



CMVA | **ACVM**
 Canadian Machinery
 Vibration Association | L'Association Canadienne
 en Vibrations de Machines

ViBs

CMVA MEMBERS' NEWSLETTER

DECEMBER 2015
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IN THIS EDITION

News

By ANDY WOODCOCK



I am happy to announce that the CMVA Annual Conference in Halifax was a great success. There have been many positive comments including the quality

of the presentations, the venue, the social evening at Alexander Keith's Brewery and the Tradeshow. The next annual conference is being held at the end of October in Toronto...more details to follow in our next newsletter.

We also held the annual election and I am proud to present our 2015-2016 Board of Directors :

Colin Ostergard (Alberta Chapter)
 President

Chieu Chau (Ontario Chapter)
 Vice President and Chair – Technical / Training

Lloyd Appelt (Alberta Chapter)
 Secretary

Andy Woodcock (Ontario Chapter)
 Executive Director and Treasurer

Behzad Alavi (Ontario Chapter)
 Mentor and Chair – Development

Matthew Holmes (Atlantic Chapter)
 Chair – ISO Accreditation

Patrice Huard (Quebec Chapter)
 Chair – ViBs Newsletter

Louis Lavallée (Quebec Chapter)
 Chair – Membership Committee

Jesse Lapaire (Atlantic Chapter)
 Newsletter Committee

John French (British Columbia Chapter)
 British Columbia Liaison

Sandy Smallwood (Alberta Chapter)
 Alberta Liaison

François Lafleur (Quebec Chapter)
 Quebec Liaison

Joe P. Koncovy (Atlantic Chapter)
 Atlantic Liaison

The Board of Directors welcomes the new directors and addresses warm thanks for their support to Greg Poirier, Wesley Albert and John Halley, who left the national BoD this year.

ATTENDING CMVA MEETING DOES PAY DOWN THE LINE

Your CMVA chapter executives are setting up some interesting and relevant chapter meetings for you. Please try to attend. It is not only an occasion to meet fellow PdM analysts but to learn from case studies and from mini-training courses. In addition, your attendance at chapter meetings and at national level allows you to earn points for renewing your certification. Please refer to page 6 of this ViBs edition for further information.

CMVA ON LINKEDIN

Did you know that the CMVA has its own LinkedIn Group? It is some 1670 member strong. If you want to share a case study or want assistance or advice on a predictive maintenance project on a forum basis... join the group and submit your "discussion". This link is meant to handle technical issues only and any marketing or sales discussion will not be posted.

www.linkedin.com/groups/3674203

WEBSITE

The CMVA will proceed with the redesign of its website in 2016 to better meet the needs of its members and its website users. We believe that the opinion of our members is essential in this process of reform, which is why we will submit a short online survey. You will soon receive by email, if not already done, a link to reach it. Feel free to use the fields provided for your comments. Any idea is good to receive.

The deadline to complete the survey is December 21 at midnight. Many thanks for your cooperation! ◀

| | |
|--------------------------------------|----------|
| News..... | 1 |
| MEETING WITH | |
| Dr. Andrew K.S. Jardine | 2 |
| From the Chapters..... | 4 |
| 2016 Membership..... | 5 |
| Tech Talk..... | 6 |
| Renewing your certification | 6 |
| In the lens | 7 |

From the CMVA Team

*Merry Christmas
 and
 Happy New Year!*

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www.linkedin.com/groups/3674203

MEETING WITH Dr. Andrew K.S. Jardine

Interview conducted by PATRICE HUARD

Dr. Andrew K.S. Jardine is a prolific researcher and advocate of advances in maintenance decision-making and reliability engineering. His views are sought after by industry, he has published numerous books and papers, and he presents his work at professional seminars and conferences worldwide.¹ During the 2015 CMVA Annual Conference, Dr Jardine kindly accepted to answer a few questions for ViBs Newsletter.

Among all the C-MORE publications, which one should every maintenance manager read to perform optimal maintenance?

I suggest the second edition of a book I co-authored with Albert H.C. Tsang. *Maintenance, Replacement, and Reliability: Theory and Applications* (CRC Press 2013). In the book, Albert and I tried to supply the tools needed to make data-driven physical asset management decisions. It's not that I'm trying to sell books. Rather, I regularly hand out this book at my Physical Asset Management courses – it has been universally well received with many positive comments, so I know it works.

What is the role of Condition-Based Maintenance in strategies such as Reactive or Preventive Maintenance?

Simply stated, reactive maintenance is performed when something breaks down. Preventive maintenance generally occurs at regular intervals, to reduce the frequency of breakdowns. However, if the equipment is expensive, it would be economically justifiable to undertake condition-based maintenance by monitoring its health by, for example, vibration analysis. Through this condition monitoring (CM), it becomes possible to intervene preventively with an appropriate maintenance action before failure, thereby reducing failures and increasing the item's useful life, since in this case preventive maintenance is not performed prematurely.

According to C-MORE, Condition-Based Maintenance is applied on expensive long-life assets, how do you determine accurately the long-life assets?

Condition based maintenance (CBM) can be applied to equipment with a "short life" or a "long life." For long-life assets where maintenance is performed at intervals measured in years, rather than weeks or months, then the time-value of money needs to be considered. Regardless of life length, if failures are costly equipment

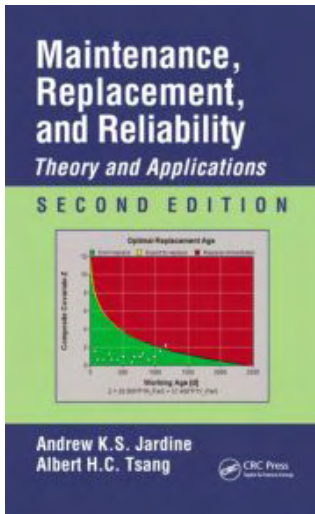
health should be monitored by some form of CM to track the condition of the various failure modes that might cause it to fail. Equipment frequently subject to CM are gearboxes, transmissions, engines and bearings. But expensive long-life assets such as station transformers are also subject to CM, including, for example, Dissolved Gas Analysis.

Two issues have been identified by the C-MORE with Condition-Based Maintenance: diagnostic of an asset's health and providing a prognosis of the remaining useful life. How would you qualify the vibration analysis in its capacity to provide information for the asset's health and remaining useful life?

At C-MORE we have developed mathematical/statistical models that enable the key CM measurements associated with failure to be identified for any form



Dr. Andrew K.S. Jardine
Photo: Courtesy



of CM. For example, in a study of Goulds 3175L pumps when vibration measurements were taken on pump bearings, our approach found only two measurements were highly correlated with bearing failure. One of our approaches includes the costs associated with preventive maintenance and the cost consequence associated with maintenance after a failure; the goal is to undertake preventive

replacement such that the cost per time unit in the long run is minimized. When CM takes place, we can forecast the time until the optimum preventive replacement time is reached. That duration can be thought of as the remaining useful life (RUL). A second possibility is to estimate the time from any inspection to when the equipment will reach a defined failed state. This is another interpretation of the RUL. I might add that vibration analysis appears to be the cheapest and one of the most effective methods for assessment of an asset's health, especially for rotating equipment; it is well rooted in mathematical theory and advanced information technology.

With all the modern diagnostic tools, how difficult it is to obtain an accurate prognostic of the remaining life?

We can provide a good estimate of the conditional probability density function at inspection, given appropriate CM measurements. While easy to estimate the mean of the distribution, which can be thought of as the RUL, there is usually a large variance associated with the distribution, so it is not an easy task to give an accurate estimate of the actual RUL. It would be more appropriate to estimate the probability of surviving some interval of time in the future.

The C-MORE approach uses economic considerations combined with hazard estimation to establish an optimal Condition Based Maintenance decision. What are the typical economic considerations or information used in the hazard estimation?

Our approach uses a hazard model that includes the key CM measurements correlated with failure, blending it with economic considerations to identify the hazard level such that the cost per unit time in the long run is minimized or, alternatively, availability is maximized. The hazard defines the time at which maintenance should take place. The key measurements in the hazard model are identified using an approach similar to multiple regression analysis; the model analyses all the CM measurements and associated events such as the life of the equipment between installation and removal, minor and major maintenance actions, reasons for removal, etc. The costs are based on all costs associated with maintenance actions, and actions at failure, such as parts cost, labour cost, outage cost etc.

In conclusion, let me say that if any reader of the newsletter wishes clarification of any point I have made or is looking for further elaboration, I'd be pleased to help. «

Regardless of life length, if failures are costly, equipment health should be monitored by some form of CM to track the condition of the various failure modes that might cause it to fail.

¹ Source: www.mie.utoronto.ca/faculty/profile.php?id=59.

FROM THE Chapters

Ontario Chapter By MERVYN CHOY

Motor Workshop & Annual Technical Conference

After successfully offering the 2-day fan workshop and Chapter Annual Technical conference in 2014, the Ontario CMVA chapter held a similar 2-day workshop + Chapter Annual Technical conference on May 26 and 27 at the Mississauga Grand Conference Centre.

On May 26, the Ontario CMVA chapter hosted a motor workshop, presented by Howard Penrose, Ph. D. The workshop discussed various diagnostic techniques and failure indicators for various types of electric motors. The workshop drew approximately 20 attendees (members and non-members).

On May 27, the Ontario CMVA chapter followed the Motor Workshop with its Annual Technical Conference which included elections for the 2015-2016 Chapter Executive. The Chapter Annual Technical Conference featured 6 technical presentations. ◀▶



Ontario Annual Technical Conference & Chapter Executive Election From Left to Right: **Mervyn Choy** (Incoming VP), **Vern Martin** (Incoming President), **Grant Akitt** (Incoming Mentor [outgoing President]), **Liane Harris** (Incoming Treasurer), **Chris Hugh** (Past President), **Joanna Rice McVicar** (Outgoing Treasurer). - Image: © Ontario Chapter

Quebec Chapter By PATRICE HUARD

The Quebec chapter held an executive meeting in Montreal on December 3rd. This meeting was a wrap-up of the 2015 year and we planned ahead for the coming year. Josée St-Laurent, member of the Quebec Chapter Executive Committee since 2008, announced she will not renew her mandate in 2016. We warmly thank her for all the excellent work done. ◀▶

Alberta Chapter By GREG POIRIER

CAT II and CAT III Certification Testing

On March 12, 2015, testers came prepared as per Andy's instructions, laptop, etc. Thanks to Andy and our proctor Vahid, for helping to get to appropriate links.

Meeting with ASME

We spent an hour and a half with ASME (American Society of Mechanical Engineers) friends by Chapter Vice President Greg Poirier: Recognizing Qiao Sun Ph.D., P.Eng, the Mechanical Engineering team and the U of C for providing an excellent venue to host our CMVA/ASME joint event. Qiao Sun presented visitors with safety details of this university building. Thank you to ASME Southern Alberta Chapter President Theo Freiheit Ph.D., P.Eng and members for joining us that day and also for sponsoring this event.

Chapter Business

With AB Chapter's new 2015 \$500 sponsorship for a student traveling to the annual National AGM to present their research, a suggestion was made for National to wave the conference fee for that student.

Request for papers of people sharing what technologies work for them with examples.

Request for CMVA website to list specific books & materials to guides one working towards each level of certification with clearly identified performance objectives.

Market need to find links to common, clear communication between analysts, engineers and managers. How does diagnostics, signatures, time wave form, synchronous time averaging, enveloping, etc. support and help managers make sound business decisions?

Encourage all Prairie students to apply for the \$1000 AB Chapter Bursary on website.

AGM Chapter Meeting

The AB held its AGM Meeting and Certification on Thursday, October 22, 2015 Sherwood Park AB. President Howard MacPherson opened the AGM with safety awareness. The membership number was 128 in the Alberta Chapter and 544 nationally. AB President Howard MacPherson congratulated Andrei Dragos of the University of Calgary as our 2015 \$1000 Bursary winner. Election results were:

Mentor: William Eckert

President: Howard MacPherson

Vice President and Secretary: Greg Poirier

Treasurer: Jacob Wiebenga

Technical Director: Qiao Sun

Technical co-Director: Scott Lylander

Membership Chair: Stanislav Kryzhenovskiy

A great PowerPoint presentation of National update & next AGM in Halifax was presented by Colin Ostergard, National President of CMVA. We also had a very informative Balancing mini-course by Rick Dusener. ◀▶



As a current member

you are not only receiving this newsletter but you also have access to the Vibration Institute **Vibration Magazine** on our web site **www.cmva.com**.

To access, log into your profile, click on «Members Only» tag across the top, then click on the **VI Vibrations Magazine** link

2016 Membership

Your 2015 membership is about to expire on December 31st and it's definitely time for renewal. And it's as easy as can be !

Login to your profile on www.cmva.com, click on the JOIN/RENEW /CHANGE tab, click on the PURCHASE OR RENEW MEMBERSHIP ONLINE link and follow the prompts.

If you are certified, membership is a must

It is mostly important that your membership is up to date. Why is that? **Since 2014, active membership is required for a valid membership.**

Membership brings a wealth of benefits

- Certification validation
- Access to the chapter meetings and attendance at lectures to various topics
- Opportunity to exchange between vibrations professionals
- Opportunity to serve on the Executive Committee of your provincial chapter and at national level
- Access to quality technical presentations and documentation that will enrich your knowledge
- Subscription to ViBs newsletter and Vibrations magazine

2016 Membership Fees

| CMVA Membership Type | Fee |
|---|--|
| Individual - Standard Annual | \$120 |
| Individual - Standard 2 Years | \$230 |
| Individual - Standard 3 Years | \$340 |
| Individual - Retired | \$50 |
| Individual - Student * | \$20 |
| Corporate - Standard Annual (First 5 members) | \$750 (\$100 for each add. member) |
| Corporate - Standard 2 Years (First 5 members) | \$1450 (\$190 for each add. member) |
| Corporate - Standard 3 Years (First 5 members) | \$2150 (\$280 for each add. member) |

* Students will have access to the Vibration magazine under the «Members Only» section of the web page but cannot vote in meetings.

TIME FOR RENEWAL

Individual Membership

Networking

- Communicate with workers in the same field
- Attend local and national meetings
- Consult with colleagues on projects
- Get referral from people who have experience

Technical Information

- Subscription to the quarterly ViBs newsletter
- Availability of quarterly VIBRATIONS magazine
- Books and correspondence courses on www.cmva.com

Certification Program

- Demonstrate your capabilities in condition monitoring and vibration analysis
- Internationally recognized ISO certificates
- Multi-level: Categories 1 to 4

Development of Standards

CMVA works with industry and users to establish a Canadian position in the formulation of both national and international standards. CMVA recommends and monitors the adoption of ISO standards as national standards.

Corporate Membership

If you run industrial machinery, sooner or later, you will need condition monitoring and diagnostics technologies and the specialists to run them. The CMVA is the only association based in Canada that certifies specialists and works to further develop the Condition-based maintenance technology.

Corporate memberships (your company's way to support the activities of CMVA and help to ensure its viability):

- Indicates to your employees that you value technical excellence
- Enhances your employees' skill and abilities by enabling ISO proficiency certification
- Supports Canada initiatives in developing world wide standards of vibration analysis and certification of technical personnel
- Enhances your visibility in the condition monitoring and vibration analysis fields.

Corporate membership includes at least five individual memberships, and they stay with your company. If individuals change jobs, you can transfer their membership & benefits to someone else.

Any questions ? Contact Andy Woodcock: awoodcock@cmva.com or 416 622-1170

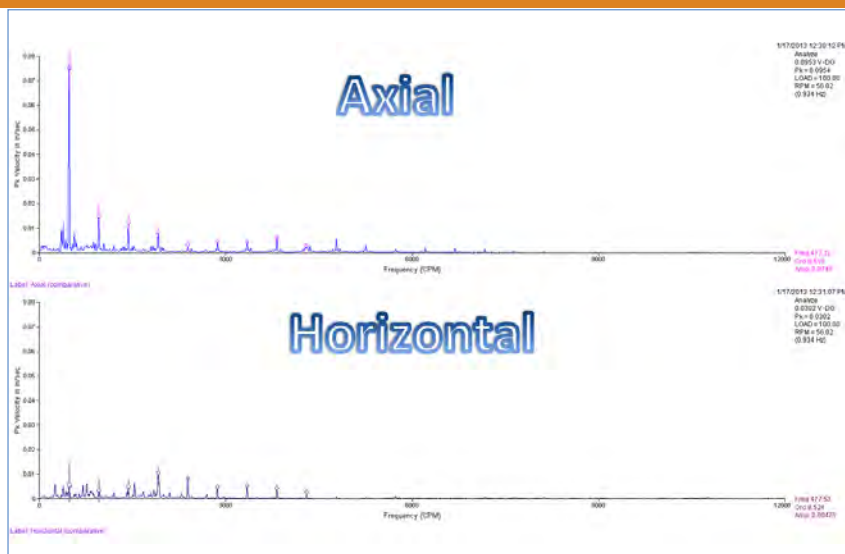
Double row cylindrical roller bearings are common in the mining industry for conveyors pulleys and rolls on paper machine.

By ALEX DUROCHER, Engineer, Proaxion, Reliability Team / Lauretinde Controls

The main characterises of this type of bearing is the capacity to support high radial and axial loads, but also to be self-aligning to allow bending in long shafts.

On slow speed applications, bearing fault are easier to measure in the axial than radial direction.

Figure 1 show an abnormal frequency visible on axial and radial spectrums, at the BPFO of a 22232 bearing mounted on a conveyor pulley turning at 56 rpm. The overall level of the axial spectrum reaches 0.095 ips-pk compare to the 0.030 ips-pk on the radial direction. ◀▶



RENEWING YOUR Certification

If you have been a valid CMVA member for the past 5 years, you can renew your certificate by accumulating enough points. There are multiple ways to earn the points needed to renew your certificate. You have **5 years** to gather the necessary points (**20 points for CAT 1 and 30 points for CAT 2-3-4**). Otherwise, you will have to rewrite an exam. A successful review in a higher category also prolongs your certificate for another five years.

Many people wait until the last minute to remember all the activities in which they participated and which account for the renewal of their certificate.

Forget activities that would have qualified? How to avoid search time that could be long and complex after 5 years?

We strongly encourage you to use the form provided (see images to the right) for that purpose and to fill it gradually. Please take note that this is a two-page form. You may toggle from one page to another using the tabs at the bottom of the Excel spreadsheet. Calculation are made automatically. The Excel spreadsheet can be downloaded at the following link:

www.cmva.com/certification.asp

Follow the **Recertification Form/ Renouvellement de Certification** link in the left column.

The validity of one's certificate depends on his / her valid membership status, renewable yearly on January 1st. The duration of a valid certificate is of 5 years.

| CMVA Canadian Machinery Vibration Association | | ACVM L'Association Canadienne en Vibrations de Machines | |
|---|------------------------|---|-------------------------|
| VIBRATION ANALYST - RENEWAL OF CERTIFICATION FORM FORMULAIRE DE RENOUVELLEMENT DE LA CERTIFICATION - ANALYSTE EN VIBRATION | | | |
| LAST NAME / NOM | | FIRST NAME / PRÉNOM | EXPIRATION / EXPIRATION |
| CERTIFICATE NO. / NO. CERTIFICAT | | CATEGORY / CATÉGORIE | |
| COMPANY / SOCIÉTÉ | | ADDRESS / ADRESSE | |
| TELEPHONE / TÉLÉPHONE | | FAX / TÉLÉCOPIER | |
| E-MAIL / COURRIEL | | | |
| SUMMARY OF POINTS (POINTS REQUIRED SUR 5 YEARS: 20 FOR CAT 1 AND 30 FOR CAT 2-3-4) SOMMAIRE DES POINTS (POINTS REQUIS SUR 5 ANS: 20 POUR CAT 1 ET 30 POUR CAT 2-3-4) | | | |
| EXPERIENCE (PART 1) EXPERIENCE (PART 1) | 0.00 | NAME OF CMVA EVALUATOR NOM DE L'ÉVALUATEUR ACVM | |
| TECHNICAL ACTIVITY (PART 2) ACTIVITÉS TECHNIQUES (PART 2) | 0.00 | | |
| TOTAL OF POINTS TOTAL DES POINTS | 0.00 | SIGNATURE | |
| PART 1 - VIBRATION RELATED WORK EXPERIENCE (5 POINTS MINIMUM) PARTIE 1 - EXPÉRIENCE DE TRAVAIL EN VIBRATION (5 POINTS MINIMUM) | | | |
| ROLE / RÔLE | POINTS EARNED / POINTS | YEAR / ANNÉE | POINTS |
| ANNUAL VIBRATION RELATED WORK ANNUAL TRAVAIL EN VIBRATION | 0 | | |
| 0 - 25% | 1 | | |
| 25 - 50% | 2 | | |
| 50 - 75% | 3 | | |
| 75 - 100% | 4 | | |
| TOTAL VIBRATION RELATED WORK / TOTAL TRAVAIL EN VIBRATION | | | |
| CONFIRMATION OF YOUR SUPERVISOR NO. 1 / CONFIRMATION DE VOTRE SUPERVISEUR NO. 1 | | | |
| FULL NAME / NOM COMPLET | SIGNATURE | DATE | |
| WORK TITLE / TITRE | | | |
| CONFIRMATION OF YOUR SUPERVISOR NO. 2 / CONFIRMATION DE VOTRE SUPERVISEUR NO. 2 | | | |
| FULL NAME / NOM COMPLET | SIGNATURE | DATE | |
| WORK TITLE / TITRE | | | |
| CONFIRMATION OF YOUR SUPERVISOR NO. 3 / CONFIRMATION DE VOTRE SUPERVISEUR NO. 3 | | | |
| FULL NAME / NOM COMPLET | SIGNATURE | DATE | |
| WORK TITLE / TITRE | | | |
| CONFIRMATION OF YOUR SUPERVISOR NO. 4 / CONFIRMATION DE VOTRE SUPERVISEUR NO. 4 | | | |
| FULL NAME / NOM COMPLET | SIGNATURE | DATE | |
| WORK TITLE / TITRE | | | |
| CONTINUE FILLING THE FORM USING "PART 2" TAB CONTINUER À REMPLIR LE FORMULAIRE EN UTILISANT L'ONGLET "PARTIE 2" | | | |



Departure for social event



Keith Brewery Tour



Dr. Andrew K.S. Jardine, Keynote speaker

Halifax, October 28-29-30



Gifts from exhibitors



Keith Brewery Tour