

Dr. Ali Usman

Department of Mechanical Engineering

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P.E.C. Registration No.: MECHATRO/494

Education

Degree From – Till	Institution	Subject	CGPA
Ph.D. 2014–2017	Kyungpook National University, S. Korea	Mechanical Engineering	4.15/4.50
MS 2008 – 2011	National University of Science and Technology, Pakistan	Mechanical Engineering	3.45/4.00
BE 2004 –2008	Air University, Pakistan	Mechatronics Engineering	3.47/4.00

Professional Experience

Designation From – Till	Institution	Department
Assistant Professor 2/2017 – Present	CIIT Wah	Mechanical Engineering Department
Assistant Professor 9/2013 – 3/2014	International Islamic University, Islamabad	Mechanical Engineering Department
Lecturer 2/2011 – 9/2013	HITEC University Taxila Cantt, Pakistan	Mechanical Engineering Department
Lab Engineer 9/2010 – 2/2011	HITEC University Taxila Cantt, Pakistan	Mechanical Engineering Department

Awards & Achievements

- Best graduate student award 2017 from Kyungpook National University South Korea.
- Best research paper award in KSV International Conference Spring-2016. Daegu, South Korea.
- HITEC University's letter of appreciation in multiple academic years for outstanding teaching practice and student feedback.
- Kyungpook National University International Graduate Scholarship
- National University of Science and Technology Mega S&T Scholarship
- Merit Scholarships during several undergraduate semesters at Air University
- AIR University Honored Student Certificate

Research Publications

International Journal Articles (SCI/SCIE Indexed—Impact Factor):

- Usman A, Park CW. Numerical investigation of tribological performance in mixed lubrication of textured piston ring-liner conjunction with a non-circular cylinder bore. Tribology International 2017;105:148–157.
- Usman A, Park CW. Modeling and Simulation of Frictional Energy Loss in Mixed Lubrication of a Textured Piston Compression Ring during Warm-up of SI Engine. International Journal of Engine Research. 2017;18:293–307
- Usman A, Park CW. Optimizing the tribological performance of textured piston ring–liner contact for reduced frictional losses in SI engine: Warm operating conditions. Tribology International 2016;99:224–236.

- Usman A, Park CW. Numerical investigation of frictional behavior and energy loss in mixed-hydrodynamic contact of piston ring pack with deformed cylinder liner during warm-up period of SI-engine. *Energy Conversion and Management* 2016;117:115–131.
- Usman A, Park CW. Mixed lubrication of piston compression ring with deformed cylinder liner during warm-up of spark ignition engine. *Proceedings of the Institution of Mechanical Engineers, Part J: Journal of Engineering Tribology* 2016;230:1288–1309
- Usman A, Park CW. Transient lubrication of piston compression ring during cold start-up of SI engine. *International Journal of Precision Engineering and Manufacturing-Green Technology* 2016;3:81–90.
- Usman A, Cheema TA, Park CW. Tribological performance evaluation and sensitivity analysis of piston ring lubricating film with deformed cylinder liner. *Proc IMechE Part J: J Engineering Tribology* 2015;229:1455–1468.

Non-SCI/SCIE:

- Riaz S, Usman A. Two Stage Discrete Time Extended Kalman Filter Scheme for Micro Air Vehicle. *International Journal of Advances in Engineering & Technology* 2012;3:76-83.
- Riaz S, Usman A. Three Stage Discrete Time Extended Kalman Filter Scheme for Micro Air Vehicles. *International Journal of Research and Reviews in Applied Sciences* 2012;11:101–6.

International Conferences Papers

- Usman A, Park CW. Optimization of surface texture for improved piston ring lubrication. *Proceedings of the KSV International Conference Spring-2016. Daegu, South Korea. 2016.*
- Usman A, Cheema TA, Kwak MK, Lee CY, Kim GM, Park CW. Effect of cylinder liner deformation on piston ring lubrication. *Proceedings of the International Conference of Manufacturing Technology Engineers (ICMTE). Jeju, South Korea. 2014. p. 184.*
- Malik MA, Qasim SA, Usman A, Mufti RA. Two-Dimensional Elastohydrodynamic Lubrication Fluid Flow Modeling of Piston Top Ring Considering Elastic Deformation in Initial Engine Start Up. *ASME 2010 International Mechanical Engineering Congress and Exposition. Vancouver, Canada: ASME; 2010. p. 119-27.*
- Malik MA, Usman A, Qasim SA, Mufti RA. Modeling of Piston Top Ring Lubrication by considering Cylinder Out-of-Roundness in Initial Engine Start up. *The World Congress on Engineering. London, U.K. 2010. p. 1331-6.*
- Usman A, Qasim SA, Mufti RA, Malik MA. Modeling the Energy Loss in the Two-Dimensional Lubrication of First Compression Ring in the Initial Engine Start-Up. *IEEE International Conference on Energy Systems Engineering Islamabad, Pakistan 2010.*

Book

- Usman A, Riaz S, Malik MA. *Introduction to Modeling and Simulation of Piston Ring Lubrication.* Deutschland: LAP LAMBERT Academic Publishing; 2013. ISBN: 978-3-659-35077-1

Ph.D. Dissertation

Title: Piston Ring Surface Modification for Improved Tribological Performance in Internal Combustion Engine

Brief Introduction: The asymmetric PRL contact of a textured piston ring in a distorted bore is considered and a 2D Reynolds equation is solved with mass-conserving cavitation algorithm. Asperity interaction in mixed lubrication, axial ring dynamics, variable ring conformability, and realistic engine oil rheology are incorporated in the investigation of tribo-performance of a non-axisymmetric textured PRL interface. Surface texture patterns with varying shapes and orientations are used and individually optimized to minimize energy loss. Thereafter, the performances of optimized texture patterns are compared at various stages of engine warm-up process. Optimized geometrical parameters for different rings with varying degrees of conformity with cylinder liner are also evaluated. Several multigrade and monograde oils are tested to draw comprehensive conclusions.

Outcomes: Results show that optimized surface textures improve the tribological performance of PRL interface, whereas textures with large lateral aspect ratios have a detrimental effect. Ring-surface texturing substantially reduces energy loss during the entire range of liner temperatures, whereas the surface texturing-induced increase in oil transport to the combustion chamber remains minimal.

MS Dissertation

Title: Compression Ring Hydrodynamic and Elastohydrodynamic Lubrication Modeling in the Initial Engine Start Up

Brief Introduction: Modern engine design demands better fuel economy, reduced exhaust emissions, increased recyclability, freedom from hazardous substances, and enhanced operating life. To fulfill these requirements, automobile engine manufacturers ensured that piston ring design must reduce frictional power loss, oil transport into the combustion chamber, and wear, as piston ring accounts for a majority of the mechanical power loss of the internal combustion engine. A two-dimensional hydrodynamic and elastohydrodynamic model is developed by incorporating axial and circumferential changes in film profile. The model is simulated using indigenously developed MATLAB computer program. A parametric study is conducted for piston ring running face profile, engine speed and degree of distortion in the noncircular cylinder liner.

Outcomes: Tribological performance parameters are strongly influenced by bore non-circularity. Liner distortion generates lateral pressure gradients resulting in non-axisymmetric ring–liner contact, and conformability of ring remains limited.

BE. Final Year Project

Title: Designing and Fabrication of Material Testing Machine using Hydraulic power

Brief Introduction: Double column machine of 4-ton capacity is developed which used hydraulic fluid power for precisely controlled strain rate. Data acquisition system is designed and developed indigenously for data handshaking. Machine can easily test all materials having tensile strength less than 150MPa according to ASTM Standard.

Project modules:

- Design of Mechanical Structure, Hydraulic, and Instrumentation Circuit
- Stress and Deflection Analysis of Mechanical Structure using ANSYS
- Fabrication and Implementation of Design
- Comparison of Experimental results to Theoretical results

Project Supervised

- Design, analysis, and manufacturing of multisource Stirling engine based power plant.
- Design and fabrication of fuel efficient prototype car for Shell Eco-marathon 2012.

Other Project

- LABVIEW coding for Valve Train Instrumentation to get tribological performance.
- Bifurcation analysis of wing fluttering using a self-excited oscillator, like Rayleigh equation.
- MATLAB coding for conventional and non-conventional optimization techniques
- Modeling and simulation of indeterministic bridge structures using FEM and MATLAB
- Drafting and stress analysis of Suzuki car piston, and piston connecting rod mechanism using ANSYS
- Interfacing Pressure sensor to microcontroller and LCD
- Interfacing DC motor to microprocessor to control motor speed
- RPM measuring of a DC motor using microcontroller and Infrared sensor
- Designing and Implementation of DC motor direction control system and interfacing to microprocessor
- Making Line Tracking Robot using LEGO
- Designing and Implementation of Traffic Light Control system
- Computer game named as “Snake and ladders” developed in C++
- Technical Report writing of all respective projects mentioned above

Internships

Designation From – Till	Institution	Department
Internee 07/2007 – 08/2007	Attock Refinery Limited, Rawalpindi, Pakistan	Maintenance Engineering Department
Internee 08/2006 – 08/2006	Orient Petroleum International Inc, Dhurnal Field, Pakistan	Maintenance Engineering Department

Skills in Technical Tools and Programming Languages

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| <ul style="list-style-type: none"> ▪ COMSOL ▪ ANSYS ▪ MATLAB ▪ LabVIEW | <ul style="list-style-type: none"> ▪ Assembly ▪ Verilog ▪ PLC Programming | <ul style="list-style-type: none"> ▪ AutoCAD ▪ Automaton Studio ▪ Turbo C++ | <ul style="list-style-type: none"> ▪ Express PCB ▪ Model Sim ▪ 20SIM |
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Conferences & Workshops Attended

- KSV International Conference Spring-2016. 02 Oct 2016, Daegu, South Korea. 2016.
- International Conference of Manufacturing Technology Engineers (ICMTE) 2014, Jeju S. Korea
- International Conference on Energy Systems Engineering 2010 Islamabad, Pakistan.
- Three Days Workshop on CFD Modeling for Internal & External flow using ANSYS 2013 held in Muhammad Ali Jinnah University Islamabad, Pakistan
- Two Days Workshop on CFD Modeling and design optimization of Turbomachinery 2013 held in Muhammad Ali Jinnah University Islamabad, Pakistan