apply.

Eligibility ... BE/ B.Tech. in any discipline  
Duration ... One year

**For Further Details:** [www.andhrauniversity.info/sde](http://www.andhrauniversity.info/sde)

**Coast down peak hold** is another method used to monitor the vibration level using a peak hold function, while shutting down the equipment, as performed normally. The vibration level should drop at a steady rate. If the vibration levels start rising at any time while the equipment is being shut down, the speed at which the amplitudes increase is a possible natural frequency as shown in Figure 3.

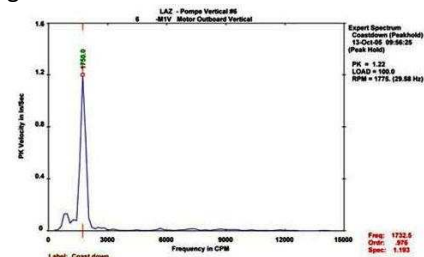


Figure 3. Coast Down Peak Hold

**Coast down peak phase:** This test is also conducted while the equipment is being shut down. By installing a photo tack and a piece of reflective tape on the rotating shaft of the equipment, you can monitor the vibration and its phase. This will allow you to see the amplitude and phase shift at all running speeds of the equipment. If there is no resonance excited by the turning speed, the vibration levels should drop at a steady rate. If the vibration peaks at a certain speed and the phase shifts by 180 degrees, this indicates a natural frequency of the equipment or structure. The actual natural frequency is the frequency situated in the middle of the phase shift (90 degrees) as shown in Figure. 4.

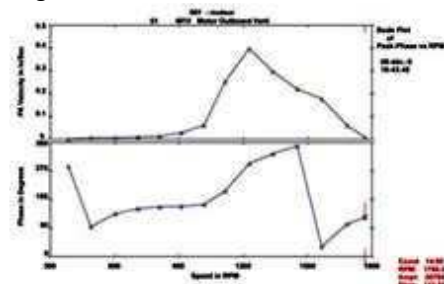


Figure 4. Coast Down Peak Phase

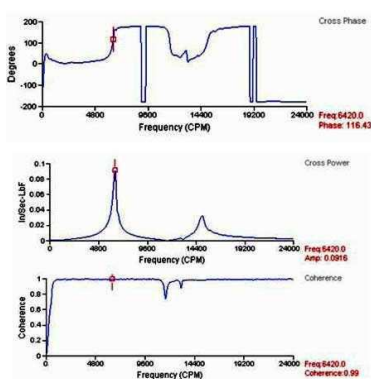
Resonance is probably one of the five common causes of excessive machine vibration. Identifying a resonance frequency effectively can be challenging. We need to positively identify the natural frequency by performing at least two different tests such as impact test, coast down peak hold, coast down peak phase or impact test using a force hammer.

Once the resonance is confirmed, either change the mass or the stiffness of the equipment to change its natural frequency. If it cannot be accomplished try to change the operating speed of the equipment. If that fails, consider installing a dynamic absorber to counteract the initial exciting force.

Source : <http://www.reliableplant.com/>

## How to identify and correct a resonance condition!!

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The advantage in using this method is that it allows you to monitor phase shifts and coherence. With this information, you can create operating deflection shapes to visualize the vibrating body.

Hammer

**SPM Instrument India Pvt. Ltd.**

7-1-27/1, Srinivasa Complex, 1 st Floor "B" Block,, Ameerpet, HYDERABAD-500 016, INDIA  
Tel +91 40 23731264/+91 40 23730644, Fax +91 40 23731314, [info@spm.co.in](mailto:info@spm.co.in)

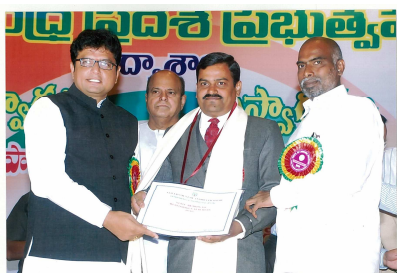


## CMSI Members bring Laurels !!



**Dr. V. Bhujanga Rao**, Distinguished Scientist, Director, NSTL and Founder President, CMSI has been honoured as **Honorary Professor of Department of Mechanical Engineering**, College of Engineering, **Andhra University** by **Prof. B. Satyanarayana**, Vice-Chancellor, Andhra University, Waltair.

CMSI wishes **Dr. K. Ramji**, Professor, Mechanical Engineering Dept, Andhra University, Waltair who received three prestigious awards from Govt. of Andhra Pradesh, Institution of Engineers (India) and Mother Theresa Welfare Organisation, Visakhapatnam.



**"BEST TEACHER AWARD - 2010"** awarded by Govt. of Andhra Pradesh – this certificate of merit and Gold Medal awarded in recognition of meritorious service for research and teaching.



**"BEST ENGINEER OF THE YEAR AWARD - 2010"** awarded by Govt. of Andhra Pradesh & Institution of Engineers (India), A.P. State Center for valuable contribution to the field of Engineering.

**"AACHARYA DEVOBHAVA – LIFE TIME ACHIEVEMENT STATE AWARD - 2010"** for his excellent performance in the field of Teaching & Social Service, awarded by Mother Theresa Welfare Organisation, Visakhapatnam.



Sri. P.V.S. Ganesh Kumar, Additional Director, NSTL & General Secretary, Acoustical Society of India (ASI) receiving CV Raman award for best paper published in the Journal of Acoustical Society of India. Our CMSI members Sri. V. Rama Mohana Rao, R. Rama Rao and V. Ramesh Babu are co-authors.

## Mechanalysis® (India) Ltd bags prestigious Contract!!

Bharat Heavy Electricals Limited, Haridwar Division, the leading Indian engineering Contractor, awarded Mumbai based Mechanalysis (India) Ltd., one of the largest single orders placed for Generator End Winding Vibration Monitoring Systems. Won through reverse auction against fierce international bidding, the order confirms Mechanalysis (ISO 9001: 2008) amongst World recognised vibration and turbine supervisory suppliers.

The rate contract over the next 12 months to deliver 17 systems for 11 power plants will incorporate the model MIL8800 programmable monitor (API670 compliant) developed by MIL. Stator End Winder monitoring trends the degradation of the electrical windings and protects against premature failure. This order will bring the total of SEW systems Mil will have commissioned in India since 1990 to 47. In 2008 the company also supplied and commissioned two FBG fibre optic SEW systems to TATA Power in Mumbai, a World First.

More information is available on

[www.mechanalysisindia.com](http://www.mechanalysisindia.com).

## TERMINOLOGY : Averaging

Averaging is a process of summing a number of time waveforms, sample by sample, or a number of spectra, frequency by frequency, to obtain a better estimate of the mean properties of a signal in the presence of noise or other interfering signals. May be carried out in a number of ways, with or without weighting, including linear (power), negative linear, exponential, peak hold, and synchronous, linear vector types.

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**M/s. Mechanalysis (India) Limited (formally IRD Mechanalysis India Ltd.)**

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# Condition Monitoring Society of India(C M S I)

## CMSI Welcomes New Members!!

### Institutional Members :

1. M/s. TATA Steel, Bistupur, Jamshedpur, INDIA
2. M/s. Jyothi Cero Rubber, Jamshedpur, INDIA
3. M/s. TATA Power Co. Ltd, Jamshedpur, INDIA



### Life Members :

1. Sri. PRANY SINHA
2. Sri. SATYAJIT CHAKRABORTY
3. Sri. SUMAN BHAGAT
4. Sri. NEMDHARI PANDIT
5. Sri. KAUSHAL KISHORE
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7. Sri. G.R.P. SINGH
8. Sri. S. K. MUKHERJEE
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10. Sri. APURBA KUMAR PAUL
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12. Sri. RAVI PRAKASH SHARMA
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27. Sri. AMARNATH KOSGI
28. Dr. B.S.MURTY

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Dr. V. Bhujanga Rao  
Prof. Dr. M. Ananda Rao  
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Sri T. Venkata Ratnam



## CONDITION MONITORING AROUND THE GLOBE...

### Courses, Conferences, Workshops

#### INTERNATIONAL CONFERENCE ON CONDITION MONITORING (ICCM-2011):

A two day International Conference on Condition Monitoring (ICCM-2011) is being jointly organized by CMSI, COMADEM and GITAM University. A number of Condition monitoring experts/ practicing specialists from various International organizations, institutes and industries are expected to participate in the conference.

Venue: **GITAM University, Visakhapatnam.**

Conference Dates: **24 – 25 February 2011**

#### For Further Details:

Convener: **Prof. S. Kamaluddin**

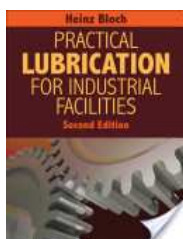
Mobile: +91-9885553432

email: [convenericcm@gmail.com](mailto:convenericcm@gmail.com),

Website: [www.gitam.edu/iccm2011/](http://www.gitam.edu/iccm2011/)

### Reference Books

#### Practical Lubrication for Industrial Facilities, 2<sup>nd</sup> Edition by Heinz P. Bloch



This new edition includes the latest material on oil analysis, the energy conservation aspects of lube oil application and selection and bearing protector seals. Information on synthesized hydrocarbons and oil mist lubrication is thoroughly revised. It addresses the full scope of industrial lubricants, including general purpose oils, hydraulic fluids, food-grade and environmentally friendly

Publisher: **The Fairmont Press, Inc., 2009**

ISBN: **0881735795, 9780881735796**

### BOOK POST

*If undelivered please return to:*

**Dr. V. Bhujanga Rao, FNAE**  
**President, Condition Monitoring Society of India,**  
**Naval Science & Technological Laboratory,**  
**Visakhapatnam – 530 027, INDIA, Phone: 0891-2586100**

*All feed back, comments and contributions to the news letter are most Welcome.*

**- Editor**