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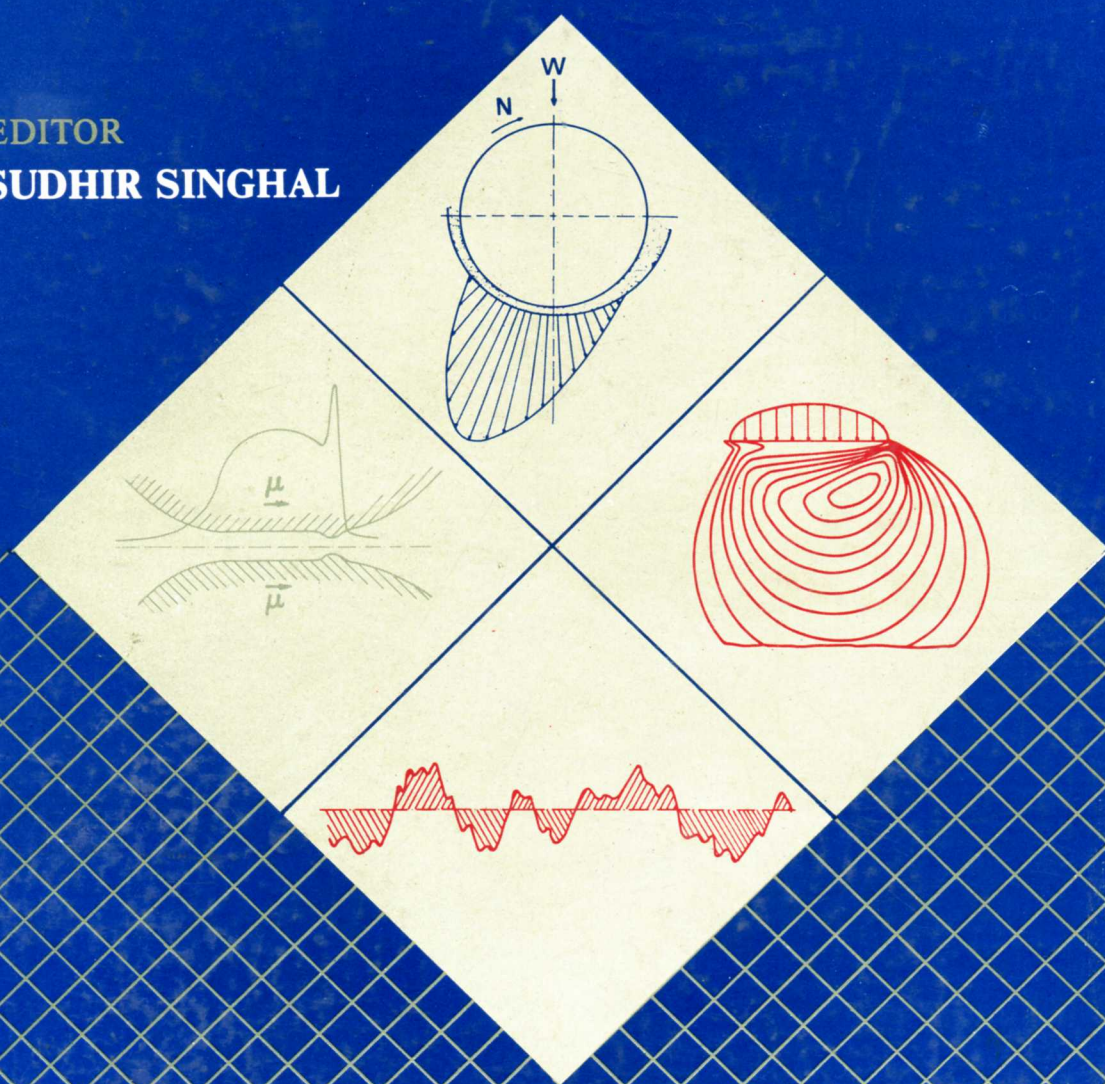
TRIBOLOGY

PROCEEDINGS OF THE X NATIONAL CONFERENCE
ON INDUSTRIAL TRIBOLOGY, MARCH 24-26, 1993,
INDIAN INSTITUTE OF PETROLEUM, DEHRA DUN

VOLUME I

EDITOR

SUDHIR SINGHAL



RECENT ADVANCES IN
TRIBOLOGY

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RECENT ADVANCES IN **TRIBOLOGY**

VOLUME I

Papers presented at the
**X NATIONAL CONFERENCE ON
INDUSTRIAL TRIBOLOGY**
INDIAN INSTITUTE OF PETROLEUM
Dehra Dun, India
March 24-26, 1993

Editor

SUDHIR SINGHAL



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Editor
SUDHIR SINGHAL

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FOREWORD

Energy efficiency is a good indicator to assess the level of advancement achieved. Over 50% of the energy need is met by the oil and about 30% of total energy produced is consumed in overcoming friction. Out of this 30%, considerable part can be conserved through application of correct tribological principles and practices. In addition to energy, material conservation can also be affected through wear reduction. Besides energy and material conservation, there are other indirect advantages such as reduced outage time of plants, improvement in production efficiency, etc. In the country like ours where energy conserved is energy produced, tribological practice can prove as a boon to harness the economy. The current world trend is towards the use of synthetic, environment friendly, multigrade lubricants, friction modifiers and wear resistant surface treatments to improve the tribological performance of the components.

The X National Conference on Industrial Tribology offers a platform to tribologists, practising engineers, professionals from research and industry to share their experience and to identify the knowledge gaps existing between theory and practice. IIP has a strong group of scientists and engineers engaged in tribological research in the area of lubrication, lubricant development, wear modelling, wear mechanisms, automotive and metal working lubrication and contributed significantly in this area of tribology.

I hope that the Conference will be able to identify the knowledge gaps and to plan for future need of the country.

I wish the Conference all success.

IIP Dehra Dun
March, 1993

Dr. T.S.R. PRASADA RAO
Director
Indian Institute of Petroleum
Dehra Dun

FROM THE ORGANISING SECRETARY

Technology advancement can be measured through effective utilization of energy. Tribological approach to machine design and selection of materials can play a dominant role in energy and material conservation. Researchers and practising engineers both have to work hand in hand to reduce the knowledge gap prevailing between the theory and practice. The role of the Government is to draw attention of people to this and to provide motivation for adopting the correct practices.

The X National Conference on Industrial Tribology is a platform where research scientists and practising engineers can share their experiences. Keeping this in view, the theme of the Conference is chosen as: *The Challenges in Tribology: Indian Requirements*. It would be a matter of great satisfaction not only to the organisers but also to the whole tribology community in the country, if some useful thoughts and directions for perspective development can come out of the deliberations at this Conference.

The subject matter of the Conference is divided into 9 broad areas. The charge of each of this area has been given to a Session Organiser, with requisite background and experience. He is responsible for selection and review of papers in his area and for the conduct of his session. This experiment has been tried for the first time in this series of conferences.

As you all know organising a conference is a large task. I have been able to accomplish this with the willing cooperation of my numerous colleagues and of tribologists and practising professionals in the country. I would like to express my gratitude to all people who have contributed towards this. I am thankful to all authors whose papers could be accommodated as well as to those for whom we could not find space this time. The response of papers was overwhelming. I hope they will understand my predicament. I am grateful to the Director, Indian Institute of Petroleum for readily agreeing to host this Conference at IIP and extending all help.

SUDHIR SINGHAL

Head

Petroleum Products Application Division

Indian Institute of Petroleum

Dehra Dun

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MARCH 24-26, 1993

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MARCH 24-26, 1993**

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