



# TSI NEWS LETTER

TSI Newsletter

July 2018

## Message From Secretary TSI



Dear Colleagues,

We at TSI deeply regret to inform you of the untimely demise of Prof D V Singh on 20th July 2018 in Delhi. Prof D V Singh was a founder member of Tribology Society of India, its past President (1998-2000), and a recipient of “TSI Life Time Achievement Award” conferred on him during NTC 2011 held at IIT Roorkee. A full obituary for Prof DV Singh appears at TSI Web site at the link: <http://www.tribologyindia.org/pdf/obituary-prof-dv-singh.pdf>



This Newsletter also gives a brief of some of the past events conducted successfully under the banner of TSI since the publication of the last issue of TSI Newsletter. These include “9th Summer School in Tribology”, during 19-23 June 2017; ICIT 2017 conducted by M/s Balmer Lawrie & Company at Kolkata during 6-9 December 2017 and “10th Summer School in Tribology” during 18-22 June 2018.

Other regular features of the Newsletter such as “Tribology Labs in India” and “Young Scholars in Tribology” also appear in this issue of the Newsletter, besides the information regarding TSI's forthcoming event “TRIBOINDIA-2018” during 13-15 December, 2018, being organized by Department of Mechanical Engineering, VJTI, Mumbai. We request you to let us know of any events being organized on Tribology in the country that you may have attended / organized, with photographs, for inclusion in the Newsletter.

It is a pleasure communicating with you through this latest issue of our Newsletter. I request you to let us know about any ideas and suggestions for this Newsletter and also regarding the activities of the Society in general.

With best wishes,

Ajay Kumar Harinarain  
Secretary – TSI  
[info@tribologyindia.org](mailto:info@tribologyindia.org)

## 10th Summer School in Tribology (SST): 18 – 22 June, 2018 at IndianOil Institute of Petroleum Management, (IIPM), Gurugram (Haryana)

The 10th Summer School in Tribology (10th SST) was organized during 18-22 June 2018 at IndianOil Institute of Petroleum Management (IIPM), Gurugram, Haryana. Like past many events, the program was partly supported by SERB / DST, primarily for the travel expenses of academia participants and faculty for the technical program and the course material. The board and lodging expenses for academia participants were supported by the Industry.

The highlights of the event are briefly mentioned below:

- The Technical Program, covering a wide spectrum of Tribology topics, was covered in 19 Technical sessions. Details of the day-wise technical program and the learned faculty members can be seen at the TSI Website at the link given below.
- Two guest lectures on “Materials Tribology”, delivered by Dr B Venkataraman, Scientist “G”, DMRL, Hyderabad and “Tribology in Mining Industry-Case Studies” by Mr Kamal Mukherjee, former GM South Eastern Coal Fields, were also covered during evening sessions on 19th and 21st June 2018, respectively.
- The Program was inaugurated by Dr Deepak Saxena, Executive Director, IndianOil R&D Centre, Faridabad. Others present during the Inaugural Session were Prof Satish V Kailas, IISc - Bangalore and Vice President (TSI), Mr S Acharya, GM IIPM - Gurugram, Mr Ajay Kumar, GM (Tribology), IndianOil R&D Centre and Secretary (TSI), Mr R Mahapatra, DGM (Tribology) IndianOil R&D Centre and Treasurer (TSI) and Mr AK Mehta, ED (TSI).



Chief Guest Dr Deepak Saxena delivering the Inaugural Address

- The program was attended by 31 academia and 22 Industry participants. A group photograph taken on the first day of the event is placed below.



## Participants of 10th Summer School in Tribology



### 10<sup>th</sup> Summer School in Tribology [18<sup>th</sup> to 22<sup>nd</sup> June, 2018] IndianOil Institute of Petroleum Management, Gurugram



**Sitting Row :** S/Shri Veeresh Murthy, Prof Ram Turaga, T L Sethuram, Dr Sarita Garg, Susanta Acharya, A K Mehta, Prof Satish Kailas, Dr Deepak Saxena, (L to R)  
**Standing I Row :** S/Shri Arun Kumar Sharma, Chandra Kumar. R, Ramakrishnaiah, B Sudhakar, Vikas Meshram, Maninder Pal Singh, Arun Kumar, Abhishek Kumar, (L to R)  
**Standing II Row :** S/Shri Amar Kumar Balabantaray, S Vignesh Kumar, Himanshu Shekhar, Pratyank Rastogi, Dr. Yogesh Jeyaram, Arivu Y, Harpreet, Saurabh Mishra, Mahesh K Bhiwapurkar, Krishnakumar N, Avi Gupta, Vivek Kumar, Anand Prakash Gupta, G J Naveen, Ankit Garg, Dr. Bikash Routh, Shankar Swarup Das, Abhijeet Shivaji Suryawanshi, Suman Das, Vijaykumar Hiremath, Rahul Naukarkar, Sanjay R Pawar, Sooraj Singh Rawat, Ashutosh Kumar, Santosh Kumar, Abhishek Babu, Ashwani Kumar, Dr Girish Kotwal, Neeraj Mittal, Chhaviideep Meena, Ashish Kachhawa,

- On the occasion of International Yoga Day on 21st June 2018, the participants attended the special Yoga Session organized at liPM in the morning. Yoga Teacher Shri Jyoti conducted the Session.



10th SST Participants attending the Yoga Session at liPM



- On 21st June 2018 afternoon Mr Ajay Kumar Harinarain, Secretary (TSI), briefed the participants on “Project Work”. The participants were requested to send a report to TSI on the “Utilization of 10th SST learning in their work at their respective Institutes”.
- A 2-hour Multiple Choice Questions (MCQ) Examination was held on the last day of the program. This was followed by the “Feedback and Concluding Session”, conducted by Mr AK Mehta, ED (TSI), Mr Ajay Kumar Harinarain, Secretary (TSI) and Mr Rahul B Meshram, Member (TSI). The participants gave their feedback on the program and their suggestions for future programs. Secretary (TSI) answered most of their queries and noted some of the suggestions for future events.



Participants giving their Feedback during Concluding Session



Secretary - TSI handing over “Participation Certificate”

- Complete details of the event in the form of brochure and technical program etc. can be viewed at the link: [http://tribologyindia.org/education\\_course\\_archives.htm](http://tribologyindia.org/education_course_archives.htm)



## 9th International Conference on Industrial Tribology – 2017 (ICIT-2017) 6th – 9th December, 2017 at Kolkata

The 9th International Conference in Industrial Tribology, (9th ICIT-2017), was organized by Balmer Lawrie & Co Ltd. under the aegis of Tribology Society of India, during 6-9 December 2017 at the Vedic Village Spa Resort, Rajarhat, Kolkata. The theme of the event was “Tribology – A Key Enabler for Industrial Growth”.

Some of the highlights of the conference are given below:

- Pre-Conference Event - Education Course on “Basics of Tribology”: an education course on “Basics of Tribology” was organized on 6th December 2017 at the conference venue, by way of pre-conference event. The program consisted of 5 lectures by experts from academia and industry. There were 26 participants for the program.



Group Photo of the Education Course Participants and Faculty Members

- The 9th ICIT was inaugurated on 7th December by Mr Ranjan Kumar Mohapatra, Director (HR), Indian Oil Corporation Ltd. Others present during the Inaugural Session include Mr D Sothi Selvam, Director (Manufacturing Business), Balmer Lawrie & Co. Ltd. and Chairman -Organizing Committee, ICIT 2017, Mr Amit Basak, Prof. Satish V Kailas, Vice President (TSI) and Mr Ajay Kumar Harinarain, Secretary (TSI).
- There were 10 Technical Sessions and 2 Plenary Sessions spread over 3 days of the conference.
- The Concluding Session was chaired by Mr D Sothi Selvam, Director (Manufacturing Business), Balmer Lawrie & Co. Ltd. and Chairman, Organizing Committee, ICIT 2017. Mr Ajay Kumar Harinarain, Secretary (TSI) and Mr R Mahapatra, Treasurer (TSI) were also present during the concluding session.



Release of Book of Abstract cum Souvenir  
During the Inaugural Session



Address by Mr. D Sothi Selvam, Director  
(Manufacturing Business), Balmer Lawrie & Co.  
Ltd. & Chairman - Organizing Committee



Plenary Talk by Dr. Nityanand Goswami  
IIT Delhi



Plenary talk by Dr. George Plint,  
Phoenix Tribology, U.K.



Mr. Ajay Kumar Harinarain presenting the highlights of ICIT 2017 during the Concluding Session

Mr Ajay Kumar Harinarain presented a brief report on the activities during the conference. Mr R Mahapatra announced the awards instituted under various categories.

- Following are the awardees under different categories:
  - ✓ Best oral paper in Basic Research category: Dr. Febin Cyriac of SRM University
  - ✓ Best oral paper in Industrial Application category: Sharmila Barman et al., of Balmer Lawrie & Co Ltd.
  - ✓ Best paper in Poster Paper category: Dheerank R et al., of Indian Institute of Science, Bengaluru.
- Mr R Mahapatra also presented the “Vote of Thanks” and acknowledged the contributions from all sponsors, exhibitors and all service providers who helped make the conference a successful event. The Organizers also invited all participants to be a part of the ICIT-2019, tentatively scheduled to be held at Indian Institute of Science, Bengaluru.



## 9th Summer School in Tribology (SST): 19 – 23 June, 2017 at IndianOil Institute of Petroleum Management, (IIPM), Gurugram (Haryana)

The 9th Summer School in Tribology (SST), the flagship educational event of TSI, was organized during 19-23 June 2017 at Indian Oil Institute of Petroleum Management (IIPM), Gurugram. A total of 54 participants (29 from Academia and 25 from Industry) enrolled for this event.

A group photograph taken on the occasion of 9th SST is shown below, with the names of participants.



### 9th Summer School in Tribology

[19<sup>th</sup> to 23<sup>rd</sup> June, 2017]

IndianOil Institute of Petroleum Management, Gurugram



Sitting Row (L to R) : Lakshmi Katta, Rashmi Bagai, Dipanwita Das, Abhishek Pariyar, Satish V. Kailas, SSV Ramakumar (Director, IOC R&D), AK Mehta, Ajay Kr. Harinarain, Srinivas, Simmi Datta, Swati Gangwar, Md. Sikandar Azam, Sanjay Sanfui, Soumya Banerjee, Seema H. Menon  
(Prof./Dr./Mr./Ms.)  
Standing I Row (L to R) : Arun Sharma, Dillip Kr. Panigrahi, Gandepalli SGKS Bharadwaj, Vivek Kashyap, Sangharatna Ramteke, Rakesh BS, Akha Gawande, Shankar Jarupula, Deepak Kumar Prajapati, Vinay Saini, Sanjeev Kumar Singh, Sanjeev Sharma, Vishwajeet Singh, Chandan Kumar, Rahul Kumar, Sandeep Bhoi, T Ramesh Kumar, Udaya Pratap Singh, PR Lohakare  
Standing II Row (L to R) : Homender Kumar, Hemant Kumar Choudhary, Vishal Kumar Sinha, Ashok Kumar MS, Amitava Pal, Ashish Kumar Mishra, Sanjay R Patel, Tamajit Biswas, Nitesh Vashishta, Krishnakurti Singh, Nilesh Kumar, Avishkar B Rathod, Awadhesh Kumar Maurya, Kavirayani Navinkiran, R. Dhanasekaran, Inder Singh, Manoj Janardan Pawar, Manender Singh, Punit Kumar Singh, Kaushik Dey, Gopinath Perumal, Sathyabalan P, Akant Kumar Singh, Dinesh D, Manoj Sardana, Barunav Kundu

The 9th SST event was inaugurated by Dr. SSV Ramakumar, Director - IndianOil R&D and President (TSI). Mr. Ajay Kumar Harinarain, General Manager (Tribology) and Secretary (TSI), Mr. A K Mehta, ED (TSI) and Prof. Satish V Kailas, Vice President (TSI) were also present during the Inaugural Session.

The Technical Program, covering a wide spectrum of topics in Tribology, was conducted in 21 Technical Sessions. A guest lecture on “Materials Tribology” was delivered by Dr. B. Venkataraman, Scientist “G”, DMRL, Hyderabad during the evening session on 19th June, 2017.



Dr. SSV Ramakumar being welcomed by Mr. Ajay K Harinarain



Dr. SSV Ramakumar, Prof. Satish V Kailas and Mr. Ajay K Harinarain lighting the Inaugural Lamp





Dr. SSV Ramakumar delivering the Inaugural Address of 9th SST



9th SST Participants during the Inaugural Session of Program

- On the occasion of International Yoga Day on 21st June 2017, a special Yoga Session was organized in the morning for all the participants of 9th SST. Yoga Teacher Shri Jyoti conducted the session.



9th SST Participants attending the Yoga Session at IIPM

Mr. Ajay Kumar Harinarain, Secretary (TSI) briefed the participants about their SST "Project work" on 22nd June 2017. The Academia participants were asked to prepare a brief report on the utilization of learning at 9th SST in their academic work.

A 2-hour Examination using Multiple Choice Questions (MCQs), based on technical lectures delivered during the program, was conducted on the final day of the event before the Feedback Session.

The "Feedback and Concluding Session" was graced by the Chief Guest, Dr. Barun Chakrabarti, General Manager -L&T Hydrocarbon Engineering. Mr. Ajay Kumar Harinarain, Secretary (TSI), Dr. Pankaj Bhatnagar, General Manager - IndianOil and Joint Secretary (TSI) and Mr. A K Mehta, ED (TSI) were also present. The participants offered their valuable comments and suggestions for further improvement of the program. Participation Certificates were given to all participants during the Concluding Session.





Dr. Barun Chakrabarti handing over participation certificate



Dr. Pankaj Bhatnagar handing over participation certificate

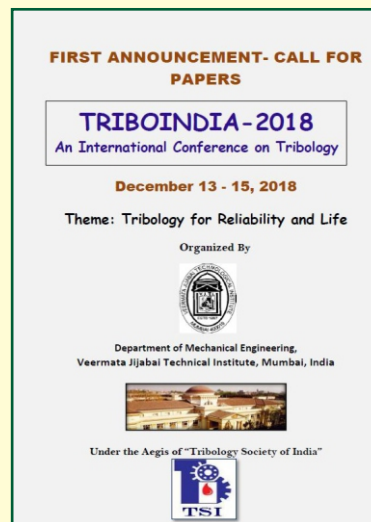
Complete details of the event in the form of brochure and technical program can be viewed at the link: [http://tribologyindia.org/education\\_course\\_archives.htm](http://tribologyindia.org/education_course_archives.htm)

## Organization of “TRIBOINDIA – 2018” (13-15 December, 2018) By the Department of Mechanical Engineering, Veermata Jijabai Technical Institute (VJTI), Mumbai

“TRIBOINDIA – 2018”, an International Conference on Tribology, will be organized by the Department of Mechanical Engineering, VJTI Mumbai under the aegis of Tribology Society of India, during 13-15 December, 2018. The Theme chosen for the event is “Tribology for Reliability and Life”.

Tribology Society of India invites academic institutions to organize an event named National Tribology Conference (NTC) once in every 2 years with the sole objective of providing a platform to academicians, researchers and practising engineers to discuss and share the current trends in Tribology. The event at VJTI Mumbai will be the fourth in this series, with the previous one having been organized by the IIT Banaras Hindu University, Varanasi in 2016. The first such event was organized by IIT Roorkee in 2011 and the second one was organized at PES University, Bengaluru in the year 2014. Now the 4th NTC has been renamed as “TRIBOINDIA-2018 : An International Conference on Tribology” and it will be organized at VJTI Mumbai.

Complete details on “TRIBOINDIA – 2018” are provided at the following link on TSI website: <http://www.tribologyindia.org/pdf/TRIBOINDIA-brochure-first-announcement-and-call-papers.pdf>



***TSI invites all Members to whole-heartedly participate in this event and make it a grand success.***

## **In Focus: Tribology Lab, Department of Mechanical Engineering Veermata Jijabai Technological Institute (VJTI), Mumbai-400 019**

Established in 1887, the Department of Mechanical Engineering remains among the premier departments of VJTI. It has had a long and illustrious history and offers courses at the graduate and postgraduate levels. The department is recognized for doctoral research by the University of Mumbai.

The department is actively working towards enhancing the research in Tribology. In July 2016, Dr. Vikas M. Phalle of Mechanical Engineering Department had invited renowned tribology expert Dr. Michel Fillon from Pprime Institute - France under "Global Initiative of Academic Networks (GIAN)", a scheme of MHRD, for one week to deliver expert lectures. Total 50 participants attended this course, which included faculties from various academic institutes, research scholars and industry professionals. Recently, Dr. Phalle was invited as a visiting faculty by Mechanical Engineering Department, Texas A&M University USA.

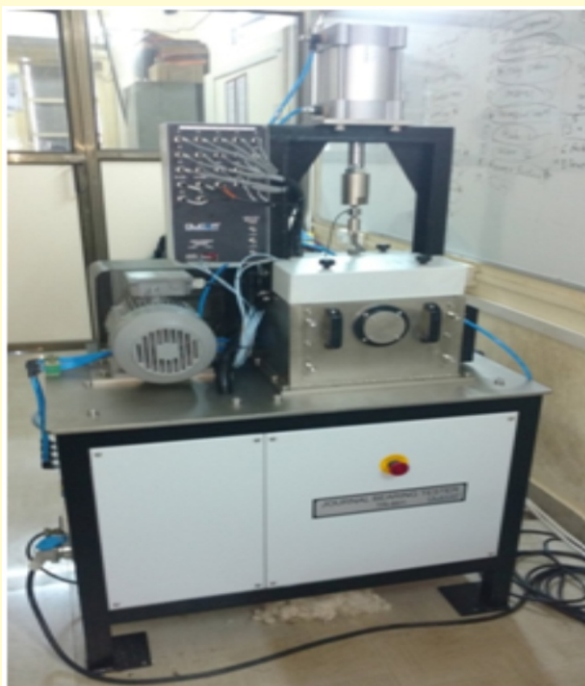
Tribology is one of the thrust areas of research work in the department. Presently 18 M.Tech and 14 Ph.D. Scholars are working in this area. The major areas of focus for research in the field of Tribology are as follows:

- Fluid film bearings
- Condition monitoring of rotating machinery
- Remote condition monitoring using IoT
- Automotive Brakes friction and wear
- Material Coating

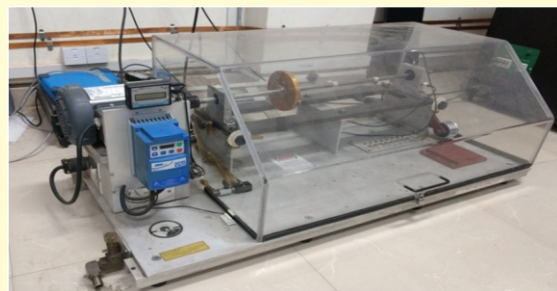
The Department of Mechanical Engineering will be organizing TRIBOINDIA-2018, an international conference on Tribology from 13th -15th December 2018 under the aegis of Tribology Society of India.

Resources available in Tribology Lab for Testing and Characterization are:

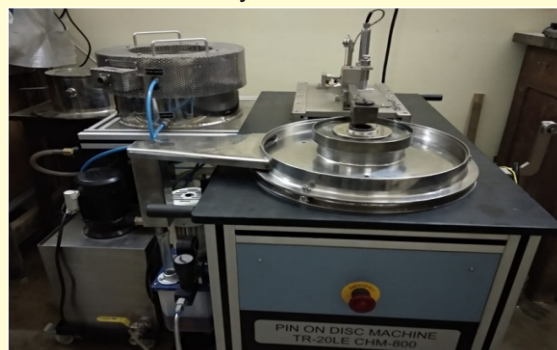
- Machinery Fault Simulator
- Conical Hydrodynamic Journal Bearing Test Rig
- Pin on Disc Tribometer



Conical Hydrodynamic Journal Bearing Test Rig



Machinery Fault Simulator



Pin on Disc Tribometer



## In Focus: Tribology Group - Defence Metallurgical Research Laboratory (DMRL), Hyderabad

The Tribology Group in DMRL is mainly involved in understanding materials aspects of tribological behaviour of different materials including metal alloys, composites and coatings with a focus towards providing tribological solutions for variety of defence applications, including aeronautics, aerospace etc. The Group is also involved in high strain rate deformation studies of advanced materials involving impact over wide range of velocities (5 to 3500m/s). The Group is headed by Dr. B. Venkataraman. Other scientists include Dr. Manish Roy, Dr. J.K.N. Murthy, Dr. Gokul Lakshmi, Shri Rajnish Goyal and Shri Ratan Toppo.

The Group has state-of-the-art facilities for characterization and tribological testing. Some of these are mentioned below.

### Tribological Test Facilities:

- High Temperature High Vacuum Tribometer
- Solid Particle Erosion Test Rig
- Rolling Contact Fatigue Tester
- Dry Rubber Wheel Abrasion Tester
- Nano-tribometer
- Induction Plasma-based Erosion cum Coating Facility (IPEC)-one of its kind for gas erosion under Aerospace Conditions, particle erosion at very high Temperature and Coating deposition under low pressure plasma.



The IPEC Facility

### Characterization Test Facilities:

- Micro Hardness Tester
- Non-Contact 3D Surface Profilometer
- Nano-indenter with AFM and Nano-scratch Tester
- Coating Pull-off Adhesion Tester
- Laser Flash Thermal Properties Analyzer



High Temperature High Vacuum Tribometer



3D Non-Contact Profilometer



Tribology Group Members at DMRL - Hyderabad

## Young Research Scholars in Tribology

**Name of Research Scholar:** Vikas Verma

**Title of Ph.D. Thesis:** TiCN Based Cermet Systems for the Improved Wear and Machining Performance

**Supervisor:** Prof. B. V. Manoj Kumar, IIT Roorkee



### **Brief Abstract of Thesis:**

The present study essentially demonstrates the potential of newly designed cermet composition of TiCN-WC-Ni-Co-TaC for superior wear performance in machining conditions. Particularly, the design of new composition and degradation mechanism in sliding wear and turning conditions are highlighted. TiCN based cermets with compositions Ti(CN)-5WC-20Ni, Ti(CN)-5WC-20Ni-5TaC, Ti(CN)-5WC-10Ni-10Co, and Ti(CN)-5WC-10Ni-10Co-5TaC were processed by conventional sintering and spark plasma sintering (SPS) techniques. The microstructure of the sintered cermets was characterized in terms of carbides (core + rim) size, ceramic contiguity and mean free path of the binder. Hardness and fracture toughness were estimated for the sintered cermets. High densities are obtained for cermets prepared via SPS than conventional sintering. Addition of TaC in Ti(CN)-WC-Ni/Co cermets resulted in high hardness and fracture toughness. Refined size and least fraction of adjacent ceramic phase are attributed for improved properties of SPSed Ti(CN)-5WC-10Ni-10Co-5TaC. To understand the friction and wear behaviour of sintered TiCN based cermets, unlubricated sliding wear study was carried out. Three different commercially available counter-body balls (steel, cemented carbide and SiC) were selected and tests were performed at varying loads. The dominant mechanisms of material removal on the worn cermet discs as well as counter bodies in the selected sliding conditions were elucidated as function of cermet composition and sintering technique. It was found that among the investigated cermets, the Ti(CN)-5WC-10Ni-10Co-5TaC cermet exhibited stabilized friction and reduced wear due to formation of strongly adherent tribochemical layer and is found to be more promising for superior performance in sliding wear conditions against any counter-body and load. Debris particles were collected after wear tests and their shape and size also studied to obtain a better understanding of friction and wear behaviour of the investigated cermets. Further performance of the sintered TiCN based cermets was studied in machining conditions against 304 stainless steel rod and compared with commercially available cemented carbide tool. Turning operations were performed at different cutting speeds and time intervals for a given feed rate, depth of cut and cutting force was recorded. Dominant crater wear mechanisms were studied on the TiCN based cermets tools and carbide tip tool. Increased intensity of crack, grain pull-out and fracture are observed in conventional sintered Ti(CN)-5WC-20Ni cermet tool, whereas increased resistance against crack or fracture is observed in conventionally sintered and SPSed Ti(CN)-5WC-10Ni-10Co-5TaC cermet tools. Further damage during turning is restricted in SPSed Ti(CN)-5WC-10Ni-10Co-5TaC cermet tool due to formation of adhered layer beneath the tool face. Summarizing, in the present study, an attempt is made to understand the relation of sintering conditions, composition, microstructure, mechanical properties, wear behavior and tool performance of newly designed TaC added Ti(CN)-WC-Ni/Co cermets.



**Name of Research Scholar:** Sandeep Soni

**Title of Ph.D. Thesis:** An Investigation into Steady-State and Dynamic Properties of the Non-Circular Cylindrical Floating Ring Bearing in Laminar and Turbulent Flow Regime (2017)

**Supervisor:** Dr. D. P. Vakharia, Professor, Department of Mechanical Engineering, Sardar Vallabhbhai National Institute of Technology, Surat (Gujarat)-395 007



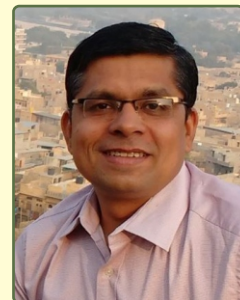
**Brief Abstract of Thesis:**

The thesis scrutinized the performance behaviour of a modified version of the plain cylindrical floating ring bearing, i.e. the non-circular cylindrical floating ring bearing (NCCFRB), in which the outer bearing of the floating ring bearing is changed in the form of lobed pattern. The proposed bearing consists of two lubricant films between inner and outer bearing. The presence of two lubricant films provides better dynamic stability and lesser temperature rise in the proposed journal bearing configuration. The classical Navier-Stokes equations along with the continuity equation in cylindrical co-ordinates, representing the flow-field in the clearance space of non-circular cylindrical floating ring bearing, are solved by finite element method applying the Galerkin's technique to obtain the bearing performance characteristics. To achieve a solution for Newtonian lubricant, firstly the three dimensional momentum and continuity equations under laminar flow condition are solved and then the solution is upgraded iteratively. The turbulence effect is incorporated in numerical iteration procedure by modifying the governing equations term using the linear turbulence model of Ng and Pan. The steady-state and dynamic performance characteristics of non-circular cylindrical floating ring bearing are computed at various eccentricity ratios and ratio of clearances over a wide range of Reynolds number up to 12000. The results for laminar flow condition are also computed. A computer algorithm has been developed for computing the various steady-state and dynamic performance characteristics of the proposed bearing. In the present dissertation work, the steady-state characteristics in terms of load carrying capacity, attitude angle, friction coefficient variable, bearing oil flow (end-leakage) and temperature rise variable are computed for laminar and turbulent flow regime. Dynamic performance characteristics of the non-circular cylindrical floating ring bearing operating in laminar and turbulent flow regime using Newtonian lubricant are computed in terms of stiffness and damping coefficients, critical journal mass, whirl frequency ratio and equivalent support stiffness coefficient. The dynamic stability margins with reference to critical mass are computed using Routh's criteria. The results obtained predict better performance in the turbulent regime as compared to the laminar regime for the noncircular floating ring bearing. The non-circular cylindrical floating ring bearing has superior performance characteristics in comparison with plain cylindrical floating ring journal bearing.

**Name of Research Scholar:** Mukesh Kumar Dubey

**Title of Ph.D. Thesis:** Development and Performance Evaluation of Polytetrafluoroethylene based Nano and Micro-Oils (2016)

**Supervisor:** Prof Jayshree Bijwe, Professor, ITMMEC, Indian Institute of Technology - Delhi and Dr. SSV Ramakumar, Director (R&D), Indian Oil Corporation, Corporate R&D, Faridabad



**Brief Abstract of Thesis:**

Nano-particles have attracted much interest in recent years due to their excellent physical and chemical properties. They are different from conventional bulk materials because of extremely small size and large surface area. The nano-particles as additive in conventional lubricants has become an important field of research. Though the area of nano lubricant is explored in some details for NPs of metal and metal dichalcogenides, hardly any efforts are put to explore the potential of PTFE NPs as an additive in lubricating oil. Hardly any comparative studies are done to provide an insight on the influence of size effect by comparing the performance of micro-lubricant (MLs) and nano-lubricants (NLs) with varying sizes of same additive. This becomes more important when such studies are reported for high performance polymer composites.

The thesis work was aimed to develop various oils containing micro and nano-particles of PTFE to investigate the influence of size and amount of particles and also that of dispersant on the performance properties including tribological ones (anti-friction, anti-wear and extreme pressure). PTFE based oils (varying sizes and amounts) with and without dispersant were developed. All the oils showed significant improvement in weld load as a result of addition of PTFE. Best performance (highest weld load) was shown by OSS12 (454 % > OP). The size of the particles played a significant role in the oil performance. Smaller the size better was the performance if % of PTFE was same. Highest reduction in friction coefficient (40%) and wear scar (20%) was reported due to addition of 12 % PTFE. Since the Nano-PTFE showed excellent performance as EP additive, it was compared with the most commonly used commercial EP additive viz. ZDDP. Best performing nano-oil (ON3) on EP test, was compared with oil containing 1%, 2 % and 3 % ZDDP. This confirmed that the Nano-PTFE at 3% concentration is twice as effective as that of popularly used EP additive in equivalent concentration. Moreover, it has special advantage of being environment friendly. The thesis also discusses on the effect of addition of dispersant in the stability and other physical properties of the nano-oils followed by the tribological properties and worn surface study to understand the wear mechanism.



## New Members of Tribology Society of India (February 2017 to July 2018)

Sr. No.	LM #	Name	Affiliation
1	5820	Dr Himanshu Pathak	IIT Mandi, Himachal Pradesh
2	5821	Dr Sunny Zafar	IIT Mandi, Himachal Pradesh
3	5822	Dr Mohammad S. Azam	IIT Dhanbad, Jharkhand
4	5823	Mr Paras Kumar	Delhi Technological University, Delhi
5	5824	Mr Kailash Nath Yadav	IOCL R&D Centre, Faridabad, Haryana
6	5825	Mr Homender Kumar	IIT BHU, Varanasi
7	5826	Mr Sooraj Singh Rawat	IIT BHU, Varanasi
8	5827	Mr Hemant Kumar	IIT BHU, Varanasi
9	S-5828	Mr Khemraj	IIT BHU, Varanasi
10	5829	Mr Shubhajit Das	NIT Arunachal Pradesh
11	5830	Ms Sangeeta Das	NERIST, Papum Pare Arunachal Pradesh
12	5831	Mr Akant Kumar Singh	NIT Hamirpur Himachal Pradesh
13	5832	Mr Hemant M Bari	Reliance Infrastructure, Dahanu Thermal Power Station, Mumbai
14	5833	Mr Sarat Kumar Senapati	IndianOil Corp.Ltd. (MD), Odisha
15	S-5834	Mr Avinash Vitthal	NIT Warangal Telangana
16	5835	Mr Ashok Kumar M. S.	Dayananda Sagar Academy of Technology & Management, Bangalore
17	5836	Mr Krishnamurti Singh	IIT PATNA Bihar
18	5837	Dr P Sathyabalan	Kumaraguru College of Technology Coimbatore, Tamil Nadu
19	5838	Mr Rahul Kumar	IIT Dhanbad Jharkhand
20	5839	Mr Vivek Kashyap	IIT Madras, Tamil Nadu
21	5840	Mr Sanjay R Patel	Maharaja Sayajirao University of Baroda, Gujarat
22	5841	Mr Sandeep Bhoi	Parala Maharaja Engineering College, Brahmapur, Odisha
23	5842	Dr R Dhanasekaran	GNIT Hyderabad Telangana,
24	S-5843	Ms Sangita Kumari	IIP Dehradun, Uttarakhand
25	5844	Mr Putta Nageswara Rao	Vasireddy Venkatadri Institute of Technology, Guntur, Andhra Pradesh
26	5845	Mr Subrata Kumar Ghosh	IIT Dhanbad Jharkhand
27	5846	Dr Swati Gangwar	Madan Mohan Malaviya University of Technology Gorakhpur UP
28	5847	Mr Niranjana Heremath	REVA University Bangalore, Karnataka
29	S-5848	Mr Aswani Kumar	IIT (ISM) Dhanbad, Jharkhand
30	5849	Dr Dinesh Singh G Thakur	DRDO , Ministry of Defence , Pune
31	S-5850	Ms Ekta Singh Shrinet	IIT (ISM Dhanbad) Dhanbad
32	5851	Mr Santosh A Dahotre	Michell Bearings India LLP, Bangalore
33	S-5852	Mr Santosh Kumar	IIT (ISM), Dhanbad
34	5853	Mr Yogesh Jeyaram	Bruker India Scientific Pvt. Ltd., Bangalore
35	5854	Dr Pikeshe Bansal	ABES EC Ghaziabad, UP
36	5855	Mr Ch. Sri Chaitanya	NIT Warangal
37	5856	Mr Vibhor	Tata Steel Ltd., Kalinganagar, Odisha
38	5857	Mr Kushal Khemka	Pensol Industries Limited, Indor MP
39	5858	Mr Syed Ismail	NIT Warangal
40	5859	Ms C Sumalatha	MVSREC, Hyderabad, Telangana
41	5860	Dr Raj Kumar Sahu	NIT Raipur, Chhattisgarh
42	5861	Mr Jibin T Philip	IIT Mizoram
43	5862	Mr Pawan Kumar	IIT Kurukshetra
44	5863	Mr Bharat Kumar	IIT BHU Varanasi
45	5864	Dr Srinivasu Gangi Setti	NIT Raipur
46	5865	Mr Vijay Kumar Hiremath	SIT Tumkur, Karnataka
47	5866	Ms Poonam Kumari	ISM Dhanbad, Jharkhand
48	5867	Mr Mehesh K. Bhiwapurkar	OP Jindal Univesity, Chhattisgarh
49	5868	Mr Krishnakumar N	PSG College of Technology, Coimbatore
50	5869	Mr Shankar Swarup Das	NIT Agartala

Sr. No.	LM #	Name	Affiliation
51	5870	Mr G J Naveen	Shambharam Institute of Technology, Bangalore
52	5871	Mr Ramakrishnaiah	Dayananda Sagar Academy of Technology & Management, Bangalore
53	5872	Mr Veeresh Murthy	Dayananda Sagar Academy of Technology & Management, Bangalore
54	5873	Ms Sangita Kumari	CSIR-IIP Dehradun
55	5874	Mr Anand Prakash Gupta	BPCL, Mumbai
56	5875	Mr Ashutosh Kumar	IIT Guwahati
57	5876	Dr Parikshit Mahato	CSIR-CMERI, Durgapur, West Bengal
58	5877	Mr Surender Kumar	NIT Hamirpur
59	5878	Mr Avi Gupta	IIT Delhi
60	5879	Mr Saurabh Mishra	IOCL, R&D Centre, Faridabad
61	S-5880	Mr Tushar Kiran	Integral University, Lucknow UP

Corporate Member			
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*We extend our hearty welcome to the new Members and look forward to their active contribution in TSI activities.*



# OBITUARY

Professor Digvijay Singh  
(11 December, 1934 - 20 July, 2018)



Tribology Society of India deeply mourns the sad demise of Prof. D V Singh, who left for his heavenly abode on 20th July 2018 at New Delhi.

Dr DV Singh obtained his basic degree of Science from Allahabad University, degrees of Mechanical Engineering and Civil Engineering from University of Roorkee and his M.S. and Ph.D. from the University of Wisconsin. He joined the faculty of University of Roorkee in 1958 and served the University as Professor and Dean until 1990. He was the Director of CSIR-Central Road Research Institute, New Delhi during 1990-1996; Vice Chairman of AICTE during 1996-2000; Vice Chancellor, University of Roorkee and then Director, IIT Roorkee during 2000-2002.

During his long and distinguished professional career, Prof. Singh published 160 research papers, guided 19 Ph.D Theses and several M.E. Theses. His areas of specialization included Dynamics and Mechanical Systems, Tribology, Stress Analysis, Fluid Mechanics and Road Transportation Engineering. Among his distinguished research output, his pioneering work on dynamic stability of two-wheeled vehicles and his analytical work on hydrodynamic and hydrostatic bearing and fluid seals stand out for their originality and high technical standard.

Prof. Singh's illustrious career is marked by numerous awards and professional recognition. He won the coveted Shanti Swarup Bhatnagar Prize in 1978 at the age of 41 years. He later went on to serve the Tribology Society of India as its President. His other accolades include the Life Time Achievement Award of Tribology Society of India, the Life Time Achievement Award of International Society of Production Engineers, USA; the Distinguished Alumnus Award of the IIT Roorkee; the National Design Award of IE (I); the IMDA Silver Jubilee Award and the Khosla Award.

Prof. Singh served on many scientific, technical and academic committees and added significant value through his expertise and rich experience. These include the Science and Engineering Council of DST; Program Advisory Committee of Civil and Mechanical Engineering (Chairman); PAC of Manufacturing Technology; TIFAC –CAR Program Committee and its Panel on IC Engines and Drive Trains (Chairman); Fly Ash Mission of DST (Lead Person); INAE Forum of Technical Education (Chairman); Research Council of

CSIR – CRRRI (Chairman); National Board of Accreditation; Board of Governors of the Engineering Council of India and Board of Governors, IIT Kanpur. He also served the DST Technology System Development Group (Chairman) and DST-PAC of International Program (Engineering and Material Science).

With Prof. Singh's demise the Tribology community has lost one of its brightest stars and Tribology Society of India, in particular, has lost one of its greatest patrons.

May his departed soul rest in eternal peace.

All Members are invited to send their publication materials, suggestions and feedback to Mr. A. K. Mehta, ED (TSI) at the email ID: [office.tsi@tribologyindia.org](mailto:office.tsi@tribologyindia.org)

Compiled by Mr. A. K. Mehta, ED (TSI) and Edited by Dr. Barun Chakrabarti, Vice President (TSI), on behalf of Tribology Society of India. This publication is for free circulation among TSI Members.



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