

## Tata Steel, Jamshedpur and CMSI jointly organises the first-ever virtual International Conference on Condition Monitoring (ICCM-21)

~ The two-day conference witnessed around 3000 participants across the globe ~

**International Conference on Condition Monitoring (ICCM 2021)**, a joint initiative by **Tata Steel Limited** and **Condition Monitoring Society of India**, Visakhapatnam, was organized on a virtual platform on **January 21-22, 2021**. This was the first-ever virtual international conference on condition monitoring.

The theme of the conference was “**Agile & Sustainable Advances in Equipment Reliability through Condition Monitoring**”. The initiative aimed to bring together thought leaders, delegates and scholars to deliberate and submit their papers on the key topics such as - Cutting Edge Technology in Rotating Equipment, Futuristic Hydraulic & Lubrication Systems, Breakthrough Innovation in Power systems & Data Analytics, Artificial intelligence and Machine learning in condition monitoring.

**Dr. G. Satheesh Reddy**, Chairman, DRDO and **Mr. T. V. Narendran**, CEO & Managing Director, Tata Steel were the chief guest and guest of honor respectively at the inaugural function. **Dr. G. Satheesh Reddy** in his inaugural address, gave insight on next generation capital equipment and emphasized the need for increased adoption of advanced technologies in machine condition monitoring like AI & ML across various industries including defence systems. He explained briefly how CM offers benefits to our industry in terms of better quality, safety, supply chain, maintenance cost, operational efficiency, machine reliability and productivity. He also stressed the necessity to produce world class talent and capacity building in this field.



**Dr. G. Satheesh Reddy**  
Chairman, DRDO

In his address, **Mr. Narendran** said: *‘Technology has always been a driver of productivity. Companies across the world are investing in technology and automation and hence, getting the best out of it is extremely critical for continued success. Condition monitoring and predictive maintenance is an important subject in this regard and creating a platform of diverse groups of industry experts, research scholars, academicians helps to share knowledge and learnings which in turn sparks new ideas and thoughts which can be leveraged appropriately’.*



**Mr. T.V. Narendran**  
CEO & MD, Tata Steel

The keynote address “Condition Monitoring in Industry 4.0 environment” was delivered by the President of CMSI **Dr. V. Bhujanga Rao**, Fmr ISRO Chair Professor, NIAS, IISc Campus Bangalore. He explained how CM has become central pillar of Industry 4.0 with data from smart sensors and predictive analytics facilitating intelligent decisions and better management of assets to operate at their peak performance.



**Dr. V. Bhujanga Rao**  
NIAS, IISc Campus

In current global pandemic scenario, connecting all experts across globe to have cross learning & knowledge Sharing, the idea of virtual conference was made possible by **Mr. Avneesh Gupta**, Vice President, TQM and Engineering & Projects, Tata Steel & **Mr. Probal Ghosh**, Vice President, Shared Services, Tata Steel.



## From President's Desk:

### Role of Condition Monitoring in stimulating Indian manufacturing Sector!!



One of the India's economic targets as enunciated by our Hon'ble Prime Minister Narendra Modi's to make manufacturing sector a \$ 1 trillion economy to become 5<sup>th</sup> largest manufacturing sector in the world with 5% of global manufacturing output distributing wealth in the most equitable manner. The targets set by our visionary Prime Minister are very challenging, **but how can CMSI help the government in offering a road map to achieve such goal.** This implies India needs revival of economy in a short run which demands an out-of-box thinking and could be even disruptive.

This proposed model titled 'Digi-Service' developed based on the concept of "Digital Servitization" by the author is aimed at creating huge consumer demand across the country generating proportionate business for the manufacturing industry over the next few years and thereby propelling the manufacturing sector in a big way to expand into \$1 trillion manufacturing economy by 2025.

In the phrase digi-service (shortened for 'digital servitisation'), the word digital conveys that digital technology plays an important role in connecting people, companies, systems and services by way of deploying IOT, Big Data, 5G/4G network, condition based remote monitoring, predictive analytics etc. Word servitisation (meaning service + organisation) implies a new business model of adding services to the products to open up new ways to create value to the customers as well as to the manufacturers. There are two potential factors which will raise significantly the GDP of India among others. They are:

1. By way of the Digi-Service model proposed in this editorial, increase the demand through enhancing the willingness and ability of consumers to experience the value of a quantity of goods and services without becoming owners of the goods in a given period of time.
2. Increase the demand for production by private sector businesses and offer products as a bundle of digitally transformed product plus services to the consumer but charging only for the service. The word service include Condition based remote monitoring and application of predictive analytics.

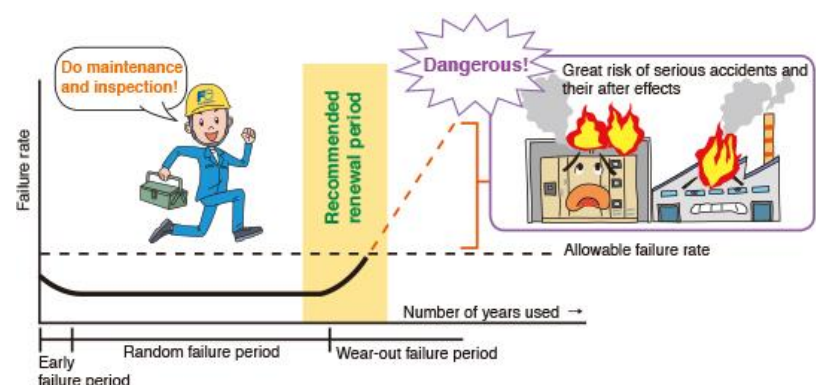
The concept behind the model is better explained through the following illustration. In India there are more than 150m households in the middle class and lower middle class income groups, (Excluding 60 million poor and BOP people) who cannot afford to buy their own car. Their savings do not permit to do that. But they can afford to hire a ride on Ola or Uber and pay point to point for their daily travel. Same thing is not possible using our conventional rental taxi system.

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#### Main Features of this Issue..

- First-ever Virtual International Conference on Condition Monitoring (ICCM-2021)
- From President's Desk
- Latest Condition Monitoring Equipment
- CMSI Awards/ Honours
- News about CMSI Activities
- What are the maintenance metrics?
- CM Conferences/ Workshops
- New CMSI Members
- New CM Books

#### Renewing equipment at the appropriate time prevents serious accidents and their spread!!



[https://www.fujielectric.com/products/renewal/hv\\_distribution/](https://www.fujielectric.com/products/renewal/hv_distribution/)

Enroll as a member of our society & advertise your products in News Letter 'MONITOR' and  
Website: [www.comsoi.org](http://www.comsoi.org)



## Role of Condition Monitoring in stimulating Indian Manufacturing Sector !!

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Ola, an Indian company made it possible just by using a self-serve 24 by 7 App and the services provided are very attractive, hassle free and cheaper. While offering such attractive service with lean charges Ola has made a revenue of Rs 25.44 billion in 2019. Uber, the American company on the other hand made a revenue of US\$11.14 billion in 2020. Let us consider another example of home appliances sector of India. In India, out of 300 million households (by 2025), there are 165 million households who do not own a refrigerator (Fridge) at home. Today, Refrigerator is considered as an essential and necessary appliance at home for better life style living. This particular group of 165m households have their own priorities in life, -like giving good education to the children, own a house, own a two-wheeler etc. Purchasing a Fridge is not usually in their priority. Thanks to technologies developed by Condition Monitoring experts, suppose this group is offered a 190 Litre fridge freely, installed it freely and maintained it freely, but asked to pay only for the value of service it provided, then this group will accept it as it will not really affect their savings. On average a fridge at home runs for 8 hours. They have to pay monthly the contracted amount towards utilised value of service it offers. The unit is to be monitored remotely for maintenance is the role of CM and bill the service offered. This digital transformation can be done in an affordable manner on any home appliance like refrigerator, washing machine, RO pure water plant, dish washer, microwave oven, TV etc at a very reasonable cost when done on a larger scale. Considering only home appliances sector, an estimate by the author reveals that a turn over \$300 billion including co created value can be realized by 2025.

The objective is to benefit more than 150 million households dispersed in urban, peri urban and rural regions while creating a healthy socio- economic structure. The impact will be seen by way of betterment of household environment and health, a reduction in urban - rural divide, increase in social literacy and awareness, reduction in human drudgery especially for women, cut down on food wastage, increase in cold storage space for perishables such as food, fruits, vegetables and many more.

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This concept suits countries like India where population is a great asset and each household is a co-creator (value in use) of the economy implying that the user is the source of revenue without being the owner. This augurs perfectly well for Indianisation of the economy and checkmating the foreign products. Many industries in India and abroad have successfully tried digital servitisation in making profitable ventures. Manufacturers in turn get on an average 10-20 % more profit by way of constant flat revenue for the life of the product.

### Employment Generation

The Digi-Service model will provide ample employment opportunities for different categories of employees across disciplines. The White goods come under the classification "machinery and metal products" as per CII-BCG report on manufacturing 2010 with a requirement of Labour Intensity Factor (LIF) of 0.23. By implementing Digi-Service in white goods sector alone, nearly 30 million jobs can be created. With Capital goods added, this will cross 100million jobs.

### Digi-Service model will be unique to India

Owing to huge population and large variation in earning power of people, such servitization requirement exists in India in the domain of white goods, for example. It improves country's economy as well as the life style requirement of the people. The household share of these appliances in India differs a lot via a vis developed country like USA, UK. In some of the developed countries like USA, UK, Germany the servitization is implemented mostly for capital equipment. It is unique in the sense that the home appliances markets have not reached saturation levels in India. Still there is large scope for manufacturing companies in India to find huge customers who will be enabled to acquire products through servitisation.

It is an appropriate and timely challenge for all stake holders to come together and implement. Already there are products in market with built-in monitoring, edge computing, real-time data analytics to allow intelligent operation and predictive maintenance as part of smart homes. The present government has the right dispensation with proper leadership to implement this techno economic proposal in right earnest. This Digi-Service model has a large potential to support a number of small business start-up units in the country.

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**M/s. Industrial Inspection & Testing Engineers**

*Quality Services in NDT & Inspection*

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The digital transformation of the product is such it is well tuned to the minds of younger generation's thinking and will be easier to implement and exploit. With minimum investment, youth can start up with varieties of food joints like bakery, biscuit making, Chocolate making, restaurants on wheels, snack shops etc using servitised equipment like ovens, refrigerators, mixer Grinder, etc. This equipment can be used and pay only for the value of services used. That means one can start a business with very less investment. This can also apply for engineering units like small workshops, machine repair shops, welding units etc possible to be set up by youth.

### Increasing Women's role in the economic growth

This techno economic model will help nearly 320 million women by reducing the quantum of household drudgery with the support of technology. The women will get respite from drudgery and more opportunity to invest their available spare time on children education, to pursue creative arts, handcrafts and artisanal work, community work, home-based businesses, develop entrepreneurial mind set, give helping hand to the bread winner etc. This is very much needed in our country to realise the full potential of women in the country's economic growth as co-creators of economy. These life style changes will inject in the family a sense of new achievement spirit making the youngsters in the family feel on par with other well to do households. Observing current combination of global and technology developments, this is ideal period to start with Digi-Service model in India in wholesome way with government playing pivotal role in coordination with FICCI, CII, academic institutions, etc.

### Implementation

Needless to mention that one key technology needed is Remote Condition Monitoring and predictive analytics. Barriers are common to exist when some major change in business model occurs like standard Product centric business to effective & efficient Product service centric business and when the new system has to be integrated into OEM. To make this system effective and adoptable a regulatory system is to be put in place by the government to remove all the administrative barriers. Sufficient research work has been done in general on this topic but we have to evolve our own India specific models. There will be many transactional issues related barriers due to cultural shift for consumers which have to be resolved through constant interactive studies.

**India will become a vibrant, peaceful and powerful country in the world!**

*(This editorial is an extract from a detailed report written by Dr. V. Bhujanga Rao for NIAS, IISc Campus, Bangalore).*



### Latest Condition Monitoring Equipment:

### FLUKE ii900 - Sonic Industrial Imager

**FLUKE ii900 - Sonic Industrial Imager** is Fluke's first sound camera. It can be used to detect leaks in compressed air, gas, steam and vacuum systems. This instrument utilises sound to locate faults and is able to isolate the sound frequencies caused by leaks and vacuums. The Fluke ii900 Sonic Imager can determine the direction of the problem by timing the delays that the sound causes as it passes over its array of microphones. This builds up a SoundMap™ which the Fluke ii900 Sonic Industrial Imager displays in colour over a visual image, enabling greater clarity, and thereby facilitating easy location of detected leaks. Images are indicated on the Fluke ii900 Sonic Imager's 7" LCD, touchscreen display.



The Fluke ii900 Sonic Imager has a frequency range of 2 kHz to 52 kHz. This intuitive camera may be operated with minimal training and can be integrated into typical maintenance routines. The Fluke ii900 Sonic Industrial Imager is suitable for predictive maintenance applications carried out during peak operating times. It improves the efficiency and ease of detecting and locating gas leaks, as well as inspecting fittings, couplings, valves, flanges, shut off valves, connections to pneumatic tools, small branches, bushings, storage tanks, and hoses and hose reels.

The detection and imaging capabilities of the Fluke ii900 Sonic Industrial Imager reduces plant downtime and associated maintenance costs as repairs can be affected more quickly and earlier. Additionally, early detection and repair of leaks delay the need for an additional air compressor, again, reducing costs.

Furthermore, using the Fluke ii900 Sonic Industrial Imager to ensure proper air pressure in pneumatic equipment improves production line reliability and can reduce energy costs.

<https://www.testers.co.uk/fluke-sonic-industrial-imager-for-leak-detection>



## CMSI Awards and Honours

Our **CMSI Honorary Fellows** for their significant contribution to the field of Condition Monitoring.



**Prof. UDAY KUMAR**  
Lulia University, Sweden



**Prof. JYOTI K. SINHA**  
Manchester University, UK



**Prof. RAJKUMAR ROY**  
Dean, University of London



**Prof. S. NARAYANAN**  
Professor Emeritus, IIT-Madras

Our newly elected **CMSI Life Fellows** for their significant services to Condition Monitoring Society of India,



**Er. GRP SINGH**  
Head, Quality Assurance Group  
Tata Steel, Jamshedpur



**Dr. RANA DUTTA**  
CBM Consultant  
Srikalahasthi Pipes Ltd.



**Er. P. VEERABHADRA RAO**  
Executive Director  
HPCL, Visakhapatnam

**CMSI Institutional Awards** to promote growth of Condition Monitoring in the country and to encourage Indian Engineers/ Scientists/ Academicians in the field of Condition Monitoring.



**Er. PVS Ganesh Kumar, Outstanding Scientist, NSTL & Sr. Vice President, CMSI** conferred with **Dr. V. Ramamurti Award** for significant contribution to the growth of condition Monitoring and providing leadership over a considerable period (2019-2020) of time.

(Conferred at periodicity of every three years).



**Dr. T. Venkata Ratnam, Technical Officer-D, NSTL & Secretary, CMSI** conferred with **Outstanding Services Award** for rendering excellent services (2019-2020) to promote the activity of CMSI.

(Conferred at periodicity of every three years).



**Er. Hemant M. Bari, Deputy General Manager, Adani Dahanu Thermal Power Station** conferred with **Dr. Baldevraj Award for the best paper** at NCCM-2019 organized by CMSI.

(Conferred at every NCCM/ ICCM for previous year's best paper).

### SPM Instrument India Pvt. Ltd.

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## NEWS ABOUT CMSI ACTIVITIES

### Executive Committee meeting (Online) of CMSI held on 16-02-2021

Executive Committee meeting of Condition Monitoring Society of India (CMSI) was held on 16-02-2021 at 1900hrs through Online under the Chairmanship of Dr.V. Bhujanga Rao, President, CMSI.

#### Following Members Attended the Meeting:

- i. Er. PVS Ganesh Kumar, Sr.Vice-President
  - ii. Prof. MRS Satyanarayana, Gen. Secretary
  - iii. Dr. T. Venkata Ratnam, Secretary
  - iv. Er. G R P Singh, Jt. Secretary
  - v. Dr. VVS Bhaskara Raju, Treasurer
  - vi. Dr. D. Dinakaran, EC Member
  - vii. Dr. Ranadutta, EC Member
  - viii. Er. Hemanth Bari, EC Member
  - ix. Er. Shivrath Ram, EC Member
  - x. Dr. (Ms.) Sidra Khanam, EC Member
  - xi. Er. S. Manjunath, Tata Steel (as Invitee)
2. Chairman welcomed all EC members. He congratulated the organizers of ICCM-2021 from Tata Steel, Jamshedpur and Condition Monitoring Society of India (CMSI), Visakhapatnam for conducting the conference and enhancing the image of CMSI.
3. Dr. T. Venkata Ratnam, Secretary informed that many participants are enquiring about issue of participation certificate (e-certificate) from Convener, ICCM-2021. Shri. Manjunath replied that certificates are being made ready and issued to the participants after finalisation of design.
4. Dr. VVS Bhaskara Raju, Treasurer sought to know whether the proceeds of the conference are being transferred to CMSI HQ Account. Er. GRP Singh stated that definitely some proceeds will be given to CMSI HQ account.
5. Dr. T. Venkata Ratnam informed that Upgradation of the website is completed and payment to be released to the website developer. Dr. V. Bhujanga Rao suggested that final version of the website may be circulated to the EC members for their comments.
6. All Executive Committee members participated enthusiastically and provided useful suggestions.



### Workshop/ Lectures/ Papers presented by CMSI members

#### Er. Hemant Bari CMSI - Life Member

Delivered online talk titled "**Basics of Condition Based Maintenance**", organized by **GITAM Institute of Technology**, Visakhapatnam on **23 April 2021**.

#### Er. Subba Rao Ganti, CMSI - Life Member

- Conducted lectures on "**Vibration based Condition Monitoring**" for Mechanical Engineering Students of Gudlavalluru Engineering College, Andhra Pradesh during 24 - 27 Jan 2021.
- Presented a paper titled "**Benefits of using Turbomachinery Online Vibration Monitoring & Diagnostic Systems**" at **Asia Turbomachinery and Pump Symposium** during 23 - 26 February 2021, virtually organized from Malaysia.
- Delivered a talk titled "**Application of Probe Gap Volt trend and Shaft Centreline Plots to evaluate health of Turbomachinery**" through webinar organized by Machinery and Consultation Services, Egypt.
- Conducted **Mobius Institute's Vibration Analyst Certification** Courses – **Category III** in March 2021 and **Category IV** in July 2021.

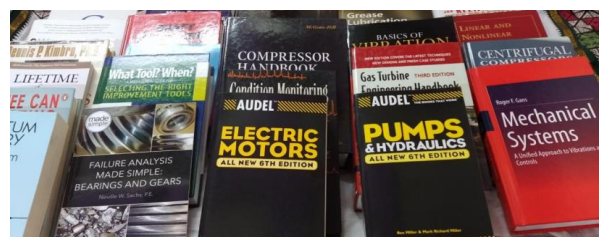


### **Noble Thought of sharing Books!!**



**Shri. Subba Rao Ganti** donated the second lot of books donated to CMSI related to Reliability Engineering, Maintenance and Oil lubrication etc., and also some management books to our CMSI Library. This reflects his noble thought of sharing the literature with his fellow members.

We profusely thank **Shri. Subba Rao Ganti** for donation of these books.



## What are the maintenance metrics?

- Bryan Christiansen is the founder and CEO at Limble CMMS

There are two categories of maintenance key performance indicators which include the leading and lagging indicators. The leading indicators signal future events and the lagging indicators follow the past events.

The leading indicator comprises from metrics like the Estimated vs Actual performance and PM Compliance, while the lagging indicators are reflected in maintenance metrics like the *Mean Time To Repair (MTTR)*, *Overall Equipment Effectiveness OEE* and *Mean time between failure (MTBF)*.

Using these maintenance metrics and turning the data into actionable information, organizations can acquire both qualitative and quantitative insights. And there is no better way to spot opportunities for improvement.

Here are some important maintenance metrics you should track if you want to improve and optimize your maintenance operations.

### 1. Planned maintenance percentage (PPC)

This metric represents the percentage of time spent on planned maintenance activities against the unplanned.

In simpler terms, this metric tells you how much maintenance work done on a particular asset was a part of your *preventive maintenance plan* versus how much time you've spent repairing it because it unexpectedly broke down.

In a great system, 90% of the maintenance should be planned. The calculation is as follows:

$$PPC = (\text{scheduled maint. time} / \text{total maint. hours}) \times 100$$

### 2. Overall Equipment Effectiveness (OEE)

OEE is the measure of the productivity of a piece of equipment. It gives informed data on how effective organization's maintenance processes is running based on factors like equipment quality, performance, and availability.

A 100% OEE means that your system is producing no defects, as fast as possible, and with no stops in the production. Understanding OEE and the *underlying losses*, organizations can gain significant insights into how to improve their manufacturing processes. Using this metric, you can identify what has a negative impact on your production, so you can eliminate it.

To calculate the OEE, you multiply the *availability by the performance and quality* :

$$OEE = \text{availability} \times \text{performance} \times \text{quality}$$

### 3. Mean time to repair (MTTR)

MTTR is the measure of the *repairable items maintainability*.

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The MTTR clock starts ticking when the repairs start and it goes on until operations are restored. This includes *repair time, testing period, and return to the normal operating condition*.

The goal of every organization is to reduce MTTR as much as possible. This is especially important for critical assets as every additional hour you need to restore an asset to a working condition amounts to huge losses for your firm.

To calculate MTTR, you divide the downtime period by the total number of downtimes:

$$MTTR = (\text{SUM of downtime periods} / \text{total number of repairs})$$

### 4. Mean time between failure (MTBF)

MTBF is the measure of the predicted time between one breakdown to the next during normal operation. In essence, MTBF tells you the expected lifetime for a specific piece of equipment. Higher MTBF means that the part (or product) you bought will work longer before it experiences failure.

If you know how long a specific part/equipment will last, it gets much easier to predict and prepare for a failure or schedule some preventive work. To calculate the MTBF, you divide the total operational time by the number of failures:

$$MTBF = (\text{SUM of operational time} / \text{total number of failures})$$

### 5. Preventive maintenance compliance (PMC)

PM compliance is defined as the percentage of the preventive work scheduled and completed in a set time. For example, you might have 60 Work Orders (that are a part of the PM plan) scheduled but 51 completed at the end of the month. In this case:

$$PMC = (51/60) \times 100 = 85\%$$

This tells you that 85% of all preventive WO's have been covered for selected month.

The disadvantage of this metric is that it doesn't tell you if the WO's have been completed on time. That is why you need to invest some additional effort and also track if the Work Orders are actually being finished on time. By far the best way to do that is to use a CMMS as it allows you to quickly create, assign, and track all of your WO's from one place.

### Conclusion

The best way to track if your actions have a positive impact on your maintenance operations is to accurately track metrics that can show you if you are going in the right direction.

Improvements based on your "feeling" can never be as good as relying on hard data.

<https://www.maintworld.com/Applications/5-Important-Maintenance-Metrics-and-How-To-Use-Them>.



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



**Dr. V Bhujanga Rao**, Visiting Professor, NIAS, Bangalore was nominated as Member of Governing Council, Karnataka State Council for Science & Technology under the Presidentship of Hon'ble Chief Minister (2021).

**CMSI Congratulates him and wish him all success during his tenure!!**



**Dr. Y. Sreenivas Rao**, Scientist-H took over as **Director, NSTL** on Jun 01, 2021 from the outgoing Director **Dr. O.R. Nandagopan**, Scientist-H on his superannuation. CMSI was started from the precincts of NSTL in 2003 and enjoyed the support of NSTL Management from inception.

**CMSI Congratulates him on his appointment and wish him all success during his tenure!!**

## Future Conference & Workshops

15<sup>th</sup> International Conference on Condition Monitoring and Diagnosis (ICCMD-2021) will be organised at Istanbul, Turkey on December 20-21, 2021.



## CMSI Welcomes New Members!!

### LIFE MEMBERS:

- Dr. K. V.S. SEHENDRA KUMAR
- Mr. VIJAY P. MOHALE
- Mr. VANKA ROSHAN
- Ms. SAMEERA MUFAZZAL
- Mr. SRIKANTH KOTA
- Prof. S. M. MUZAKKIR
- Mr. PRASENJIT SAHA
- Mr. S. DATTA SAI PAVAN KUMAR
- Dr. K.C. DEEKSHIT KOMPPELLA
- Dr. GOPALA VENU MADHAV
- Mr. PRAMOD NETYIL PRABHAKARAN
- Mr. SYED ASAD IMAM
- Dr. Y. SREENIVAS RAO
- Mr. G.V. RAMANUJAM

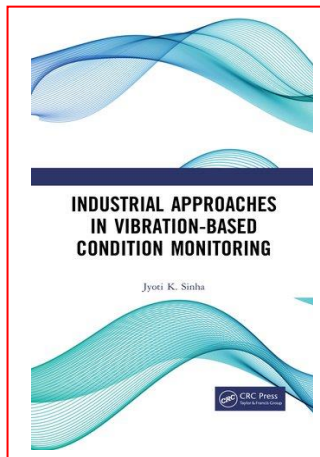


## Editorial Board :

Dr. V. Bhujanga Rao  
Er. P.V.S. Ganesh Kumar  
Dr. T. Venkata Ratnam  
Er. Hemant M. Bari

## New CM Books

**Industrial Approaches in Vibration - Based Condition Monitoring (2020)** by **Jyoti K Sinha**, Professor, Manchester University, UK.



Vibration-based condition monitoring (VCM) is a well-accepted approach in industries for early detection of any defect, thereby triggering the maintenance process and ultimately reducing overhead sand plant downtime. A number of vibration instruments, data analyzer and related hardware and software codes are

developed to meet the industry requirements. This book aims to address issues faced by VCM professionals, such as frequency range estimation for vibration measurements, sensors, data collection and data analyzer including related parameters which are explained through step-by-step approaches. Each chapter is written in the tutorial style with experimental and/or industrial examples for clear understanding.

**Publisher :** CRC Press  
**Hard Cover:** 254 Pages  
**ISBN :** 9781138550339

*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](mailto:cmsi.hq@gmail.com).*

--Editor

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