ACKNOWLEDGEMENT

The author is pleased to express his sincere thanks and gratitude beyond words to his supervisor Prof. Rajnesh Tyagi and co-supervisors, Prof. Jianbin Luo and Dr. Rakesh Kumar Gautam for their consistent help, encouragement and valuable discussions during the entire period of his research work. The author would not have been able to complete the thesis without their utmost involvement and invaluable efforts. They motivated the author to pursue research problems and the need for persistent effort to accomplish the goal. The author is truly indebted to them.

Besides supervisors, the author would like to thank his RPEC members, Prof. A. P. Harsha and Prof. Sunil Mohan for their insightful comments and encouragement. The author acknowledges his deep sense of gratitude to the current and former Heads of the Department of Mechanical Engineering for providing all the research facilities to accomplish his research in the Department successfully. The author has an immense sense of gratitude to all the faculty members of the Department of Mechanical Engineering, IIT (BHU), Varanasi for their cooperation and inspiration.

The author is highly obliged and wishes to express his sincere thanks to Prof. Jianbin Luo (Tsinghua University) for allowing him to work in the State Key Laboratory of Tribology (SKLT), Tsinghua University China as a non-degree student. The author also wishes to record his sincere thanks to Prof. Zhang Chenhui and Dr. Xinchun Chen for lending their continuous support during his stay at Tsinghua University. The author is also thankful to all his friends, lab and office staff of the SKLT, Tsinghua University.

The author is grateful to all his friends Mr. Hemant Nautiyal, Mr. Amit Ambar Gupta, Mr. Sushil Yadav, Mr. Rabindra Prasad, Mr. Ashish Pareta, Mr. Akash Awale, Mr. Ashwani Ranjan, Mr. Sanjay Gupta, Ms. Pooja Verma, Mr. Nitish Mahto, Km Shafali, Mr. Mithlesh Kumar Mahto, Mr. Adarsh Kumar and seniors especially Dr. Pushkar Jha, Dr. Avinash Ravi Raja, Dr. Manvendra Singh, Dr. Prashant Kumar, Mr. Manish Kumar, and Mr. Rohit Kumar Singh Gautam for their constant encouragement, making joyful and memorable life being with him in moments of happiness and difficulties at IIT (BHU), Varanasi. The author is also thankful to all the lab and office staff of the department, especially Mr. Vijay Pratap Srivastava (CAM lab).

The author would also like to express his immense gratitude to his grand-parents Smt. Keshrani and Shri Chet Singh, parents Smt. Krishna Sengar and Shri Ram Kishor Sengar, brother Mukesh Singh, and sister Dolly Sengar for their unconditional support and encouragement to pursue his interest. The author also wishes to thank all those who have helped in any manner during the course of his research work.

At last thanks to the almighty God who has given the author spiritual support and courage to carry out this work.

(SUDESH SINGH)