

## **Shafaat Ahmed Bazaz**

Foreign Professor (HEC)

**Chairman, Department of Computer Science**

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### **Qualification**

- **PhD:** Controls and Computer Sciences (1994-1998)

**Specialty:** On Line trajectory generation of robotic manipulator using CAD geometric modeling techniques.

**From:** [National Institute of Applied Sciences, Toulouse](#), France.

- **M.S:** Controls-Production-Computer Sciences (1993-94)

**Specialty:** Industrial Computerization and Control

**From:** [National Superior School of Mechanics and Microtechniques](#), University of Franche Compte, Besancon, France.

- **Bachelor of Engineering** (1985-89)

**Specialty:** Avionics Engineering

**From:** [N.E.D University of Engineering & Technology, Karachi](#), Pakistan.

### **Some Short Courses attended**

- **Principles of effective Management** (May 2003)

**From:** Schulich school of business, York University, Toronto

- **Project leadership strategies & simulation** (November, 2001)

**From:** Schulich school of business, York University, Toronto

- **Advance Training on MEMSPro** (May 2001)- Tanner tools (L-Edit, T-Spice, LVS, extraction, Place & Route, Design rule checker, 3D modeler etc), CAD suit for MEMS

**From:** MEMSCAP/Mechanical Dynamics Ltd, Montreal

- **Fundamentals of Sensors Science and Technology** (August, 2000)

**From:** 2<sup>nd</sup> Eurosensor school (Satellite event of Eurosensor XIV conference), Copenhagen, Denmark

- **Introductory training on MEMCAD** (April 2000) - CAD tool for Microsystems

**From:** Coventor Inc, Amsterdam, Netherlands

### **Work Experience**

**1.Center for Advanced Studies in Engineering (CASE), Islamabad. Since August 2011.**  
HEC Foreign Professor, Chairman Computer Science Department, HEC Foreign Professor

**2. Ghulam Ishaq Khan Institute, Dean Faculty of Computer Science & Engineering, 2006-2011:**

- Joined GIKI under Foreign Faculty Hiring Program (FFHP) of Higher Education Commission of Pakistan (HEC) as foreign professor from Canada.
- Developed MEMS and VLSI Chip design lab. Initiated research in MEMS based Neural Implants, microgrippers for blood cell manipulation, accelerometer and Gyroscope for defence and gaming applications

**3. Canadian Microelectronics Corporation ([www.cmc.ca](http://www.cmc.ca)), Kingston, Ontario (2000-2006):**

Worked as Senior Staff Scientist. This is unique organizations in the world that revolutionarized Canadian Semiconductor industry in last 30 years. Its mission is to provide infrastructure to Canadian Universities in the area of Chip design, Manufacturing and testing to keep Canadian

Commercial competitiveness in telecomm, wireless, automobile and life science worldwide.  
Funded by Canadian Federal Government.

#### **4. Assistant Professor in Denmark Technical University ([www.dtu.dk](http://www.dtu.dk)), Denmark. (1999-2000)**

Worked on the project funded by Denmark Technical Research Council (Center for Micro-instruments) for the program on the modeling and simulation of Microsystems. Worked in world class **Center for Micro Electronics** ([www.mic.dtu.dk](http://www.mic.dtu.dk)) and **Information Technology Department** ([www.it.dtu.dk](http://www.it.dtu.dk)).

#### **Distinctions**

- Adjunct Professor, Department of Electrical Engineering, University of Waterloo, Canada (Present)
- Organize Canadian workshop on MEMS each after two years in 2001, 2003 and 2005. The objective of this workshops was to develop the nexus of research across Canadian Universities and bring their research closer to industry:
- Part of the three judges panel in THE SYMPOSIUM ON MICROELECTRONICS RESEARCH & DEVELOPMENT IN CANADA (MR&DCAN) Years 2001 and 2002 for selecting the best poster paper for Micralyne's Microsystems Design best Award
- Reviewer for Micro System Technology Institute (MSTRI) in Edmonton for the research grant applications related to MEMS designs ([www.mstri.ualberta.ca](http://www.mstri.ualberta.ca)).
- Reviewer for International *Mechatronics* Journal (affiliated with IFAC, the International Federation of Automatic Control)
- Reviewer for IEEE Sensor Journal

#### **Collaborators**

- **NESCOM (Air Weapon Complex, Abbottabad):**
  - working as Consultant to development of MEMS devices.
- **Shifa Tameer-e-Millat University, Armed Forces Institute of Ophthalmology (AFIO), Shifa International Hospital:** On the development of biomedical devices and Systems (diabetic retino pathy diagnostic, Ultra sound Machine etc)
- **Developed NEXUS of MEMS and semiconductor technology Research at following organizations:**
  - National Institute of Lasers and Optics (NILOP)
  - GIKI
  - PIEAS
  - COMSATs Physics Department, Islamabad
  - NUST:
  - Air University
- **Professor Yongjun Lai (<http://me.queensu.ca/people/lai/>)**  
Queens University, Mechanical Engineering Department
- **Professor Dean Aslam (<http://www.eqr.msu.edu/~aslaml/home.html>)**  
Director, Micro and Nano Technology Laboratory (MANTL),  
Electrical and Computer Engineering Department, Michigan State University
- **Dr Michele Kraft, University of Southampton (UK)**  
Electronics and Computer Science
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## Graduate Students Supervised in Pakistan

Sr. No	Name	Program	Thesis Title	Graduation Date	Employment Status
1	Rana Iqtidar Shakoor	PhD	Design, Fabrication and Characterization of MetalMUMPs based MEMS Gyroscopes	July2010	Scientific Officer at PAEC
2	Kinnan Amjad	MSc	Design of MEMS Microgripper integrated with force sensor in commercial prototyping process.	May2008	Asst.Manager at AWC
3	Muhammad Yasin	MSc	Reduced Order Model Development of MEMS Gyroscope for System Level Simulations	May2008	Asst.Manager at AWC
4	Najamuddin	MSc	Characterization of an All-Diamond Neural Probe and its Simulations in Implantable Conditions	May2008	Asst.Manager at AWC
5	Muhammad Bilal Saif	MSc	Interface Electronics & control of Electrostatically Actuated MEMS Microgripper	May2009	Lecturer at GIKI, now in GC-University, Faisalabad, pursuing PhD in Netherlands
6	Muhammad Sohail	MSc	Design of an Electrostatic SOI-MUMPs Microgripper Integrated with Capacitive Force Sensor	May2009	Lecturer at GIKI, Now at Islamic International University Islamabad
7	Ahmad Naeem	MSc	Design of low power & low noise Preamplifier for Brain Implantable Neural Recording Microsystem	May2009	Asst.Manager at AWC
8	Hafiz Usman Sani	MSc	Behavioral Model Development and simulation of SOIMUMPs based Microgripper	May2009	Asst.Manager at AWC
9	Sharif Khan	MSc	Interface Characterization and Selectivity Analysis of MEMS based All-Diamond Neural Probe	May2009	Asst.Manager at AWC
10	Muhammad Shuja Khan	MSc	Design of a Monolithic 3 DoF MEMS Capacitive Accelerometer	May2009	Lecturer at COMSATS Lahore
11	Fahimullah Khan	MSc	Finite Element Analysis and Testing of Electrostatic SOI-MUMPs Microgripper Integrated with Capacitive Contact Sensor	May2010	Lecturer at COMSATS Abbottabad
12	Abid Iqbal	MSc	Design and Analysis of a Monolithic Tri-axis MEMS Capacitive Accelerometer Based on MetalMUMP	May2010	Lecturer at COMSATS Abbottabad). Research internee in Hong Kong University for 9 months
13	M.Mubasher Saleem	MSc	Design, Optimization and Behavioral Modeling of 3-DoF Non-Resonant MEMS Gyroscope based MetalMUMPs.	May2010	pursuing PhD in Italy
14	Faiza	MSc	Lifetime Optimization of Wireless Sensor Network through Energy Efficient Clustering for Robust Data Routing	May 2010	pursuing PhD in Malaysia
15	Khurram Javed	MSc	Interface Circuit Design for MEMS Capacitive Accelerometer	May 2011	Lecturer NFC University, Faisalabad
16	Kashif Riaz	MSc	Damping Estimation, Fabrication	May	Lecturer at GIKI

			Imperfection Simulations and performance Enhancement of 3-DoF MEMS Gyroscope	2011	
17	Umar Mian	MSc	Investigation of 3-DoF Non-Resonant MEMS Gyroscope through Lumped Equivalent Circuit Modeling	August 2011	pursuing PhD in Malaysia
18	Nayer Abbas	MSc	Design and Characterization of MEMS based Automated Micromanipulator System and its Failure Analysis	December 2011	Lecturer at GIKI

### **Research Grants Received**

1. **2013-2014:** Rs 13 Millions, National ICT Fund, Project Title: Development of a Net Enabled Retinal Image Analysis and Screening System for Grading and Diagnosis of Diabetic Retinopathy and its Integration in i-telemedicine system,

The proposed system is a telemedicine system for telescreening of Diabetic retinopathy (DR) with capabilities of self diagnosis, real time access to data from rural areas, assignment of ophthalmologist for expert opinion and management of a national database for regular monitoring. The system will be a low cost and easy access solution to patients with diabetes for regular monitoring of the retina to avoid the risk of sudden vision loss. In this project, we propose a self diagnosis system for DR with capabilities of automated screening and diagnosis of abnormalities present in human retina, a universal communication node to provide real time availability of data and intelligent server to assign expert and schedule patient's data and help in early detection of DR to save patient's vision.

2. **2008-2011:** Rs 15 Millions, National ICT Fund, Project Title: Development of Open Source Cell Library for MEMS Components Verified through Modeling and Simulation. Complete proposal can be found at : <http://www.ictrdf.org.pk/fp-osmem.htm>

This project plans and envisions sufficient design work on various MEMS and VLSI devices and will also be able to offer such design services to Pakistani Universities and international customers in next 2-3 years after creating enough skilled manpower inside Pakistan in this area. This web-based Open Source libraries will include MEMS/VLSI chip design projected accomplished at GIKI and other Pakistani universities to show case their work in front of the international community while sharing all design knowledge.

3. Rs 3 Million, National Research Grant, Higher Education Commission of Pakistan,  
**Project Title:** *Integrating Microcontroller, MEMS based force sensors and Microgrippers for Biomedical and Microassembly Applications*

4. **2006:** Rs 1 Million HECs Initial Start-up Grant to develop initial Setup for designing MEMS devices

## Scientific Publications

### Reviewed Journal Papers

1. Shafaat A. Bazaz, Nayyer Abbas, Bilal Saif, Nisar Ahmad, "Design and Characterization of MEMS based Automated Micromanipulator System for Micrograsping", The international journal of assembly technology and management, Impact factor 0.584)
2. Shams ur Rahman, Mushtaq Ahmad, Shafaat A. Bazaz, "A new Energy-Efficient TDMA-based MAC Protocol for Periodic Sensing Applications in Wireless Sensor Networks", International Journal of Computer Science Issues, Vol. 9, Issue 4, No 1, July 2012, ISSN (Online): 1694-0814 (Impact Factor:0.225)
3. M. Shuja Khan, Abid Iqbal, Shafaat A. Bazaz, Muhammad Abid, "Physical Level Simulation of PolyMUMPs Based Monolithic Tri-Axis MEMS Capacitive Accelerometer Using FEM Technique", Advanced Materials Research, pp: 4625-4632, Vol: 403-408, November, 2011, Switzerland
4. Shafaat A. Bazaz, Abid Iqbal, Muhammad S. Khan "Monolithic Tri-axes Nickel based Accelerometer design verified through Finite Element Analysis", Arabian Journal for Science and Engineering, 2011, (Impact Factor: 0.224)
5. Kashif Riaz, Shafaat Bazaz, Mubashir Saleem, Rana Iqtidar Shakoor "Design damping estimation and experimental characterization of decoupled 3DOF robust MEMS gyroscope", Sensors & Actuator: A. Physical, Accepted, (Impact Factor: 1.74)
6. Shafaat A. Bazaz, Mubasher Saleem, " Design and robustness analysis of structurally decoupled 3-DoF MEMS gyroscope in the presence of worst-case process tolerances", Journal of Microsystem Technologies, MITE1507R1, 2011 (Impact Factor:1.29)
7. Abid Iqbal, Shafaat A. Bazaz, " Behavioral Modeling of monolithically integrate Capacitive Accelerometer based on MetalMUMPs", Journal of Simulation: International Transactions of the Society for Modelling and Simulation, ID # T-10-0124.R2, Accepted (Impact Factor 0.448)
8. Shafaat A. Bazaz, Fahimullah Khan , R. I. Shakoor, " Design, simulation and testing of electrostatic SOI MUMPs based microgripper integrated with capacitive contact sensor", Sensors & Actuators: A. Physical (*Elsevier*), 167, 2011, 44-53, ISSN 0924-4247 (Impact Factor: 1.74)
9. R. I. Shakoor, P. Srinivasan, Shafaat A. Bazaz, Performance of a compliant structure for resonant microgyroscope, IEEE Sensors Journal, doi: 10.1109/JSEN.2010.2094185, 2010 (Impact Factor 1.58)
10. Rana I. Shakoor, S.A. Bazaz, Mubasher Saleem, M.M. Hasan "Mechanically Amplified 3-DoF Non-Resonant MEMS gyroscope Fabricated in Low Cost MetalMUMPs Process" revision under review ASME Journal of Mechanical Design (2010), (Impact Factor:0.869).
11. Shakoor, R. I., Bazaz, S., Burnie, M., Lai, Y. and Hassan, M., Electrothermally Actuated Resonant Rate Gyroscope Fabricated using the MetalMUMPs, *Microelectronics Journal (Elsevier)*, 42, 2011, 585-593, ISSN 0026-2692.(Impact Factor:0.778)
12. Fahimullah Khan , S.A Bazaz, Muhammad Sohail " Design and implementation of Electrostatic SOI-MUMPs microgripper" Journal of Microsystem Technologies, DOI 10.1007/s00542-010-1129-2, ISSN 0946-7076, Volume 16, Number 11, August 2010.(Impact Factor:1.29)
13. H. M. Usman Sani, Shafaat A. Bazaz, and Nisar Ahmed "Fabless Prototyping Methodology for the Development of SOI based MEMS Microgripper", Journal of Engineering & Technology, World Academy of Science, Issue 64, 2010, pp. 492-496 (EBSCO, INTUTE, Engineering Index (EI))
14. R.I.Shakoor, Shafaat A. Bazaz, Michael Kraft, Yongjun Lai, M. Masood ul Hassan," Thermal Actuation based 3-DoF non Resonant Microgyroscope using MetalMUMPS," journal of Sensors 2009, 9(4), 2389-2414; 1 April 2009 (Impact Factor 1.87)
15. Shafaat Ahmed Bazaz, " Design Methodology and Modelling Strategies for MEMS", Bulletin of Canadian Society of Mechanical Engineers, September 2003
16. S.A. Bazaz, B. Tondu, " Minimum Time On-Line Trajectory Generation based on Low order Spline Methods for Industrial Manipulators" Journal of Robotics and Autonomous Systems, no 29 (4), 1999, pp. 257-268 (Impact factor 1.36)
17. Tondu, S.A. Bazaz, " The 3-Cubic Method: An Optimal On -Line Robot Joint Trajectory Generation under Acceleration, Velocity and Wandering Constraints. " The Int. Journal of Robotics Research, 1999, 18 (9), p. 893-901 (Impact factor 1.99)

## Reviewed Conference Papers

1. Nayyer Abbas, Shafaat, A. Bazaz, Nisar Ahmed, Rahim Umer "Behavioral Modeling of Microtweezer integrated with Capacitive Touch Sensor", The 6<sup>th</sup> Chaotic Modeling and Simulation International Conference, held on June 11-14, 2013, Turkey
2. Ahmad Naeem, Shafaat A. Bazaz, Dean M. Aslam, "A Low-Power and Low-Noise Neural Amplifier for All-Diamond Neural Probes" 6<sup>th</sup> IEEE International Conference on Emerging Technologies, Islamabad, Pakistan, October 18-19, 2010
3. Faiza Nawaz, Shafaat Ahmed Bazaz, "Lifetime Optimization of Wireless Sensor Network through Energy Efficient Clustering for Robust Data Routing" 2nd International Conference on Computer Technology and Development, Cairo, Egypt. November 2-4, 2010
4. M. Shuja Khan, Abid Iqbal, Shafaat A. Bazaz and Muhammad Abid, "A Monolithic Three-Axis PolyMUMPs Based MEMS Capacitive Sensing Accelerometer", SPIE International Conference on NanoScience Engineering, 1-5 August 2010, San Diego Convention Center, San Diego, California, USA
5. M. Shuja Khan, Shafaat A. Bazaz and Muhammad Abid, "Comparative Study on System Model and Finite Element Analysis of a Monolithic 3DOF MEMS Capacitive Accelerometer", International Conference on Information and Multimedia Technology, ISBN: 978-0-7695-3922-5, December 18-19, 2009 Jeju Island, South Korea
6. Rana I. Shakoor, Shafaat A. Bazaz, M. M. Hasan, "Design Modeling and Simulation of Electrothermally Actuated Microgyroscope Fabricated using the MetalMUMPs", International Workshop on Thermal investigations of ICs and Systems (THERMINIC), 7-9 October 2009, Leuven, Belgium
7. Marc Burnie, Yongjun Lai, R. Iqtidar Shakoor and Shafaat A. Bazaz, "Design and Simulation of Thermally Driven Microgyroscopes", 2nd Micro and Nanoelectronics Research Conference 13-14 October 2009, Ottawa, Canada
8. Bilal Saif, Shafaat A. Bazaz, Nisar Ahmed, "Interface Electronics and Control of Electrostatically Actuated MEMS Microgripper", 13th IEEE International Multitopic Conference 2009 (INMIC-2009), December 14-15, 2009 Islamabad
9. Rana I. Shakoor, Shafaat A. Bazaz, M. M. Hasan, "Design of Thermal Dual-Mass MEMS Gyroscope with 2-DoF Drive Model Oscillator", 2008 IEEE International Conference on Semiconductor Electronics, 25-27 November 2008, Johor Bahru, Malaysia
10. Najamuddin, Shafaat A. Bazaz, H.Y. Chan, Dean M. Aslam, "Impedance Characterization of MEMS based All Diamond Neural Probe", 20<sup>th</sup> International Conference on Microelectronics, 14-17 December 2008, Sharjah
11. Kinnan Amjad, Shafaat A. Bazaz, Youngjun Lai, "Design of an Electrostatic MEMS Microgripper Systems Integrated with Force Sensor", 20<sup>th</sup> International Conference on Microelectronics, 14-17 December 2008, Sharjah
12. Rana I. Shakoor, Shafaat A. Bazaz, Y. Lai, M. M. Hasan. "3-DoF Dual-Mass Nickel MEMS Gyroscope utilizing Chevron Based Thermal Actuation", SPIE, 1<sup>st</sup> International Conference of the Chinese society of Micro/Nano Technology, Beijing, China
13. Rana I. Shakoor, Shafaat A. Bazaz, M. M. Hasan, "Comparative Study on Finite Element Analysis & System Model Extraction for Non-Resonant 3-DoF Microgyroscope" IEEE International Behavioral Modeling and Simulation conference BMAS 2008, San Jose, CA, USA
14. Yongjun Lai, Shafaat Bazaz, "Engineering curriculum development in microsystems" 3<sup>rd</sup> CDEN (Canadian Design Engineering Network) International Design Conference, 24-26 July, 2006, Toronto, Canada
15. R.I. Shakoor, I.R. Chughtai, S.A. Bazaz, M.J. Hyder, Masood-ul-Hassan, "Numerical Simulations of MEMS Comb-Drive Using Coupled Mechanical and Electrostatic Analyses", International Conference on Microelectronics, 13-15 December, 2005, Islamabad, Pakistan
16. Jalal, S. Bazaz, M. Hefnawi, D. Choi, "Modeling of MEMS Varactors as phase shifters for multi-energy domain modeling in VHDL- AMS", 3rd Canadian Workshop on MEMS, Ottawa, Canada, August 2003
17. Brian Barge, Shafaat A. Bazaz, Dan Gale "MEMS Research, Technology and Product Development in Canada", The 8th International Conference on the Commercialization of Micro and Nano Systems, September 8-11, 2003, Amsterdam, The Netherlands

18. Dan Gale, Shafaat A. Bazaz, "Canadian Research, Technology, and Product Interests in Micromachining: An Update", Proceedings 8<sup>th</sup> World Micromachine Summit Maastricht, The Netherlands, April 30- May 2, 2002
19. S.A. Bazaz, B. Tondu, "On-Line computing of a robotic manipulator Joint trajectory with Velocity and Acceleration Constraints. " 1997 IEEE Int. Symp. on Assembly and Task planning, August 1997, Los Angeles, USA, pp. 1-6
20. Tondu, S.A. Bazaz, "The 3-Cubic Method: An On- Line Robot Joint Trajectory Generator under Acceleration, Velocity and Wandering constraints." 4th Int. Symp. on Methods and Models in Automation and Robotics, August 1997, Miedzyzdroje, Poland, pp. 1195-1200
21. S.A. Bazaz, B. Tondu, "An optimal on- line robot trajectory generation in Cartesian space." Int. Conf. on Architectures, Networks and Intelligent Systems for manufacturing Integration, SPIE's Intelligent & Automated Manufacturing Society, Oct. 1997, Pittsburgh, USA, pp. 2-10
22. S.A. Bazaz, B. Tondu, "3-Cubic Spline for On-Line Cartesian Space Trajectory Planning of Industrial Manipulators." 5th IEEE Int. Workshop on Advanced Motion Control, July 1998, Coimbra, Portugal, pp. 493-8

### **Book**

Partly translated a book from French to English (200 pages)

**Title of the book:** Modelisation, Identification et Commande des robots (modeling, identification and control of robot) by Wisama Khalil ([Ecole Centrale de Nante, France](#)), Etienne Dombre ([Laboratoire d'Informatique, de robotique et de microelectronique de Montpellier, France](#))

### **Teaching Interest**

#### **Undergraduate:**

Circuit Design 1 & 2, Digital Logic Design, Digital Integrated Circuit Design, VLSI Design, Engineering Mechanics

#### **Graduate:**

MEMS design and Micromachining, Advanced VLSI Design