MONITOR

A Publication of Condition Monitoring Society of India

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From President's Desk...

Make Indian Industry less maintenance intensive !!

Greetings! It is time to think about our maintenance strategies we are following for machines, vehicles and structures. As always, economics of industry drives the maintenance programs and "cost saving" is the key. Major drivers for industrial productivity in today's highly competitive market is Condition Monitoring. This is precisely where we need to imbibe new strategies in our maintenance approaches.

Computerised maintenance monitoring systems are changing the approach of maintenance engineers. Embedded sensor technology is being used in monitorng machine tool performance. World is moving towards proactive maintenance strategies. Proactive maintenances targets root causes of machine wear and failure. In fact this actually aims at pinpointing and eliminating a likely fault long before even symptoms occur. It obviously extends life of equipments.

I am sure with the increasing awareness and continuous improvement; our maintenance engineers will adopt these new trends into their daily practice and ensure larger savings for our Nation. Let's be proactive in pursuing this dream of making Indian Industry less maintenance intensive!!

-- Dr. V. BHUJANGA RAO

Main Features of this Issue…

Announcement: NCCM-2014

CMSI is glad to announce that Combat Vehicle Research & Development Establishment (CVRDE), Chennai has accepted to host Fifth **National Conference on Condition Monitoring (NCCM-2014).** Further details will be announced shortly.

MAINTENANCE PLAN ?!

Web Resource: www.dilbert.com

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

SCREW COMPRESSOR FAILURE IDENTIFICATION USING LOBE PASS FREQUENCY

A screw compressor is the best descried as a positive displacement volume reduction device. Its action is analogous to reciprocating compressor more than any of the other common compressor types. Rotary screw compressors tend to be compact and smooth running with low vibration. These screw pumps are mostly used for air conditioning systems in various marine platforms as part of stealth technologies.

The rotary screw compressor operates without the need for suction or discharge valves. It has the ability to automatically vary suction volume internally while reducing part load power consumption. Screw compressors provide a much wider operating range and lower maintenance costs than conventional reciprocating compressors. A typical screw compressor consists of male and female rotors mounted on bearings to fix their position in a rotor housing which holds the rotors in closely toleranced intersecting cylindrical bores. The rotors basic shape is a screw thread, with varying numbers of lobes on the male and female rotors. The driving device is generally connected to the male rotor with the male driving the female through an oil film as shown in Fig.1.

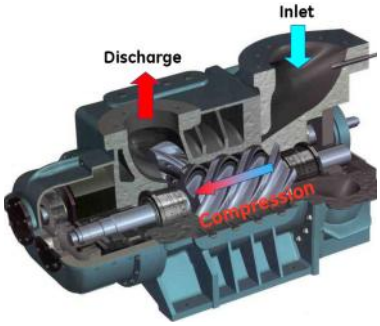

Fig. 1 Rotary Screw Compressor

Screw compressors are commonly used in a variety of process gas, refrigeration and natural gas applications, including individual wellhead boosters, low pressure gathering systems, low stage boosters to existing reciprocating machines, fuel gas compression, solution gas and vapour recovery compression systems.

In machinery vibration condition monitoring point of view, one of the characteristics of screw compressors, is that the dominant vibration signal will always be at lobe passing frequency (LPF) or its harmonics. LPF occurred when the dominant peak frequency matches with multiplied value of fundamental screw frequency and number of lobes of male/female rotor. When compressor runs at a fixed speed, fixed LPF and its Harmonics will be occurred. Whereas for variable speed compressor, LPF and its harmonics will vary with compressor operating speed.

The vibration signals generated by the early stages of bearing fatigue are a much lower amplitude and at higher frequency than lobe passing and its harmonics.

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Vibration spectrum for typical screw compressor is shown in Figure 2 below.

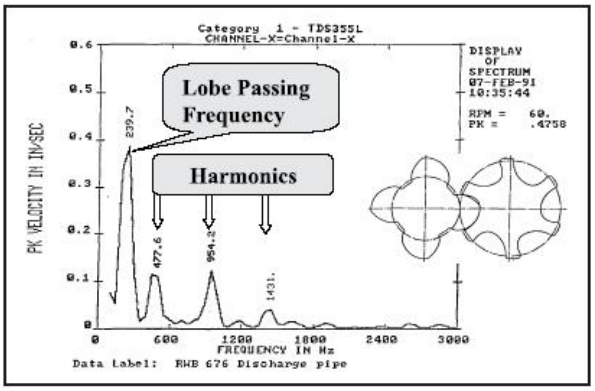

Fig. 2 Vibration Spectrum of Typical Screw Compressor

During condition monitoring of an AC Plant of a naval platform Vibrations measurements has been carried out. Vibration signature was measured on all bearings in vertical and horizontal directions. This plant consists of variable screw compressor and it operates from the speed 2500 rpm to 3000 rpm. Its male rotor has six numbers of lobes. Vibration data has been analysed and it was observed that the fundamental screw frequency of this compressor varies from 41.6 Hz to 50 Hz.

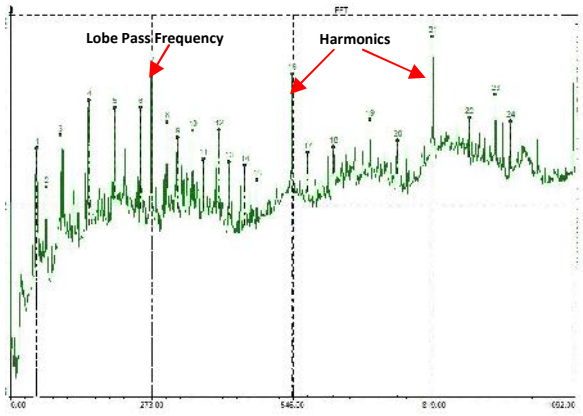

Fig. 3 Vibration Spectrum of Variable Screw Compressor

Narrow band analysis as shown in Fig. 3 reveals that predominant peaks occurred at a frequency of 272 Hz (fundamental screw frequency (45.3Hz) X number of screw lobes) and its harmonics (544Hz & 816Hz). This Lobe Pass Frequency (LPF) is due to the following reasons.

i. Eccentricity and unbalance of driven screw.
ii. Pitch error or damage/crack on driven screw lobes.
iii. Accumulation of foreign particles between screw lobes.
iv. Missing of contact between screw lobes.

This is a typical phenomenon of a screw compressor. By taking the necessary action for above causes, LPF and its harmonics in screw compressor can be minimized. Thus vibration signature can be minimised.

Contributed by:

Shri. D.T.V. Vara Prasad and Shri. K. Udayanand, Vibration Lab, NSTL, DRDO, Visakhapatnam.

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CM Awareness Training organized by CMSI-Jamshedpur Chapter for Small Scale Industries

On 04 December 2013, Condition Monitoring (CM) Awareness Training was jointly organized by CMSI- Jamshedpur Chapter with SKF India Ltd. & Technomec Solutions Pvt Ltd at ASIA (Adityapur Small Scale Industries Association) Hall, Adityapur, Jamshedpur. This awareness training was done exclusively for Small Scale Industries of the region. The welcome address was given by CMSI, Jamshedpur chapter Secretary Mr. G R P Singh of Tata Steel.

In the Key note address, role of condition monitoring in Maintenance was explained by Mr. B.K Das, Chairman CMSI, Jamshedpur Chapter and Dy. Vice President, Tata Steel. He urged Small Scale Industries to start implementation of condition monitoring activities in their plants and also assured them that in the long run it will prove to beneficial for their overall business. CMSI, Jamshedpur Chapter Jt. Secretary Mr. A. K. Paul who is also working with Tata Steel, made the participants understand various condition monitoring techniques and its application with practical examples and case studies.

From SKF India Ltd, Mr. Rahul Sah had took a lecture on SKF products & Services that help Condition Monitoring, increase in life of machineries and reduction in breakdowns. Mr. Sunil Bagrodia, Jt. Secretary, CMSI Jamshedpur Chapter and Director of Technomec Solutions Pvt Ltd. in the end thanked all the participants from various local industries viz Ramkrishna Forging, RSB Transmission, Metaldyne, BMC, Omni, Caparo, Highco, Sokhi Eng, Auto profile etc.

Mr. Bagrodia also thanked executives from CMSI, Tata steel and SKF for their active contributions for the programme.

NMAM Institute of Technology, Nitte , Karnataka Student CMSI Chapter Activities Report - 2013-14

The chapter was inaugurated on 01-02-2014 by Mr. Deepak Prabhakar, DGM (Mechanical), MRPL, Mangalore. Dr. Niranjan N.Chiplunkar, Principal, NMAMIT, Nitte presided over the function.

Mr. Grynal D'mello, Faculty, Dept. of Mechanical Engg., NMAMIT, Nitte delivered a technical lecture on "Reliability Centered Maintenance", on 15-03-2014.

Two Industrial visits were organized under the banner of CMSI Student Chapter – one was to (i) Manipal Power Press, (ii) Ganga Plastics and (iii) Rainbow Plastics at Manipal. The second was to (i) Bola Cashew Industries, Kedinje and (ii) Suzlon Wind Mill Manufacturing Industry at Padubidri.

NMAM Institute of Technology, Nitte , Karnataka have a total of 27 active student CMSI members during this academic year, which includes both UG and PG students.

Staff Coordinator: **Dr. Srinivasa Pai P**

Student Coordinator: **Mr. Austine D'Souza**

Highlights of National Conference on Condition Monitoring (NCCM-2013) held at GTRE, Bangalore

The Fourth National Conference on Condition Monitoring (NCCM-2013) was jointly organized by Gas Turbine Research Establishment (GTRE), Bangalore and Condition Monitoring Society of India (CMSI), Vishakhapatnam during 04-05 October 2013 at J.N. Tata Auditorium, Indian Institute of Science, Bangalore.

Dr. C. P. Ramanarayanan, Outstanding Scientist, Director. GTRE was the Chairman for this conference and Shri. PVS Ganesh Kumar, Scientist 'G', NSTL, Visakhapatnam was the co-chairman with Shri. Sanjay G. Barad, Scientist 'F', GTRE, Bangalore as the Convener.

The Conference was inaugurated by the Chief Guest, Dr. K. Tamilmani, Distinguished Scientist & Director General (Aeronautics), DRDO and Chief Executive, CEMILAC. Dr. D.N. Reddy, Chairman RAC, New Delhi and Shri. P. S. Subramanyam, Distinguished Scientist, PGD (CA), Director ADA, Bangalore were the Guests of Honor.

The Chief Guest mentioned during his address how CM has become a part of life. The importance of monitoring system for reducing the downtime was brought out. The importance of this CM in life extension program was also brought out specifically with the LRUs, engines, structures, etc. The extensive use of CM in enhancing the availability of the aircrafts was highlighted. He emphasized the economics of implementing these systems in aircraft. He also stressed the need for development of sensor technology and proving of these products in the real life environment.

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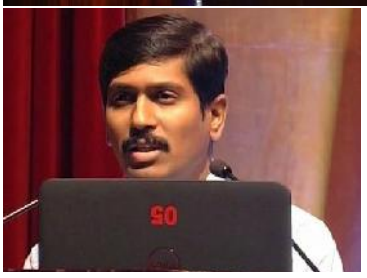
Some Highlights of NCCM-2013













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Some Glimpses of Dr. V. Bhujanga Rao Endowment Lecture: Delivered by Dr. Kota Harinarayana, Dr. DS Kothari DRDO Chair, ADA, Bangalore

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Highlights of NCCM-2013 held at GTRE, Bangalore ..Contd,.

Dr. V. Bhujanga Rao, Distiguished Scientist, Director General (Naval Systems & Materials) and Founder President of Condition Monitoring Society of India, gave a brief on activities undertaken by CMSI. He also mentioned about the various works that were in progress at various universities around the globe. He stressed the need for implementation of CM in industries and its advantages in minimizing the downtime. He also stressed upon the need to have more trained CM engineers in the country - the effort that CMSI is already making in realizing this goal.

Earlier, Dr. C. P. Ramanarayanan, OS, Director, GTRE & Chairman, NCCM-2013, welcomed the dignitaries and delegates from Industry, academia and various R&D orgnisations. In his welcome speech, he briefed about the importance of condition monitoring. He outlined that the event was intended to serve as a forum for integration of the knowledge and explore the potential of this specialized field of Condition Monitoring.

This year the theme of the conference was focused on condition monitoring of 'High Speed Turbomachinery'. A number of participants representing various sectors of the industry, the services, academic institutions, and students actively participated in the deliberations and presented papers on various topics such as 'Maintenance management', 'vibration monitoring', 'materials and structural health monitoring', 'infrared thermography', 'condition monitoring and diagnosis', 'motor current signature analysis methods and technologies', 'oil/wear debris analysis', 'ferrography', 'online/real time condition monitoring', 'expert systems', 'neural networks' , 'case studies in condition monitoring', 'maintenance management', 'Rotor Dynamics' and IVHM.

Over 332 participants attended the conference including delegates from industries, technical experts, academicians, scientists and students. The conference venue also had an exhibit display form leading companies in Condition Monitoring. This had given opportunity to these companies/ industries to showcase their products and expertise. There were also participants from companies that contributed generously for the conference. These were the Gold sponsors M/s Test Devices Inc, USA, M/s AneCom Aero Test, Germany, M/s RotaData, India and Silver sponsors M/s Dynaspede Integrated Systems Private Limited, Bangalore, M/s Ansys India, Bangalore, M/s Numeca India Software Private Limited, Bangalore, respectively.

The eminent professors and experts in condition monitoring field were present in the conference including Dr. Kota Harinarayan, Dr. DS Kothari Chair, DRDO, Dr. Don Davies, M/s Prosig Ltd, United Kingdom, RAdm. S. Nedunchezian NM, ACOM (D&R), IHQ (N), Dr. S. Guruprasad, Director, R & D engineer, Pune, Dr. Vinay B. Jammu, GE Global Research, Bangalore, and Prof. N. Vyas, IIT, Kanpur.

A cultural program was organized in the evening on 04 Oct 2013. It was based on the theme Baby's Cry – A poem on Condition Monitoring. The stunning performance by all the dancers and an enthralling live music made this event memorable.

Finally, Shri PVS Ganesh Kumar, Sc. 'G', NSTL & Secretary CMSI proposed the vote of thanks on behalf of the organizers. He stated that CMSI will undertake the lead in contributing to the IVHM program. He also mentioned that steps will be taken to improve the quality of papers that will bring about more understanding about physics of the phenomena.

Dr. Kota Harinarayana delivers Dr. V. Bhujanga Rao Endowment Lecture

'Third Dr. V. Bhujanga Rao Endowment Lecture' was delivered by Dr. Kota Harinarayana, Dr. DS Kotari DRDO Chair at ADA, Bangalore at GITAM University Campus on **06 February 2014**.

Dr. Kota Harinarayana, DRDO Scientist, program Director and Chief Designer of Light Combat Aircraft delivered the lecture at the GITAM University on **'Technology, Aviation and National Security'**, jointly organised by Mechanical Engineering Department and Condition Monitoring Society of India.

According to Dr. Kota Harinarayana, in US and European countries, the government and industry cooperate with each other to promote high tech industry because they consider technological superiority as well as broader economic security. He pointed out that the strategic thinkers, planners and all military forces recognized the importance of aviation sector and thought that a war is not winnable unless one has air superiority.

Dr. Harinarayana revealed that around 40 R&D labs, 100 industries and 25 academic institutions in the country were jointly working on Light Combat Aircraft (LCA) knowledge circuit to develop new technologies. The "Project Rustom-II" is a new initiation in aviation sector. He predicted that the future aircrafts are pilotless, self repairing and autonomous damage tolerant vehicles.

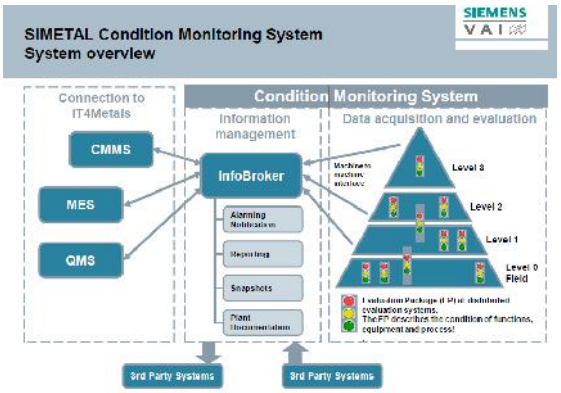
He also stressed that integrated vehicle health monitoring (IVHM) was extremely crucial as maintenance cost had turned out to be 10 times that of acquisition and around 30 per cent of the cost of operation. He said IVHM should be a national programme with academic institutes, R&D and industry coming together.

Distinguished Scientist and Director General (Naval Systems and Materials) Dr. V. Bhujanga Rao lauded the efforts of Dr. Harinarayana in developing LCA and said it would cost Rs. 120 crore to make and Rs. 200 crore if imported. He stressed that CM was crucial for any assets including dams and heritage buildings. It could ultimately lead to monitoring fifth generation aircraft onboard, online.

GITAM University Vice-Chancellor Prof. G. Subrahmanyam, Principal of GITAM Institute of Technology Prof. K. Lakshmi Prasad, Mechanical Engineering Development Head Dr. V Srinivas and others participated in the programme and felicitated Dr. V. Bhujanga Rao and Dr. Kota Harinarayana.

CMSI - Jamshedpur Chapter Activity - A Presentation on "SIMETAL Condition Monitoring System"

A presentation on "ON-LINE CONDITION MONITORING SYSTEM FOR MILLS" by M/s Siemens VAI was organized on 20th November 2013 inside Tata Steel premises. SIMETAL Condition Monitoring System is Integrative monitoring for mechanics, automation and processes. It includes monitoring of plant equipment, process and automation, detects deviations from the normal state in good time to plan the corrective measures and provides common platform for management, production, electrical and mechanical maintenance, technology and service providers.



Presentation was made by Mr. Arno Haschke – Product & Sales Manager – Simetal CMS for Siemens AG , Metal Technology, Germany and Mr. Jonathan Davis – CEO – The ITR Company, Bethlehem, PA, USA. The ITR Co. are the Service partners for Siemens Industry Inc., USA for Vibration Signature Analysis PdM Services. Presentation was attended by Maintenance Engineers of Wire Rod Mill, New Bar Mill and other Mills of Tata Steel.

CMSI Members in News

Dr. V. Bhujanga Rao, Director General (Naval Systems & Materials), DRDO, Visakhapatnam, and Founder President, CMSI received the prestigious Prof. S. Bhagavantham Award for the year 2013 for outstanding contributions and leadership provided in the field of Acoustics. The award was declared by Acoustical Society of India during the year 2013 for the years 2011-2012. He received the award from Dr. V.K. Saraswat, former Chief of DRDO.

CMSI congratulates him for this notable achievement and wishes him all the best in future endeavors!!

Prof. GSN Raju, Vice Chancellor, Andhra University received the prestigious MOTHR THERESA LIFE TIME ACHIEVEMENT AWARD - 2014 of Mother Theresa Organisation of Kolkata in recognition of his services to the academics and research. He received award from Chief Justice of Calcutta High Court and former Governor of West Bengal Justice Shyamal Sen. He received the award in recognition of his services to the academics and research.

CMSI Congratulates him for thisachievement and wishes him all the best for his future endeavors!!

Dr. K. TRINATH, Scientist 'G' (Retd.), Naval Science and Technological Laboratory (NSTL), Visakhapatnam and Life Member of CMSI was awarded Sir CV Raman Award by Acoustical Society of India (ASI). The award was given for best article contributed to the Journal of Acoustical Society of India for the year 2012.

CMSI Congratulates Dr. Trinath for getting the award and wishes him more laurels in his future endeavours.

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Condition Monitoring Society of India(C M S I)

Honorary Degree to President, CMSI

Dr. V. Bhujanga Rao, Distinguished Scientist and Director General (Naval Systems & Materials), and Founder President, CMSI was conferred with **Doctor of Science (Honoris Causa)** at 11th Convocation of **National Institute of Technology - Kurukshetra**, on 07 March 2014. The honour was bestowed for his exemplary leadership and pioneering work in the field of indigenous Defence R & D. Shri. A Sivathanu Pillai, Distinguished Scientist and CEO of Brahmos Aerospace Limited, gave away the award to Dr. V Bhujanga Rao.

CMSI congratulates him for this prestigious Doctor of Science (Honoris Causa) from National Institute of Technology - Kurukshetra and wishes him many more laurels in his future endeavors!!

CM Courses/Conferences around the Globe: Bearing maintenance technology – WE201

Course objective: Goal of this course is to provide the participants with the knowledge and practical skills to select the best bearings for applications. Learn world's best practice in bearing, fitting and dismounting from engineers using the correct fitting and removal tools and techniques. This will improve reliability of the rotating equipments. Course contents include Basics of bearings, Ball bearing types, Roller bearing types, Bearing selection criteria, Bearing life calculation, Selection of fits & tolerance, Bearing lubrication, Mounting & dismounting, Introduction to bearing failures and their causes, Bearing storage & handling, Maintenance tips, Brief review on spurious and reconditioned bearings.

Course schedule:

Date: **4-8 Aug, 2014, 15-18 Dec, 2014, and 3-5 Mar, 2015**

Location : **Pune**

For Further details: Website: www.skf.com (or) www.skfindia.com

CMSI Welcomes New Members!!

Life Members:

Cdr. D RAVI KUMAR (Retd.)
Mr. V. RAMESH BABU
Mr. BVSS KRISHNA KUMAR
Mr. B. BALENDRA KUMAR
Mr. AVINASH MAHESH TAWANI

Student Members:

123 Student Members from Andhra University, Visakhapatnam and

30 Members from NMAM Institute of Technology, NITTE, Karnataka

Editorial Board :

Dr. V. Bhujanga Rao
Dr. M. Ananda Rao
Sri. P.V.S. Ganesh Kumar
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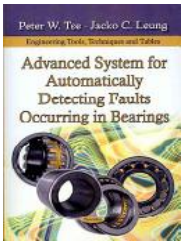
🕮 Reference Book 🕮

Advanced System for Automatically Detecting Faults Occurring in Bearings
by Peter W. Tse, Jacko C. Leung



Maintenance is essential in all kinds of machinery. In order to prevent long-term breakdown or catastrophic failure, faults should be detected at their incipient stage. Bearing faults are the most frequent cause of failures of machinery. Most of the faults occurring in bearings will introduce impact-like vibration signals when bearings are rotating.

Such impacts behave like damped oscillations and can be detected using accelerometers. This book introduces an automatic, effective but simpler-to-use system for bearing fault diagnosis so that the industry can use its equipment without the need of hiring experts.

Publisher: **Nova Science Publishers, Incorporated, 2010**

ISBN: **1617289531, 9781617289538**

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***

If undelivered please return to:

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All feedback, comments and contributions to the news letter are most welcome.

- Editor