**ENGR. MUHAMMAD SHUJA KHAN**
Graduate Assistant (Teaching/Research)
PhD Student (Major: Electrical)
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## RESEARCH INTERESTS

- Bio – Nanotechnology (Biological Machines at Nano level), N/MEMS fabricating techniques, Smart N/MEMS devices, Renewable Energy Technologies.

## EDUCATIONAL RECORD

- **PhD Electrical and Electronics Engineering:** The University of Alabama in Huntsville Alabama USA (August 2012 to date).
- **MS Electronic Engineering**: Ghulam Ishaq Khan **(G.I.K.)** Institute of Engineering Sciences & Technology, Swabi, Pakistan (September 2007 to June 2009).
- **B.Sc. Electrical Engineering (POWER)**: University of Engineering & Technology (**U.E.T.**), Lahore, Pakistan (January 2003 to July 2007).

## WORK EXPERIENCE

- **Lecturer,** Department of Electrical Engineering, **COMSATS** Institute of Information Technology (CIIT), (*COMSATS – Lancaster UK Dual Degree Programme)* Lahore, Pakistan ***August 07, 2009 to date (study leave***)
- **Foreign Research Internee (Honorary)** at **NanoFabrication Facility, City University of NewYork NanoEngineering and Technology Laboratory**, NY, USA (***July 22, 2011 to August 19, 2011***).
- **Trainee at GEM4 Summer School** Program on **Cellular and Molecular Machines with a focus on Biological Machines, Georgia Institute of Technology, Atlanta**, GA USA (***June 20- 30, 2011***).
- **Teaching Assistantship**, Faculty of Electronic Engineering, Ghulam Ishaq Khan Institute of Engineering Sciences & Technology, Swabi, Pakistan **(*September 08, 2008 to May 20, 2009***).

## COURSES TAUGHT (January 2009 to June 2012)

- EEE231Electronics-I SPRING2012
- EEE375 Power Distribution and Utilization in SPRING 2011, SPRING2012
- EEE371 Electric Machine in FALL 2011, SPRING2011, FALL 2010
- EEE261 Electromagnetic Theory in FALL 2009, SPRING 2010
- Undergraduate Lab: Electric Circuit Analysis-I in FALL 2008
- Graduate Lab: EE526 Introduction to MEMS design in SPRING 2009

## HONORS AND AWARDS

- **Best Research Productivity Award 2011 on April 15, 2012** by COMSATS Institute of Information Technology Pakistan
- **Recipient of Honorarium Award** in recognition of excellent services rendered at COMSATS Institute of Information Technology during **financial year 2010-11.**
- **Recipient of International Conference Travel Grant Award** for attending and presenting research paper **(ORAL) in IEEE/ICMENS 2010, China.**
- **Recipient of Honorarium Award** in recognition of excellent services rendered at COMSATS Institute of Information Technology during **financial year 2009-10.**
- **Recipient of International Conference Travel Grant Award** for attending and presenting research paper **(ORAL) in IEEE/ICSCT 2009, South Korea.**
- **Recipient of MS/M.PHILL Leading to PhD under Indigenous 5000 PhD Fellowship Scheme Award, Batch-IV, 2007.**
- **IEEE student chapter Consolation Award** for the Final Year Project "Prototype Modeling of Smart Grid Technology using Solar-Wind energy at CIIT Lahore Pakistan" (Project Supervisor: Engr. Muhammad

Shuja Khan) in All Pakistan Technical Paper Competition APTEC held on **April 19, 2011, IEEE Student Chapter CIIT Lahore Pakistan.**

## RESEARCH PUBLICATIONS DETAILS 2009 to Date

### Book:

1. **Muhammad Shuja Khan**, "Design of a Monolithic 3DOF MEMS Capacitive Accelerometer: Utilizing Surface Micromachining Technology Using PolyMUMPS Process" LAP Lambert Academic Publishing Germany, **July 07, 2011**, ISBN: 978-3845409528

### International Journals

1. **M. Shuja Khan**, S. Iqbal, I. Ahmad, E. Ibrahim, M. Imran, (2012) "Design and Implementation of Micro-Grid Smart Station Using Hybrid Integration of Solar-Wind" Journal of Smart Grid and Renewable Energy (SGRE). (***Accepted)*.**
2. **M. Shuja Khan**, Abid Iqbal, Shafaat A. Bazaz and Muhammad Abid (2012) "Physical Level Simulation of PolyMUMPs Based Monolithic Tri-Axis MEMS Capacitive Accelerometer Using FEM Technique", Advanced Materials Research Journal, Trans. Tech. Publications, Switzerland, ISSN: 1022-6680 and ISO certified; Vol: 403-408 (2012), pp. 4625-4632
3. Shafaat A. Bazaz, Abid Iqbal, **Muhammad S. Khan** (2011) "Monolithic Tri-axes Nickel based MEMS Accelerometer design verified through Finite Element Analysis (FEA)", Arabian Journal for Science and Engineering, Springer. Vol: in-press, ISSN: 2191-4281 (in press) **(Impact factor 0.224**)
4. I. Ahmed, M. Ahmed, **M. Shuja Khan**, K. Imran (2011) "A Novel Approach for Detection of Shorted Turns Fault in Machine Using Combination of Flux and Instantaneous Power Signal", International Journal of Computer and Electrical Engineering, (IJCEE), ISSN: 1793-8198, Vol: 3, Issue: 2, pp 233-239.
5. I. Ahmed, M. Ahmed, K. Imran, **M. Shuja Khan**, S. Junaid Akhtar (2011) "Detection of Eccentricity Fault in Electrical Machines Using Current, Flux and Instantaneous Power Signals", International Journal of Computer and Electrical Engineering, (IJCEE), ISSN: 1793-8198, Vol: 03, Issue: 01, pp 111-119.
6. I. Ahmed, Z. Ahmed, F. Patel, **M. Shuja Khan** (2011) "A Photo-Cathodic Protection System Utilizing UV Radiations", International Journal of Engineering & Technology, (IJET), ISSN: 2077-1185, Vol: 11, Issue: 01, pp 197-202.
7. M Arshad Javaid, Pir Bukhsh Khan, Mukhtar-ul-Hassan, **M Shuja Khan**, S F Shaukat, (2011) "Estimation of Solar Power Efficiency in Day Time at Different Temperature", International Journal of Engineering & Technology, (IJET), ISSN: 2077-1185, Vol: 11, Issue: 02, pp 54-58.
8. Nazifa Fatima, I. Ahmad, Kashif Imran, **M. Shuja Khan**, (2011) "Efficient path planning in semi-fault tolerant robotics", International Journal of Engineering and Technology (IJET), ISSN: 2077-1185, Vol: 11, Issue: 03, pp 120-125.
9. I. Ahmed, M. Ahmed, K. Imran, **M. Shuja Khan**, T. Akram, and M. Jawad (2010) "Spectral Analysis of misalignment in Machines using sideband components of Eccentricity, Shorted Turn and Broken Rotor Bar", International Journal of Electrical and Computer Sciences, IJECS, ISSN: 2077-1231, Vol: 10, Issue: 06, pp 85-93.
10. Intesar Ahmed, Manzar Ahmed, **M. Shuja Khan**, Kashif Imran (2010) "Investigation of Multiple Faults Detection in Electric Machine Using Broken Rotor Bar and Eccentricity Fault Frequencies Techniques", International Journal of Electrical and Computer Sciences, IJECS, ISSN: 2077-1231, Vol: 10, Issue: 05, pp 24-31.
11. M. Arshad Javaid, Pir Bukhsh Khan, Mukhtar-Ul-Hassan, **M. Shuja Khan** and S.F. Shaukat (2010) "The Measurement of Solar Electric Power in Form of A.C, D.C. Volt, Current and Power Efficiency of the System Using Inverter (Regulated Voltage)", World Applied Sciences Journal (WASJ), ISSN: 1818-4952, Vol: 10, Issue: 05, pp 508-512. **(Impact Factor: 0.2)**

### International Conference Proceedings

1. E. Ibrahim, S. Iqbal, M. Imran, **M. Shuja Khan** (April 2011) "Prototype modeling of Micro Grid Smart Station Using Hybrid Solar-Wind at COMSATS Institute Lahore Pakistan", IEEE All Pakistan Technical paper Competition (APTEC), 2011, April 19, 2011, Lahore Pakistan **(ORAL)**
2. **M. Shuja Khan**, Abid Iqbal, Shafaat A. Bazaz and Muhammad Abid (Dec 2010) "Physical Level Simulation of PolyMUMPs Based Monolithic Tri-Axis MEMS Capacitive Accelerometer Using FEM Technique", 6th IEEE International Conference on MEMS, NANO and Smart Systems, ICMENS 2010, 14-15 DEC 2010, pp 213-217, China (**ORAL)**

3. **M. Shuja Khan**, Shafaat A. Bazaz and Muhammad Abid (Dec 2009) "Comparative Study on System Model and Finite Element Analysis of a Monolithic 3DOF MEMS Capacitive Accelerometer", IEEE International Conference on Semi-Conductor Technology, ICSCT 2009, 17-19DEC 2009, pp 524-528, South Korea (**ORAL**)

## RESEARCH EXPERIENCE/INVOLMENTS

- **(03/2012 to date)** COMSATS Institute of Information Technology, Lahore Pakistan Renewable Energy and Power System (REAPS) Research Group, http://research.ciitlahore.edu.pk/Groups/REAPS/research.html
  **Study, Design and Prototype Modeling of DFIG Wind Turbine in Matlab/Simulink**
  **Brief Description:** In this project, students will focus on feasibility report and design implementation in MATLAB Simulink. Main theme of this project is to give alternative concept of generation and utilization of energy. Upon successful completion, proposed research will be utilized in implementing the real hardware which has the capacity of 1MW output power to mitigate the current demand-supply energy gap. Project investigator (PI) is working on writing the mega proposal for future implementation and research publications in ISI journals.

- **(09/2010 to 12/2011)** COMSATS Institute of Information Technology, Lahore Pakistan Renewable Energy and Power System (REAPS) Research Group, http://research.ciitlahore.edu.pk/Groups/REAPS/research.html
  **"Implementation of SMART-GRID Power Station using Hybrid Solar-Wind Technology"**
  **Brief Description:** In this project prototype modeling and implementation of smart grid (SG) with a small wind plant integrated with a solar panel has been done successfully at COMSATS Institute Lahore Pakistan. The charge controllers are special circuits for the purpose of controlling the abrupt change in voltage and stop the reverse flow of current towards Photovoltaic (PV) system or wind turbine, and also controlling the charging and discharging system. The integrator combines the two subsystems (solar and wind) and gives continuous reliable power. It provides regulated 12.3V DC voltage to load and 14.3V DC to battery bank and the excess amount of energy is being stored in the battery as a backup. Power inverter is used to for AC Load. The conclusion described in this project will focus the researchers to work for providing the clean energy using SG technology. I supervised two final year undergraduate projects relating to Smart Grid implementation and published one international conference paper.

- **(08/2009 to 08/2010)** COMSATS Institute of Information Technology, Lahore Pakistan Renewable Energy and Power System (REAPS) Research Group, http://research.ciitlahore.edu.pk/Groups/REAPS/research.html
  **"Investigation of Multiple Faults (Eccentricity, shorted turn and Misalignment) in Electric Machine"**
  **Brief Description:** In this work, non-invasive multiple sensors for the detection of shorted turns fault have been used. The fault has been detected using fault frequency components from flux and instantaneous power and a single signal (combination of flux and instantaneous power signals) called power-flux over a wide range of loads. To achieve this task, stator winding of the machine was re-wounded with taps to introduce shorted turns fault. An extensive series of laboratory tests were conducted to examine the fault frequency amplitudes for the healthy motor and faulty motors with different shorted turns. Results based on the variations in the amplitude of sideband components between healthy and faulty motors versus different frequencies over a wide range of loading conditions from different signals have been analyzed experimentally in detail. Overall, this extensive experimental work provides comprehensive detail to detect the shorted turn faults in machines using a novel combination of axial flux and instantaneous power signals into a single signal called Power-Flux Signal. I worked in this project as member REAPS research group and we extracted four Journal publications from this work.

- **(07/2011 to 08/2011)** City College of NewYork, Grove School of Engineering, MEMS and Nanotechnology Laboratory http://www-me.ccny.cuny.edu/ccnf/index.html
  **"Design structure of Microfludics with serpentine channels in COMSOL to study the physical growth of live human cells"**
  **Brief Description:** We demonstrated the use of a microfluidic device to micropattern cells in a microchannel and investigated the behavior of these cells under a concentration gradient. The designed microfluidic device consisted of 3 parts: a branched channel for generating a stable concentration gradient, a main channel for culturing cells, and 2 side channels that flowed into the main channel in COMSOL. This study describes modeling of a pressure driven laminar flow at low Reynolds number, inside a network of microchannels. This approach could be useful in advancing our understanding of cell behavior, especially in wound healing, tissue formation, and embryonic development. I gave my contribution as internee and as co-author, submitted the paper from this research.

- **(09/2007 to 06/2010)** Ghulam Ishaq Khan Institute of Engineering Science & Technology, Pakistan, MEMS Design Laboratory http://www.giki.edu.pk/pakmems/index.html
  **"Development of a Monolithic 3D MEMS Capacitive Accelerometer for Automobile Applications"**
  **Brief Description:** In this research we presented a novel monolithically integrated tri-axis capacitive accelerometer using standard PolyMUMPs and MetalMUMPs process. The behavioral modeling is done to verify the design, structural, modal and electrostatic performance of the designed three axis capacitive accelerometer. The 2D model is created in the designer module of Coventorware. The 3D layout is generated in the preprocessor module and mesh is created on solid model. The designed accelerometer is 3.2mm×3.5mm in size, designed for sensing the acceleration of 25g in three axis, has 0.291μg/√(Hz), 0.316μg/√(Hz), and 2.84μg/√(Hz) mechanical noise floor for in-plane(x & y) and out-of-plane(z) axes respectively. The total sense capacitance along x, y and z-axes is 68.5fF, 100fF and 6.19pF respectively. Sensitivity of 2.568fF/g, 4fF/g and 0.252pF/g is obtained for in-plane (x and y) and out-of-plane (z) axes respectively. The resonance frequency for the designed accelerometer is 800Hz and 2500 Hz for in-plane and out-of-plane axis. The device has been successfully fabricated and under testing. This research work was supported by National ICT R&D Fund and Higher Education Commission Pakistan under grant no. ICTRDF/TR2D/2008/02. I as principal author published one Journal and two International conference proceedings from this work.

## PROFESSIONAL ASSOCIATIONS

- **International Reviewer** of 3rd IEEE International Conference on Electrical and Mechanical Technology, (ICEMT), 26-27 August 2011, China.
- **International Reviewer** of 3rd IEEE International Conference on Machine Learning and Computing, (ICMLC), 26-28 February 2011, Singapore.
- **Member Final Technical Review Committee,** All Pakistan Technical Paper Competition (APTEC 2011), 19 April 2011, Pakistan.
- **Member International Technological Committee**, 6th IEEE International Conference on MEMS NANO, and Smart Systems, (ICMENS), 14-15 December 2010, China.
- **Member PAKMEMS Team**, ***Project of Microsystem***, funded by National Information and Communication Technologies Fund (NICT) of Ministry of Information Technology, Pakistan.
- **Member** of International Association of Computer Science and Information Technology (**IACSIT**), Singapore. (June 2009 to date).
- **Student Member** - Association of Energy Engineers (**AEE**), USA. (2006-2009).
- **Student Member** - The Institution of Electrical and Electronic Engineers (**IEEE**), USA. (2006-2007).

## TRAINING WORKSHOPS

- **Conducted Workshop** on ***Intelligent Control System***, offered by Control Power & Computing Research Group, CIIT Lahore on Dec 30, 2011
- **Attended GEM4 Summer School Program** on ***Cellular and Molecular Machines with a focus on Biological Machines***, Georgia Institute of Technology, Atlanta, GA USA (June 2011).
- **Instructor for the Short Training Certificate** course: ***"Power Distribution System Design", offered*** by Renewable Energy and Power system Research Group, CIIT in March-April 2010.
- **Instructor for the Seminar** on ***MEMS Inertial Sensors (Accelerometer & Gyroscope)***, July 21, 2010
- **Attended workshop**: Verilog HDL & RTL Level Design, 17th to19th February, 2009, G.I.K. Institute, Swabi, Pakistan.
- **Attended workshop**: "***Design Optimization & Analysis Techniques***" under Asia-Link FASTAHEAD Project, 15th to 17th Nov, 2008, G.I.K. Institute, Swabi, Pakistan.
- **Supervised workshop**: ***MATLAB and Simulink***, A tool for Engineering Applications, 27th to 29th Oct, 2008, G.I.K. Institute, Swabi, Pakistan.

## Co-curricular Responsibilities at COMSATS Institute Lahore

- Member IEEE Student Chapter CIIT Lahore
- Batch Advisor BTE FA06, BTE FA08 and BTE SP09
- Secretary, Industrial Liaison Committee, Dept. of Electrical Engineering, CIIT LHR
- Member Orientation Committee SPRING 2011
- Deputy Convener, Dramatics, Dept. of Electrical Engineering, CIIT LHR
- Member PEC Departmental Committee, Dept. of Electrical Engineering, CIIT LHR
- Member Convocation Committee 2010, Dept. of Electrical Engineering, CIIT LHR

- Member Publication Committee/Newsletter, Dept. of Electrical Engineering, CIIT LHR (September 2009 to February 2010).
- Member Publication Committee, Digital Innovation Competition & Exhibition (DICE), held at CIIT, Lahore on 23-24 Dec 2009

**Software Expertise**

- COMSOL
- L-Edit MEMS-Pro (Poly-MUMPS, SOI-MUMPS, Metal-MUMPs)
- ANSYS
- Pro Engineer MATLAB

**REFERENCES**

1) **Dr. Saleem Farooq Shaukat, Professor** Head Department of Electrical Engineering, COMSATS Institute of Information Technology, Pakistan.
Email: saleem@ciitlahore.edu.pk.
URL: http://www.ciitlahore.edu.pk/PL/profile.aspx?employeeId=399
2) **Dr. Ioana Voiculesu, Associate Professor**, Director of MEMS and Nanotechnology Lab, Department of Mechanical Engineering, City College of NewYork, NewYork.
Email: voicules@me.ccny.cuny.edu
URL: http://www-me.ccny.cuny.edu/ccnf/index.html
3) **Dr. Intesar Ahmad, Associate Professor,** Head Electrical Engineering Department, Lahore College for Women University, Lahore, Pakistan.
Email: drintesarahmad@ciitlahore.edu.pk.
URL: http://www.ciitlahore.edu.pk/PL/profile.aspx?employeeId=308
4) **Dr. Shafaat A. Bazaz, Professor (HEC Foreign Professor)**, Chairman, Faculty of Computer Science, Center for Advanced Studies in Engineering, University of Engineering & Technology, Taxila, Pakistan
Email: bazaz@case.edu.pk.
URL: http://www.case.edu.pk/Faculty/DrShafaatAhmedBazaz.aspx
5) **Dr. Abid Iqbal, Associate Professor,** Dean Faculty of Mechanical Engineering, Ghulam Ishaq Khan Institute of Engineering Science & Technology Pakistan.
Email: abid@giki.edu.pk
URL:http://www.giki.edu.pk/Academics/Undergraduate/Faculty%20of%20ME/FacultyDetail.php?un=abid