MONITOR

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From President's Desk..

Greetings! Maintenance, Condition Monitoring, Fault diagnosis, Signal Processing, Vibration, Thermography, Oil analysis… Don't they all look so familiar to us? Day in and day out Condition Monitoring practitioners spend time in using these techniques/ tools for predicting the condition of engines, vehicles or structures so as to provide early warning of impending failures and suggest corrective actions in advance. So, don't you also think we all must keep ourselves abreast of latest happenings around the world in condition monitoring and associated domains?

I understand that future fault diagnosis would rely on research on various aspects such as fault mechanisms, feature extraction through signal processing, fault reasoning and condition monitoring equipment. Another significant concept in focus nowadays is IVHM (Integrated Health Management System). It is a strategy for prognostics that enables realtime assessment of vehicle health.Though it is currently employed mostly in aircrafts, its applications to marine and land vehicles are also seen recently. The potential of IVHM is high but there appears to be apprehensions in its adoption due to difficulty in assessing the tradeoff between its benefits and risks. The challenge lies in catching the opportunity that IVHM offers for life cycle management. I wish we all are ready to accept this challenge and adopt it in our defence and civilian applications. Looking forward to meet you all at NCCM-2014 for a healthy discussion on condition monitoring!

-- Dr. V. Bhujanga Rao

Main Features of this Issue…

National Conference on Condition Monitoring (NCCM-2014)

As a part of CMSI's endeavor to bring out the growing importance and recent trends in condition monitoring, a two day **National Conference on Condition Monitoring (NCCM-2014)** is being organized in association with **Combat Vehicles Research and Development Establishment (CVRDE),** Chennai during **December 18-20, 2014** with an emphasis on Vehicle Health Monitoring application.

The conference provides a common platform for interaction on the state of the art technology on condition monitoring strategies. This would immensely benefit the maintenance engineers, R&D Professionals, academicians and students. NCCM – 2014 received a good number of technical papers related to various disciplines on Condition Monitoring of Machines & Structural Health Monitoring. A large number of experts/ practicing engineers from various organization, institutes and industries attended the earlier conferences conducted by CMSI. In view of the importance and potential benefits of proactive philosophy to be discussed during the conference, it is requested to register personnel from your maintenance department to participate in the Conference.

Excessive Vibration of Condensate Extraction Pump - A case study

A condensate extraction pump (CXP) is an important part of a feed water system. Generally, fitted in between the condenser and de-aerator, the extraction pump works as an excellent tool for generating the requisite pressure, to deliver the feed water from a condenser under vacuum to de-aerator or a feed pump inlet. Condensate extraction pump as shown in Fig. 1 is usually a vertical shaft, two stage, centrifugal pump, which is used in applications involving high pressure and high volume. Almost all the feed systems having an extraction pump use a condensate level controller system, which is attached to the condenser to maintain the amount of condensate in the condenser and to provide the sufficient suction head.

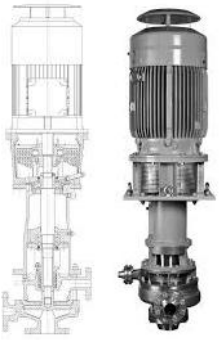

Fig.1

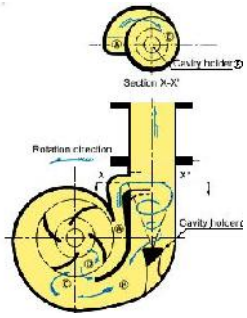

Fig. 2

A condensate centrifugal pump consists of three main parts - impeller, diffuser and diffuser casing as shown in Fig. 2. The CXP with impeller/diffuser reported high vibration levels at pump side. Vibration measurements were carried out on bearings of motor and pump and observed high vibration levels at pump side. The CXP consists of nine number of impeller vanes and is running at 1500 RPM (25Hz). The vibration spectrum as shown in Fig. 3, depicts SRF and its harmonics predominantly at Vane Pass Frequency (VPF) and its harmonics

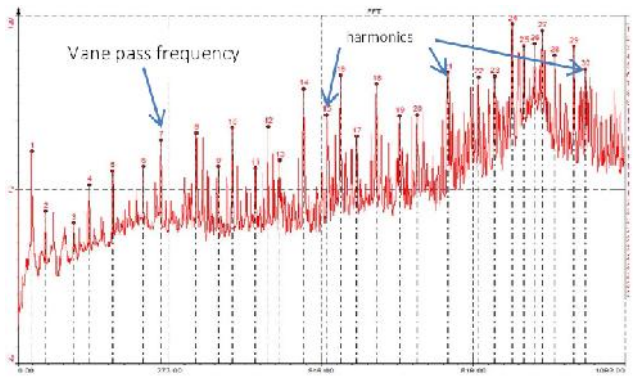

Fig. 3

The frequency of vane pass fluctuations (VPF) is equal to the pump rotor rotational speed, n, multiplied by the impeller vane number, z_1, and harmonics of n (1, 2, 3, etc.) thereof., i.e., $f_{vp} = n\, z_1\, (N/60)$.

Contd.,

Therefore, these VPFs are occurring at 225Hz and its harmonics 550Hz, 775Hz and 1100Hz. Normally the wake flow at the impeller outlet is the strongest source of pressure pulsations in a centrifugal pump. Pressure fluctuations at rotational frequency are generated by circumferential irregularities in the hydraulic passages of the impeller and other deviations from rotational symmetry, and result in an effect normally referred to as 'hydraulic unbalance.''

Both broad band and discrete frequency pressure pulsations are intricately related to the specific hydraulic design of the pumps inlet, impeller, and stator, and the flow distributions throughout resulting from pump operation. The vane pass pressure pulsations are mainly due to the speed of the Impeller and radial gap between impeller and diffuser. Influence of rotational speed is one of the reasons for vane pass pressure fluctuation. The fluid wake represents a deficit is the relative velocity within the rotation speed. The variation in pressure caused by the wake at the diffuser depends upon the velocity of the impeller. It can be represented as follows.

$$\Delta P_d = 0.75\, \rho/2\, u_2^2$$

Therefore high speed pump have a higher potential for high pressure pulsation. The radial gap between the impeller vane outer diameter and the diffuser is considered to be the most important design parameter that affects the pressure pulsation at vane passing frequency. An impeller relation is shown below is which pressure pulsation decrease with a power of -0.77 of the radial gap between impeller and diffuser.

$$\Delta p^* \approx [(D_3/D_2)-1]^{-0.77}$$

Where Δp^* is the dimensionless pressure fluctuation for the pump suction and discharge.

$$\Delta p^* = 2\Delta p/\rho u_2^2$$

Therefore, the VPF of CXP can be avoided by maintaining the proper speed of impeller and proper radial gap between diffuser and impeller vane outer diameter.

K. UDAYANAND, Sc.'C' and M.V. RAO, STA 'B', NSTL, DRDO, Visakhapatnam.

TERMINOLOGY: Rotating Stall

Rotating stall is one of the **flow-induced vibrations** that can occur in fans and compressors. Rotating stall is a flow separation of the fluid from the blades under certain low-flow conditions. Rotating stall sometimes occur in a system with a partially closed inlet damper. The condition usually appears as a low sub-synchronous frequency component in the rotor vibration spectrum (frequency ratios are typically between 8 and 40%, but can be as high as 80% of the rotational speed). From a diagnostics point of view, rotating stall differs from the other whirl category instabilities due to its strong dependence on the *operating conditions*.

Contd.,

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Workshop on "Recent Developments in Condition Monitoring and Maintenance of Machinery" at NMAM Institute of Technology, NITTE,, KARNATAKA

The Department of Mechanical Engineering, **NMAM Institute of Technology, NITTE,, KARNATAKA** and CMSI, Vishakapatnam Chapter organized a Three Day Workshop on **"Recent Developments in Condition Monitoring and Maintenance of Machinery**" during **June 5-7, 2014,** sponsored by TEQIP Phase II. The inauguration was held on 05-06-2014 at 9.30 AM in the department seminar hall. Dr. K.V.Gangadharan, Professor, Dept. of Mechanical Engg., NITK Surathkal inaugurated the workshop and gave a keynote lecture on condition monitoring with practical demonstartion of simple concepts related to the theme of the workshop. Dr. K. Subrahmanya Bhat, Head, Dept. of Mechanical Engg., welcomed the gathering. Dr. P. Srinivasa Pai, Coordinator of the workshop gave an overview and Mr. Kumar H S, another coordinator, introduced the chief guest. Dr. Niranjan N. Chiplunkar, Principal presided over the function. About 30 participants from within and outside Karnataka participated in the workshop.

Dr. K.P. Ramachandran, Associate Dean (PG Studies & Research), Caledonian College of Engg., Sultanate of Oman, Muscat who is an expert in the field of condition monitoring gave lecture on Fundamentals of Condition Monitoring, Vibration Monitoring and Signal Processing and techniques. Dr. Vijay G. S., Associate Professor, Dept. of Mechanical and Manufacturing Engg., MIT, Manipal delivered a talk on Condition Monitoring of Bearings and Gear. Mr. Santhosh C. of AIMIL Limited, Bangalore presented a talk on Latest developments in Instrumentation used in Condition Monitoring on the second day.

On the final day, two well known resource persons from the industry, Mr. Deepak Prabhakar, DGM, Mechanical Maintenance and Mr. Arun Kulkarni, Senior Manager, Mechanical Maintenance, MRPL Mangalore, presented talk on Reliability Centred Maintenance and Latest Condition Monitoring techniques used in the Petrochemical Industry. The valedictory function of the workshop included distribution of certificates to the participants by Principal Dr. Niranjan N. Chiplunkar.

TECHNOLOGY MEET ORGANIZED BY CMSI JAMSHEDPUR CHAPTER, SKF & TECHNOMEC SOLUTIONS PVT. LTD.

Technology Meet was organized jointly by CMSI, Jamshedpur Chapter, SKF and Technomec Solution Pvt. Ltd. On 12th September, 2014 at Hotel Alcor, Jamshedpur from 6:30 pm onward.

Welcome Address was given by Mr. Sunil Bagrodia from Technomec Solutions Pvt. Ltd. Who is also Joint Secretary of CMSI, Jamshedpur Chapter.

Program was inaugurated by Vice Chairman, CMSI Jamshedpur Chapter and Chief of Mechanical Maintenance, Tata Steel, Mr. ProbalGhosh. He spoke about importance of Condition Monitoring in Maintenance of Plant Equipment and Condition Monitoring Services being provided by SKF.

Mr. G.R.P. Singh, Secretary, CMSI Jamshedpur Chapter, spoke about activities of CMSI, Jamshedpur Chapter.
Team from SKF made presentation on following.

- SKF New Generation Bearing
- SKF Sealing Solutions
- Increased Machine Reliability using SKF Condition Monitoring Techniques.

Around 200 people representing various companies from Jamshedpur like Tata Steel, Tata Motors, Tata Power, Tata Tinplate, Tata BlueScope, Usha Martin. etc. attended the meet.

Rotating Stall (Contd..)

Normally, correcting the operating flow makes it disappear. It differs from surge because it is proportional to the running speed of the fan or compressor. Surging is in the axial direction, which is not the case with rotating stall. Rotating stall manifests in the rotor vibration spectrum with sub-synchronous frequencies, which tracks the rotor speed. The orbit will have a forward precession.

In pumps, flow turbulence induces vortices and wakes in the clearance space between the impeller vane tips and the diffuser or volute lips. Dynamic pressure fluctuations or pulsation produced in this way can result in shaft vibrations because the pressure pulses impinge on the impeller.

Text Source: Practical Machinery Vibration Analysis and Predictive Maintenance by Paresh Girdhar

A Technical Talk on "Condition Monitoring and Diagnostics for Industrial Machinery" by Shri. RVS KRISHNA DUTT, GM, BHEL (R&D), Hyderabad

CMSI Executive Committee met on 12 July 2014 at Hotel Green Park, Visakhapatnam followed by a Technical talk on "Condition Monitoring and Diagnostics for Industrial Machinery" by Shri. RVS KRISHNA DUTT, GM, BHER (R&D), Hyderabad.

At the Outset, Dr. V Bhujanga Rao, President, CMSI, welcomed all the EC Members for the meeting and requested General Secretary to proceed with agenda. Mr. PVS Ganesh Kumar, General Secretary presented annual report. A Proposal for next Conference were sought by the members and Dr. K Ramji, treasurer expressed willingness to take up NCCM-2015 at Andhra University, Visakhapatnam. The Committee authorized president to finalize the venue giving due weightage for places that have not conducted NCCM so far. In the forth coming conferences, a Best paper award proposal was proposed and discussed. In principle, the committee agreed with the proposal. However, it was opined by Dr. Edwin Vijaya Kumar, Joint secretary that the award may be given in three categories. The committee deliberated and authorized president to take appropriate decision in this regard. Dr. K Ramji Suggested a chair for Condition Monitoring be created at Andhra University. As this involves financial implication, President said that this is to be examined carefully before taking any decision. Mr. B K Das of Tatasteel Suggested that one day workshop at any one of the non-active local centres be planned to rejuvenate such local centers and the proposal was unanimously accepted. Dr. K Ramji suggested that guest lectures by resource persons be arranged for student chapter of CMSI at Andhra University to motivate students and the suggestion was accepted. Dr. Edwin Vijay Kumar Suggested that the list of resource persons be made available on CMSI's website so that any agencies interested in organizing events on CM can utilize the same. The suggestion was accepted. Mr. PVS Ganesh Kumar, General Secretary requested all the members to contribute case studies/technical articles for News letter "Monitor". As there are no other points, the meeting ended with thanks to the Chair.

Bio - Data of Shri. RVS Krishna Dutt

Mr. Krishna Dutt holds a Bachelor of Electrical Engineer, MS Degree in Applied Mechanics and another M. Tech degree in Computer Science & Engineering. He is exactly pursuing Doctorate degree in Applied Computing. He joined BHEL as engineer in the year 1977 and worked at Bhopal from 6 years unit where he is involved in designing & tests large rotating electrical machines. Subsequently he moved to lab R&D at Hyderabad. Where in he worked on interdisciplinary problems involving applied image processing, vibration signal processing, past plant process optimization. He also worked on torsion of composite rectangular detector with analytical & FE approaches. He has both national & international publications. He is currently directly development projects in the areas of design high speed compressing, pumps for nuclear process plant, Data validation and Acoustics & Noise suppression techniques. He needs Turbo machinery, Head Transfer, applied FE, Robotics and Fuel cell department. Ha also heads project management group.

CMSI MEMBERS ACHIEVEMENTS

Mr. Binod Kumar Das, Dy. VIce President Coke Sinter & Iron, Tata Steel and Founder chairman of Condition Monitoring Society of India, Jamshedpur Chapter was redesignated as Vice President Coke Sinter & Iron, Tata Steel from 1st April, 2014.

CMSI Congratulations Mr. Binod Kumar Das for being elevated to Vice President, Coke, Sinter and Iron plant, Tata Steel, Jamshedpur and wishes him more promotions in his future endeavours !!

PRODUCT NEWS

PlantProtech™ 720 Advanced Plant Monitor

The PlantProtech 720 is an advanced plant monitor provides a powerful and versatile automated surveillance system for all strategic plant items where regular monitoring is required. It is Designed For Cooling water pumps, Emergency boiler feed pumps, Wind turbines, Hydro turbines, Cooling tower fans, Industrial gas turbines.

The Key Features are a cost-effective alternative to "walk-around" periodic monitoring solutions, Routine surveillance of critical plant items, 16 channels for vibration and process data, 4 speed inputs, Autonomous internal data storage, Local display of real-time vibration levels via LCD display, Local alarm traffic light display and readout, Stand-alone and network operation, and Open interface for implementation with other third party applications.

For further details visit: http://www.beraninstruments.com

CMSI MEMBERS ACHIEVEMENTS

Prof (Dr) K.Venkatasubbaiah, FIE, Department of Mechanical Engineering, Andhra University is being conferred with prestigeous **Bharat Ratna Sir Mokshagundam Visvesvaraya Award** constituted by **Government of Andhra Pradesh** and **The Institution of Engineers (India), A P State Centre.** on the occasion of 47th Engineers day celebrations held at Hyderabad on 15-09-2014. He had received this Award from the **Chief Guest, Shri Konda Vishweshwar Reddy, Hon'ble Member of Parliament,** Chevella Constituency, R R District.

CMSI Congratulates **Prof (Dr) K.Venkatasubbaiah** for getting the award and wishes him more laurels in his future endeavours.

Mr. Hemant M. Bari, Senior Manager, MTP Dept, Condition Monitoring Cell, Reliance Infrastructure, Dahanu Thermal Power Station, Mumbai published TWO technical papers at International Conferences in September 2014 given below:

"Availability Improvement by Early Detection of Motor Bearing Failure (CONV. 4B) using Comprehensive Condition Monitoring Techniques at DTPS", *published at VETOMAC X - Condition Monitoring International Conference during 9 - 11 September 2014, Manchester, UK.*

"Asset Management Through Life Cycle Analysis By Philosophy Change In Condition Monitoring Techniques At DTPS ", *published at COMADEM 2014 - Condition Monitoring International Conference during 16 - 18 September 2014, Brisbane Convention & Exhibition Centre, Australia.*

CMSI Congratulates **Mr. Hemant M. Bari** for publishing papers at international fora and wishes him many more such contributions in his future endeavours.

Any achievements of our life members, Institutional members and local chapters may please be informed through our email: cmsi.hq@gmail.com to publish in our news letter 'MONITOR'

Condition Monitoring Society of India(C M S I)

CMSI Member in News

Dr. V Bhujanga Rao, President, CMSI and Distinguished Scientist & Director General (NS&M), was conferred with **Doctor of Science (Honoris Causa)** at First Convocation of **Vikrama Simhapuri University, Government of Andhra Pradesh, Nellore** on 09 June 2014.

CMSI Congratulates **Dr. V. Bhujanga Rao** for getting the prestigious Doctor of Science award and wishes him more laurels in his future endeavours.

** CM Conferences around the Globe ** Quantitative InfraRed Thermography (QIRT-Asia 2015)

QIRT-Asia 2015 Conference will take place during **July 6-10, 2015,** Mahabalipuram, (near Chennai) India. QIRT-Asia 2015 conference is a biannual international forum which brings together specialists from industry and academia, who share an active interest in the latest developments of science, experimental practices and instrumentation, related to IR thermography.

Important Dates: Abstract submission deadline: **December 20, 2014,** Acceptance notification: **February 28, 2015**
Paper submission deadline: **April 30, 2015**
For further details, visit website : http://www.qirtasia2015.com

CMSI Welcomes New Members!!

Life Members:

Dr. SANJAY HARI SAWANT
Mr. B VASANTHAN
Mr. K. SATYANARAYANA
Mr. K. VISWANATHAN

Student Annual Members:

41 Student Annual Members Enrolled from NMAM Institute of Technology, Nitte, Karnataka.

🕮 Reference Book 🕮

Recent Trends in the Condition Monitoring of Transformers: Theory, Implementation and Analysis (Power Systems) by **Sivaji Chakravorti, Debangshu Dey** and **Biswendu Chatterjee**

The Text book reflects the current interest in replacing traditional techniques used in power transformer condition monitoring with non-invasive measures such as polarization/ depolarization current measurement, recovery voltage measurement, frequency domain spectroscopy and frequency response analysis.

The book also stresses the importance of scrutinizing the condition of transformer insulation which may fail under present day conditions of intensive use with the resulting degradation of dielectric properties causing functional failure of the transformer. The text shows the reader how to overcome the key challenges facing today's maintenance policies, namely, the selection of appropriate techniques for dealing with each type of failure process accounting for the needs of plant owners, plant users and wider society; and cost-efficiency and durability of effect.

Hardcover: 280 pages
Publisher: Springer; 2013 edition
ISBN-10: 1447155491, **ISBN-13:** 978-1447155492

If undelivered please return to:

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

- Editor