CMSI MONITOR

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From President's Desk

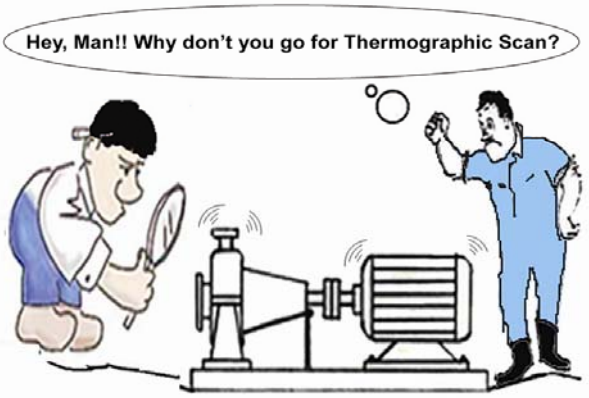
How do you create Operational Excellence?

It has become a dream for every plant CEO to achieve operational excellence in the total plant. CBM as a tech--nology is a very successful tool but sometimes, it failed to give expected returns. The reason is, it is not CBM that failed but the management which fails to work together as a team. It goes without saying that opera--tional excellence demands collective contribution of its maintenance, operations, engineering and finance people in any work place. All these men are to be involved relentlessly in risk management, root cause investigations, continuous improvement and involvement in decision making. There should be an operational excellence policy in every organization from which responsibilities can be delineated to achieve overall operational excellence. One should develop out of such shared vision on engineering asset management and operational excellence policy. Constant produc-tion and operation improvement only takes place when work is done in cooperation and harmony involving all parties pulling in the same direction together. When you work with such operation and maintenance strategy, I am sure you would get low maintenance costs, high equipment reli-ability and high equipment availability. Please understand that this is the foundation for the per-formance results you want!.

CMSI WISHES ITS MEMBERS A VERY HAPPY AND PROSPEROUS UGADI 2007

PRESIDENT CMSI THANKS:

President CMSI takes pride in stating that the first ever CMSI National Conference held at NSTL during 15th -16th Dec. 2006 went off extremely well. Vice Admiral NM Nadaph, AVSM, VSM gave a kick-start by inaugurating the conference. Professor BVA Rao (Retd IIT M) gave a stimulating Key Note. Rear Admiral Dilip Deshpande shared his vast experiences on CBM. All the delegates have shown constant enthusiasm till the last session. President CMSI takes this opportunity to thank all the organizers, Conference Committee members and co-coordinators for their whole hearted involve-ment and significant contribution in making this National Conference a grand success.



ELECTRICAL SIGNATURE ANALYSIS (ESA)

Electrical Signature Analysis (ESA) is a powerful tool where the equipment needs to be monitored from a remote point and/or where non-intrusive techniques are required.

Electrical Signature Analysis (ESA) is the term used for the evaluation of the voltage and current waveforms. This provides an increased advantage to diagnostic as power-related, motor-related and load-related signals can be quickly compared. A key consideration when using ESA is that voltage signature relate to the upstream of the circuit being tested (towards power generation) and current signatures related to the downstream of the circuit being tested (towards the motor and load).

ESA is a versatile technology that can be readily integrated into electro mechanical equipment to enhance condition diagnostics and prognostics capabilities. It provides diagnostic and prognostic information comparable to conventional vibration analysis. It requires only access to electrical lines carrying input or output power rather than to the equipment itself. ESA analyses small load and speed variations in electro mechanical systems and matches them to their source. The resulting time and frequency signatures reflect loads, stresses and wear throughout the system and allow an extensive range of mechanical diagnostic information to be obtained from a single sensor attached to an electrical line.

ESA technology diagnostics can pinpoint electrical and mechanical problems and target maintenance on an as needed basis, in that way increasing equipment reliability and maintenance efficiency and minimizing unexpected downtime.

Web resource: www.ornl.gov/lod

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Do U Know ?! It's Very Interesting !!

The solutions for oil whip and oil whirl are small bearing clearances and adequate radial loading. When bringing a large turbine up to speed, it is important to pass through the critical frequencies very quickly to prevent the buildup of oil whip.

ANNOUNCEMENT!!

CMSI will organise a 3-day workshop on Condition based Maintenance for industries in October '07. Details will be made available on website shortly.

THERMOGRAPHY: A POWERFUL TOOL TODAY IN INDUSTRY

Infrared (IR) detectors can "sense" infrared radiant energy and produce electrical signals proportional to the surface temperature of target object. Presently, hand held equipment called "Thermographic Cameras or Imagers" are available which use optics to gather and focus IR energy into these detectors. These cameras are used to make non - contact temperature measurement of multiple points on a target simultaneously. This data is displayed in the camera in form of a picture. These pictures are commonly known as "Thermograms or Thermograph". Each "Thermograph" represents the thermal pattern and displays temperature in colour scale.

What can be scanned using Thermography ?

* Electrical switchgear, breakers, bus connections, and contacts.
* Transformer connections, Motor and generator connections, windings, feeders and exciters.
* Furnaces, refractory lining, boiler & kilns.
* Mechanical couplings on rotating equipment, Process piping and heat exchangers, Compressor heads, Bearings, Drive gears and drive belts (for excessive friction), Steam traps and piping insulation, Steam systems.
* Buildings, Flat roofs.
* Non-destructive testing (bonding, thickness, intrusion).
* Casting & moulding.

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TERMINOLOGY

Ghost Components: These ghost components, sometimes called ghost frequencies, are usually due to irregularities in the tooth spacing of one of the gears. The irregularities are the result of machining errors or hobbing errors when the gear was manufactured. New gear sets will sometime exhibit these spectral components that are not related to the tooth counts of either gear. Ghost components generally tend to disappear over time since there is no mechanical action that reinforces them.

Hunting Tooth Frequency : The hunting tooth frequency of a pair of gears is the gear mesh frequency divided by least common multiple of the numbers of teeth on the two gears. The least common multiple is often just the product of the numbers of teeth. In some gearboxes , the hunting tooth frequency will appear in the vibration spectrum, and if so, it should be trended over time, because rapid wear usually results under these conditions.

INAUGURATION OF NEW LOCAL CHAPTER VIJAYAWADA

Condition Monitoring Society of India (CMSI) started its new local chapter at Vijayawada on 23rd September 2006. CMSI president Dr. V. Bhujanga Rao and General Secretary Prof. (Dr.) M. Ananda Rao were inaugurated the Vijayawada local chapter at Koneru Lakshmaiah college of Engineering (KLCE), Vaddeswaram followed by a one-day Workshop on "Applications of Condition Monitoring in the Industry". The executive committee of local chapter was constituted with following office bearers:

Chairman :
Dr. K.V. Ramana, Dean, Academics, KLCE

Vice-Chairman :
Dr. K. J. Babu, Professor, Department of Industrial & Production Engineering, KLCE

Secretary :
Dr. K.L.Narayana, Professor & HOD,
Department of Mechanical and Industrial & Production Engineering, KLCE

Joint Secretary :
Dr. K. Srinivas, Professor, Department of Mechanical Engineering, RVR & JC, Guntur

Treasurer :
Dr. C. Naga Bhaskar, Professor, Department of Mechanical Engineering, PVPSIT, Vijayawada

Executive body

1. Dr. K. Murali Mohan Rao
   Professor & Head, Department of Mechanical Engineering, VRSEC, Vijayawada.
2. Prof. V.C.A. Vara Kumar
   Professor & Head, Department of Mechanical Engineering, BEC, Bapatla
3. Dr. K.V.N. Srinivasa Rao
   Professor & Head, Department of Mechanical Engineering, VEC, Guntur
4. Dr. V. Bala Krishna Murty
   Professor, Department of Mechanical Engineering, PVPSIT, Vijayawada
5. Er. Y. Mallikarjuna Rao
   Assistant Divisional Engineer, VTPS, Vijayawada.

In the workshop CMSI president Dr. V. Bhujanga Rao delivered a lecture on 'Condition based Maintenance : A Technical and Economical Appraisal'. CMSI General Secretary Prof. M. Ananda Rao, GITAM, Visakhapatnam delivered a lecture on 'Data Processing & Signal Analysis'.

Mr. PVS Ganesh Kumar, Head (Vibration), NSTL, Visakhapatnam delivered lecture on 'Machine Condition Monitoring: Some Aspects'.

Mr. Edwin Vijay Kumar, General Manager (Technical Services), Visakhapatnam Steel Plant has also presented several practical case studies on "Predictive Maintenance" using Vibration Monitoring and Thermography Analysis.

Mr. P. Sreedhar, Technical Manager, M/s. Structural Solutions has also delivered a lecture on "Sensors for condition monitoring", covering various sensors required for condition monitoring of machinery.

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CM – Around the Globe
Conferences, Workshops

1. Condition Monitoring and Fault Diagnosis in Electric Machine Drives: From Induction Motor Applications to Wind Energy Conversion Systems.

International Conference on Power and Energy Systems (EuroPES 2007) will serve as a major forum for international researchers and professionals to present their latest research, results, and ideas in all areas of power and energy systems.

Website address:
www.iasted.org/conferences/tutorialsubmit-582.html

2. Thermography for Condition Monitoring

Thermography for Condition Monitoring is a 5 day program suitable for all personnel who are operators of infrared thermographic equipment or who may be operators in the near future. The program covers the key areas of thermal physics, radiosity concepts, thermography operations and infrared survey applications.

Date: 25 - 29 June 2007, Venue: Carlton, Melbourne.
Registration enquires: Rebecca Appleton
Project Officer, School of Enterprise
E-mail: r.appleton@soe.unimelb.edu.au
Tel: +61 3 9810 3354

Inauguration of Vijayawada Local Chapter
&
One Day Workshop on Applications of Condition Monitoring

23 September 2006

GLIMPSES OF NCCM-2006

15-16 December 2006

NATIONAL CONFERENCE ON CONDITION MONITORING (NCCM 2006): SOME HIGHLIGHTS

The first National Conference on Condition Monitoring (NCCM 2006) was organized by Naval Science and Technological Laboratory (NSTL) and Condition Monitoring Society of India (CMSI) under the aegis of Defence Research and Development Organisation (DRDO) during 15-16 December 2006 at Visakhapatnam.

Dr. V. Bhujanga Rao, Director NSTL and Founder President of CMSI was the Chairman for this conference and Prof (Dr.) M. Ananda Rao was the Co-chairman with Shri KVVSS Murty, Additional Director, as the Convener and Shri PVS Ganesh Kumar, Additional Director, as the Secretary. The Conference was inaugurated by Vice Admiral N.M. Nadaph, AVSM, VSM, Indian Navy. Rear Admiral Dilip Deshpande, VSM, Admiral Superintendent, Naval Dockyard (V) was the Guest of Honor.

The conference was planned with the objective of bringing together practitioners and experts of Condition Monitoring and spread the message of effectively implementing Condition Monitoring practices in the industry for enhanced productivity and increased availability.

The Chief guest of the conference Vice Admiral N.M. Nadaph said lot of research is being carried out to develop new techniques of condition based monitoring of machines to reduce disadvantages of preventive maintenance.

The keynote address was delivered by Prof. Dr. BVA Rao, a pioneer of Condition Monitoring in India, and Director (International Relations), VIT. He stressed the need for developing machines with less noise and vibration.

Invited talks were delivered by Dr. V. Ramamurti, Former Professor, IIT Madras, Sri B.K. Patnaik, Associate Director, IIPM, Dr. R.K. Biswas, Head Condition Monitoring, CMERI, Prof. Idichandy, IIT Madras, Sri. M.P. Srivastava, ex-IIPM. These lectures were of immense benefit to the participants and helped to enrich their knowledge base.

A number of participants representing various sectors of the industry and the services, academic institutions, and students actively participated in the deliberations and presented papers on various themes such as 'vibration based diagnostics', 'wear debris analysis', 'Thermography','Automation in Condition Monitoring', 'Sensors and Signal Processing for Condition Monitoring'.

It particularly, it is heartening to note that practicing maintenance engineers had come forward and narrated their experiences in the conference through their papers. Engineers from Industry such as VSP, RCF, IFFCO participated.

Similarly R&D scientists from DRDO and IGCAR also presented their case studies. Consultants such as ACME Sampoorna Rotor dynamics also narrated their view points. The sessions were highly interactive and were chaired by eminent academicians, industrial and naval experts.

A cultural programme was organized before the Conference dinner to the appreciation of the audience. An exhibition was also organized during the conference showcasing the technologies and tools available for Condition Monitoring.

The conference was well attended and widely appreciated, and helped in spreading the utility of Condition Monitoring practices for achieving better productivity in industry.

The proceedings of the conference are available for members in our website **www.comsoi.org .**

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Cool the oil ! Never the bearing !!

Most of the times, bearing lubricant is getting heated, for which pumps have a facility for cooling the oil in the bearing case.

Never attempt to cool a bearing by cooling the outer case. Steel will expand or contract at the rate of about 0.001 of an inch, per inch, per 1000 Fahrenheit. (0.001 mm/ mm/ 500 C).

In other words, if you cool the bearing case it will contract or shrink and increase the load on the bearing. The rules is "cool the oil, never the bearing".

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MOTOR CIRCUIT ANALYSIS (MCA)

MCA is a low voltage method for testing, connections, windings, rotor and electrical machinery cables for developing faults. The technique involves individual readings of DC resistance (R), Impedance (Z), Inductance (L), Phase Angle (Fi), Current/ Frequency Response (I/F) and insulation to ground (MegOhm) testing. Resistance is used for detecting loose connections and broken conductors, insulation to ground is used for detecting ground faults, Z and L are matched to evaluate the insulation condition for winding contamination, and, Fi and I/F are used to detect winding shorts. One of the key aspects of MCA is the ability to detect winding defects that can be trended over time and time to time failure can be estimated.

As a vast majority of the rotating machinery, that MCA is used to evaluate , required balanced phases, pass fail criteria for individual readings can be developed for both assembled and disassembled machines as shown in Table 1 and 2. These values indicate a guideline and value outside of these guides identify component failures that have occurred, or are developing.

In addition to the power of detecting a motor system defect, the values are trendable without the requirement of temperature adjustment for a majority of faults. This allows for the ability to evaluate condition and provide estimates for time to failure by monitoring changes to the phase unbalances over time.

Table 1: Pass/Fail considerations for Assembled Machines

Test Result	Tolerance	Detail
Resistance (R)	<5%	Used for detecting loose connections, broken Wires, direct shorts and diff wire sizes
Impedance (Z) and Inductance (L)	Similar Patterns	Changes to impedance that cause its phase to phase pattern to appear different from inductance are normally the result in the change to the material condition of the insulation system. Used for detecting windings (overheated), very large phase unbalances or very poor bar condition.
Phase Angle (Fi)	± 1 digit from average	Indicates a winding short:74, 75, 76, OK: 74, 74, 76, suspect: 73, 73, 76 failed.
I/F	± 2 digits from average	Indicates a winding short:-44, -45, -46 OK: -44, -46, -46, supect: -42, -45, -45 failed.
Insulation Resistance (MegOhm)	> 5 (MegOhm) > 100 (MegOhm)	Indicates poor insulation to ground (i.e., ground fault)

When a motor does not have a rotor in place, such as in a motor repair shop with a stator only, the tolerance change:

Table 2: Pass/Fall Criteria for Disassembled Machines

Test Result	Tolerance
Resistance (R)	< 5%
Impedance (Z)	< 3%
Inductance (L)	< 5%
Phase Angle (Fi)	± 0
I/F	± 0
Insulation Restack (MegOhm)	> 5 MegOhms / > 100 MegOhms

For trending and analysis purpose, MCA is a comparative tool using percent unbalance and difference between tests methods. In the percent unbalance method, the difference between like coils (i.e., between phases in a three phase motor) is treaded over time. This method is best for restack values are impacted by temperature, impedance and inductance. While restack values are impacted by temperature, for instance, the relative difference between phases is not. By using the percent unbalanced method, the user or software do not have to rely upon perfuming temperature correction calculations. Therefore, and unbalance method is the most convenient way of ducting faults over time. The difference between tests method is used for phase angle and I/F in which the lowest value for each is subtracted from the highest value for each. Web resource: **www.reliabilityweb.com**

CMSI NEWS

CMSI Welcomes It's New Institutional Members!!!

- M/s Bharat Heavy Electricals Limited (R&D Division), Hyderabad
- M/s Visakhapatnam Port Trust, Visakhapatnam
- M/s. Naval Science & Technological Laboratory, Visakhapatnam

CMSI Welcomes It's New Members!!

LIFE MEMBERS:

Vice Adm. N.M. NADAPH
Dr. B.V.A. RAO
Dr. K. V. RAMANA
Dr. K. J. BABU
Dr. NAGA BHASKAR
Dr. K. MURALI MOHAN RAO
Dr. K. V. N. SRINIVASA RAO
Dr. BALA KRISHNA MURTY
Dr. K. SRINIVAS
Prof. V. C. A. VARA KUMAR
Dr. K.V. BHASKARA SARMA
Sri G. DURGA PRASAD

Cmde. S.S. LAL
Dr. K.V. BHASKARA SARMA
Sri YVN CHANDRA SEKHAR
Sri M SURYA PRAKASH RAJU
Sri S VEERESH
Sri RANGA NAGENDRABABU
Sri Y. MALLIKARJUN
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Sri M. RAMBABU
Sri T. VENKATA RATNAM

Dr. OM PRAKASH SHRIVASTAV
Sri P. SATISH KUMAR REDDY
Sri B. RAGHU KUMAR
Sri Y. V. HANUMANTHA RAO
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Sri R. B. CHOWDARY
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Sri K. V. G. RAO
Sri M. BABURAO
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Sri G. DIWAKAR
Sri VENIGALLA NAGESWARA RAO

Sri K. RAMA KOTAIAH
Sri V. RADHA KRISHNA

Reference Books

Reference books in the upcoming months :

- **Effective Maintenance Management: Risk and Reliability Strategies for Optimizing Performance By V. Narayan; ISBN 0831131780**
  This book has the depth and content to really help maintenance organizations change and improve reliability. Addresses the philosophical question of why we need to do maintenance and what is the value added by doing it.
- **Fundamentals of Preventive Maintenance By John M. Gross; ISBN-13: 9780814407363**
  This book provides readers with an easy-to-follow, economically sensible maintenance and workorder management program. This results-driven guidebook outlines a 7-step process for designing and implementing the program.
- **Predictive Maintenance Of Pumps Using Condition Monitoring By Raymond Beebe; ISBN-13: 978-1-85617-408-4**
  This book shows how condition monitoring can be applied to detect internal degradation in pumps so that appropriate maintenance can be decided upon based on actual condition rather than arbitrary time scales.

All feed back, comments and contribution to the news letter are most Welcome.
- Editor

If undelivered please return to:
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Naval Science & Technological Laboratory,
Visakhapatnam – 530 027, INDIA

To,