# Maqsood Ali Mughal

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Worcester Polytechnic Institute (WPI)

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An Electronics Engineer with eight years of teaching experience. Research interests revolves around forecasting power variability in photovoltaic (PV) systems. Currently working on developing an algorithm to detect clouds in real time with high accuracy and measure the impacts of cloudy weather conditions upon circuits with PV penetration. Professional experience ranging in academics and in oil, telecommunication, and energy industries.

## EDUCATION

### Ph.D. Semiconductor Physics
ARKANSAS STATE UNIVERSITY

12/2015 — *Jonesboro, AR*

*Dissertation Topic*

- Electrochemical deposition of chalcogenides for thin film solar cell fabrication

### M.S. Environmental Sciences
ARKANSAS STATE UNIVERSITY

12/2014 — *Jonesboro, AR*

### M.S. Engineering Management
ARKANSAS STATE UNIVERSITY

12/2010 — *Jonesboro, AR*

### B.S. Electronics Engineering
SIR SYED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

12/2008 — *Karachi, PAK*

## ACTIVE RESEARCH PROJECTS

### PI - Cloud Motion Vector System (2019 - Present)

- In collaboration with industry partner (Eversource), working on developing a smart cloud motion vector system model that predicts photovoltaic output power as a function of moving clouds and it's impact upon the performance of the electrical grid network and equipment.

### Designing a Cricket Game using Verilog HDL onto FPGAs

- *System implementationofa scoreboard for a T20 Cricket Gameusing Verilog HDL, RTL analysis at the schematic level.*

### PI - High Altitude Balloon for Measuring Environmental Pollution (2019 - Present)

- The project will provide information on environmental pollution at different levels of atmosphere to the scientific community, and government regulatory institutions that will be beneficial to the long-term health and well-being of the world.

## ACADEMIC EXPERIENCE

### ASSISTANT PROFESSOR
WORCESTER POLYTECHNIC INSTITUTE (WPI)

01/2018 - Present — *Worcester, MA*

*Tasks*

- Teaching undergraduate courses. See the list of courses taught on page 2. Experienced in delivering the content in following formats: in-person, online, and hybrid.
- Assisting in ABET accreditation process. Program assessment and execution of a continuous improvement plan.
- Curriculum development, drafting technical laboratory sheets/manuals, creating new courses and degree plan, and students' academic advising. Updating student handbooks and bulletin.
- Advising students on their senior design projects. Actively involved in industry-sponsored projects (Eversource, Dell, etc.)
- Ability to work with most electronic instrumentation (and supporting languages/platforms): frequency generator, power supply, NI ELVIS breadboards, FPGA Boards, cRIO, myRIO, oscilloscope, multimeters, EMONA Sigex/Datex, 3D Printers, etc.
- Serving on various committees such as UPCCE, ABET, and Visibility.

### ASSISTANT PROFESSOR
FITCHBURG STATE UNIVERSITY (FSU)

01/2017 - 12/2017 — *Fitchburg, MA*

*Tasks*

- Similar role as mentioned above. See the list of courses taught on page 3.
- Taught special topics courses and delivered in a seminar format. Topics include: additive manufacturing and artificial Intelligence (AI) to practice industry-manufacturing techniques.

### INSTRUCTOR
ARKANSAS STATE UNIVERSITY (A-State)

08/2015 - 12/2016 — *Jonesboro, AR*

*Tasks*

- Primarily a teaching position. See the list of courses taught on page 3.

## FUNDS & AWARDS

PI - Designing an Intelligent Cloud Motion Vector Sensor (CMVS) System to Detect Clouds and Forecast Real-time Photovoltaic (PV) System Performance (Pending) - $575,139
*NSF EPCN*

PI - Community Catalyst Grant - $65k (06/2021 - Present)
*Mass Clean Energy Center*

Co-PI TRIADS - $60k (2019 - 2021)
*Worcester Polytechnic Institute*

- Detection Of Bioelectrical Changes As A Function Of NeoplasticProgression

PI - AmplifMass Grant - $54.5k (2019 - 2020)
*Mass Clean Energy Center & Eversource Energy*

- Integrating Cloud Motion Simulator into Synergi's Platform to Study Impacts of Cloudy Weather Conditions upon Circuits with Photovoltaic Penetration

PI - Special Projects Grant - $25k (2017)
*Fitchburg State University*

- Awarded to build a workshop to support Capstone Projects

## CERTIFICATES/LICENSES

Professional Engineering (PE) License
*Scheduled to take Exam in October 2021*

Professional Engineering (PE) License (2009 - Present)
*Pakistan Engineering Council*

Professional Work Development (2009)
*A-State/NSF*

## PUBLICATIONS

*Journal*
**Designing and Implementing a T20 Cricket Board Game onto an FPGA Development Board using Verilog HDL**
*Author(s)*
M. A. Mughal, R. J. Egyir, and R. Devevdorf1
*Under Review*
Journal of Computing Entertainment

*Conference*
**BYOE: An Evaporative Cooler with Virtual Connectivity**
*Author(s)*
A. Sabuncu and M. A. Mughal
08/2021
in: 2021 ASEE Annual Conference and Exposition

*Conference*
**Cloud Motion Vector System to Detect Clouds and Forecast Real-time Photovoltaic System Performance**
*Author(s)*
M. A. Mughal, S. Cui, and H. Zhang
08/2021
in: Proceedings of the 48th IEEE Photovoltaic Specialist Conference (PVSC)

## ACADEMIC EXPERIENCE

### RESEARCH ASSISTANT
### OPTOELECTRONIC MATERIALS RESEARCH LABORATORY, A-STATE

2010 - 2015 *Jonesboro, AR*

*Achievements/Tasks*

- Fabricated n-In2S3/p-CdTe and n-In2S3/p-CuInS2 nano-structured solar cells and studied device properties including IV measurements, FFs, Vocs, etc.
- Performed in-situ measurements (cyclic voltammograms, thickness measurement, stress/strain, etc.) to optimize the electrochemical deposition process using LabVIEW.
- Synthesized nano-structured (2D) materials (chalcogenides, sulfides, metal oxides) as thin films using techniques, such as electrochemical deposition (ED), PVD, CVD, e-Beam, sputtering, etc. upon coated-glass substrates (FTO, ITO, Mo, etc.)
- Characterized the optical, structural, crystallographic, electrical, compositional, photoluminescence, and thermal properties of the films.
- Executed engineering experiments through DOE to optimize the deposition process, suggested alternatives, and achieved optimal performance.
- Statistically analyzed data to measure/predict the optimal performance and detect failures.
- Performed computational material science, failure analysis/mechanics, improved film adhesion and heterojunction interface properties. Stress/strain caused by deposition parameters by measuring fracture and buckling density, and avoiding cracks.
- Identified nature of cracks through image processing (using MATLAB)
- Studied the deformation of thin film materials under extreme process temperatures and higher nucleation growth.

## INDUSTRY EXPERIENCE

### OPERATION AND MAINTENANCE ENGINEER
### RELACOM PAKISTAN PVT. LTD.

2008 - 2009 *Karachi, Pakistan*

*Achievements/Tasks*

- Drafted technical documents; scheduled preventive/monthly maintenance plan, and dispatched operation/installation instruction procedures for over 1200 BTS in South Pakistan.
- Supported OMD and executed operational implementation of all types of contractual declaration (Generators, AirConditioners, Line conditioners, etc.) at all sites.
- Liaison with various departments and vendors to troubleshoot network problems.

## COURSES TAUGHT

ECE 2010 Introduction to Electrical & Computer Engineering

ECE 1799 Frontiers and Current Issues of Electrical & Computer Engineering

# PUBLICATIONS

*Media*

**Eversource Studies Impact of Clouds on PV Circuits**

*Author(s)*

M. A. Mughal, B. Aslanian Jr., etc.

*October 2020*

T&D World

*Journal*

**Cadmium Sulfide-buffered PV Systems: Assessing the Environmental, Health, and Economic Impacts**

*Author(s)*

M. A. Mughal and R. Sharma

*June 2019*

Journal of the Arkansas Academy of Science

*Conference*

**All-Electrodeposited p-Cu2ZnSnS4/n-In2S3 Heterojunction Formation for Solar Cell Applications**

*Author(s)*

M. A. Mughal, P. M. Rao, et al.

*June 2018*

in: Proceedings of the 45th IEEE Photovoltaic Specialist Conference (PVSC)

*Journal*

**Optimization of Process Parameters in Palletization of Crop Residues by Taguchi-grey Relational Analysis**

*Author(s)*

S. Thapa, M. A. Mughal, et al.

*April 2018*

International Journal of Agriculture, Environment and Bioresearch

*Journal*

**Progress in indium (III) sulfide (In2S3) buffer layer deposition techniques for CIS, CIGS, and CdTe-based thin film solar cells**

*Author(s)*

M. A. Mughal, R. Sharma, and R. Engelken

*October 2015*

Solar Energy

*Journal*

**Morphological and Compositional Analysis of Electrodeposited Indium (III) Sulfide (In2S3) films**

*Author(s)*

M. A. Mughal, M. J. Newell, R. Engelken, et al.

*March 2015*

Journal of Electrochemical Society

*Journal*

**Optimization of the Electrodeposition Parameters to Improve the Stoichiometry of In2S3 Films for Solar Applications Using the Taguchi Method**

*Author(s)*

M. A. Mughal, R. Engelken, et al.,

*March 2014*

Journal of Nanomaterials

# COURSES TAUGHT

ECE 2029 Introduction to Digital Circuit Design

ECE 2049 Embedded Computing in Engineering Design

ECE 2019 Sensors, Signals & Systems

ECE 2799 Engineering Design & experimentation

Electronics I & II

Industrial Electronics

Microcontrollers and PLCs

Electrical Workshop

Software Applications for Engineers

# HONORS & AWARDS - TEACHING

2021 Summer Sandbox Grant Recipient - PI

***Creating Scenes using OBS Studio for Streaming Virtual Classroom over Zoom and other Platforms***

2021 Summer Sandbox Grant Recipient - Co-PI

***Leveraging History to Teach Engineering***

2020 Campus (WPI) KEEN Rising Star

2020 Faculty Champion, ECE

2020 KEEN Community Catalyst (Reviewer)

*Review cards, connect faculty to topics and people. The program provides an opportunity to serve as a role model for community behavior, engage in forums, greet new users, and steer the direction of the community*

2019 Teacher's Note Challenge Winner

*The Teacher Note Challenge is about showcasing how you used any Instructable in your classroom*

2019 KEEN Book Club Grant Recipient (Co-PI)

# MQP'S ADVISED

**2020-2021 High Altitude Balloon Launch II to Measure and Monitor Environmental Pollution**

Lucas Falsarella Guerreiro, Leo Gross, Tae Hyun (Ted) Je, Zachary Langlois

**2020-2021 Cloud Motion Vector System to Monitor and Predict Output Power of a Photovoltaic System in Real Time (ECE Finalist)**

Michael Carpinello, Jacob McManus, Matthew Moreira, and Kyle Pacheco

**2019-2020 Design of a Cricket Game Using FPGAs**

Ronald J. Egyir and Ryan P. Devendorf

**2019-2020 High Altitude Balloon Launch I to Measure and Monitor Environmental Pollution**

Jiayi Jiang, Jonney Lee, Hanyang Ru

## PUBLICATIONS

*Conference*

**Photo Electrochemical Characterization of Titania Photoanodes Fabricated using Varying Anodization Parameters**

*Author(s)*

M. A. Mughal, R. Sharma, et al.

*August 2015*

in: Proceedings of the 50th IEEE Industry Application Society Annual Meeting

*Conference*

**Stoichiometric Control via Periods of Open-circuit During Electrodeposition**

*Author(s)*

M. J. Newell, M. A. Mughal, R. Engelken, et al.

*June 2014*

in: Proceedings of the 40th IEEE Photovoltaic Specialist Conference (PVSC)

*Conference*

**Statistical Analysis of Electroplated Indium (III) Sulfide (In2S3) Films, a Potential Buffer Material for PV (Heterojunction Solar Cell) Systems, using Organic Electrolytes**

*Author(s)*

M. A. Mughal, Michael J. Newell, R. Engelken, et al.

*June 2014*

in: Proceedings of the 40th IEEE Photovoltaic Specialist Conference (PVSC)

## CONFERENCES & SEMINARS

Cloud Motion Vector System to Detect Clouds and Forecast Real-time Photovoltaic System Performance (06/2021)

*48th IEEE Photovoltaic Specialist Conference (PVSC)*

- Poster Presentation

All-Electrodeposited p-Cu2ZnSnS4/n-In2S3 Heterojunction Formation for Solar Cell Applications (06/2018)

*45th IEEE Photovoltaic Specialist Conference (PVSC)*

- Poster Presentation

ECE Graduate Seminar Lecture Series, WPI, Worcester, MA (09/2017)

*Thin Film Semiconductors for Photovoltaic Applications*

- Invited Speaker

New England Association of Chemistry Teachers (NEACT) - 78th Summer Conference, Fitchburg, MA (07/2017)

*Thin Film Semiconductors for Solar Cells Applications*

- Invited Speaker

8th Undergraduate Research Conference and Practices, FSU, Fitchburg, MA (04/2017)

*Industrial Electronics Research Projects Development at Fitchburg State University*

- Poster presentation

8th Undergraduate Research Conference and Practices, FSU, Fitchburg, MA (04/2017)

*Electronics Research Projects Development at Fitchburg State University*

- Poster presentation

## MQP'S ADVISED

**2019-2020 Study on Impacts of Varying Weather Patterns upon Circuits with Photovoltaic (PV) Penetration**

Barry Aslanian Jr, Christian Curll, Matthew Scherrer, Markus Zimmermann

**2018-2019 Remy: AR Assisted Cooking**

Benjamin L. Hylak and Mona Elodka

**2018-2019 Face Recognition Door Lock**

Aleksander Ibro, Mario A. Zyla, and Augusto Rolando

**2018-2019 Fire Detection and Suppression Drone**

Nicholas Janco, Xiaoyi Long, and Elizabeth Walling

**2018-2019 Telenursing RoboPuppet**

Zachary Davis Caplin and Ryan Zachary-Snow Kennedy

**2017-2018 Thin Film Solar Cell with Cu2ZnSnS4 (CZTS) Absorber Layer**

Matthew Breidenbach, Nicole Candanedo, and Abraham Cano Ventura

## WORKSHOPS - TEACHING

2020 Online Pedagogy Workshop (OPW) - WPI

2019 Faculty Workshop on Teaching with Writing - WPI

2019 Faculty-Industry Relationships (FIRe) – Dayton, Ohio

2018 KEEN Innovating Curriculum With Entrepreneurial Mindset (ICE) Workshop

## SERVICE

**Service to Department**

ECE

*Team Member/Role*

- Committee Member (Visibility, UPCCE, ABET)
- Faculty Recruitment
- MQP Coordinator

## CONFERENCES & SEMINARS

Annual Renewable Energy Conference, A-State, Jonesboro, AR (09/2014)
*Update on Semiconductor Film Electrodeposition Research at Arkansas State University*
- Poster presentation

ASSET Initiative Annual Meeting - NASA/EPSCoR, Little Rock, AR (09/2014)
*Update on Semiconductor Film Electrodeposition Research at Arkansas State University*
- Oral presentation

40th IEEE Photovoltaic Specialist Conference (PVSC), Denver, CO (06/2014)
*Morphological and Compositional Analysis of Electrodeposited In2S3 films*
- Poster presentation

TechConnect Conference,Washington, DC (05/2013)
*Statistical Analysis of Electroplated Indium (III) Sulfide (In2S3) Films, a Potential Buffer Material for PV (Heterojunction Solar Cells) Systems, using Organic Electrolytes*
- Poster presentation

A-State Create@State, Jonesboro, AR (04/2013)
*Innovations in semiconductor electrodeposition*
- Oral presentation

Arkansas State Capitol, Little Rock, AR (02/2013)
*CdTe/ In2S3 Solar Cells by Electrodeposition and Evaporation*
- Poster presentation

ASSET Initiative Annual Meeting - NASA/EPSCoR, Springdale, AR (08/2012)
*Progress and Challenges in Electrodeposition of Indium (III) Sulfide (In2S3) Films from Organic Electrolytes for Potential Solar Cell Use*
- Oral presentation

Arkansas Academy of Science (AAS), (04/2012)
*Taguchi Analysis and Characterization of Electrodeposited Indium Sulfide Films for Use as Potential Buffer Layers in Solar Cells*
- Oral presentation, 3rd prize

A-State Create@State, Jonesboro, AR (04/2012)
*Rest Potential-Based Electrodeposition of Metal Sulfide Films*
- Oral presentation

Arkansas State Capitol, Little Rock, AR (02/2012)
*Progress in Electrodeposition of Indium Sulfide and Copper Indium Disulfide*
- Poster presentation

ASSET Initiative Annual Meeting - NASA/EPSCoR, Heber Springs, AR (07/2011)
*Research at Arkansas State University Optoelectronic Materials Research Laboratory*
- Oral presentation

Electronic Materials Conference (EMC), Santa Barbara, CA (06/2011)
*Electrodeposition of Indium Sulfide Films from Organic Electrolyte*
- Oral presentation, 1st prize

A-State Create@State, Jonesboro, AR (04/2011)
*Electrodeposition of Indium Sulfide from Organic Electrolyte*
- Oral presentation

Arkansas Academy of Science (AAS), Monticello, AR (04/2011)
*Conference/Issuer of the certificate*
- Oral presentation, 1st prize

## SERVICE

### Service to WPI
Worcester Polytechnic Institute

*Team Member/Role*
- TouchTomorrow, ECE
- Launch Workshops I & II, ECE
- Frontiers Program, ECE
- eWeek - KEEN

### Local Civic Engagement
Financial Aid & Admissions

*Promoting ECE/WPI at Worcester Islamic Center*

### Service to Profession
Journals and Societies

*Role*
- Journal Reviewer
- NSPE, IEEE, SASE, IAE

## SCIENTIFIC/PROFESSIONAL ORGANIZATIONS

Institute of Electrical and Electronics Engineer (IEEE) (2015 - Present)
*Senior Member*

The Optical Society (2015 - 2016)
*Member*

Coatings, MDPI (2015 - 2016)
*Reviewer*

Advance Energy Materials (2016 - Present)
*Reviewer*

Journal of Alloys and Compounds, Elsevier (2016 - Present)
*Reviewer*

Solar Energy, Elsevier (2016 - Present)
*Reviewer*

The European Physical Journal Applied Physics (EDP Sciences) (2015 - 2017)
*Reviewer*

Journal of Renewable Energy, Elsevier (2015 - Present)
*Reviewer*

Society of of Asian Scientists & Engineers (2016 - Present)
*Member*

International Association of Engineers (IAE) (2015 - Present)
*Member*

National Society of Professional Engineers (NSPE) (2015 - 2016)
*Member*

Member, Arkansas Academy of Science (AAS) (2012 - 2018)
*Member*

## CONFERENCES & SEMINARS

Arkansas NSF EPSCoR Annual Conference, Little Rock, AR (10/2010)
*NASA and NSF EPSCoR – Sponsored Semiconductor Research at Arkansas State University*
- Visitor

## TECHNICAL SKILLS

**Hardware - Electronics & Prototyping**
FPGAs (Xilinx, Altera), Arduino Family, Raspberry Pi, ATMEL AVR STK 500, PLC (Allen Bradley & Mitsubishi), NI ELVIS II+, myRIO, cRIO, 3D Printers, MSP430., CNC & Laser Cutting machines, PCBs

**Hardware - Material Synthesis and Characterization**
PVD, E-Beam, Electrodeposition, SEM, TEM, XRD, XPS, AFM, Solar Simulator, Surface Profilometer

**Software - Electronics, Design, & Simulation**
AutoCAD, Solid Works, TinkerCad, Multisim, EveryCircuit, LabVIEW, RS Logix, CCW, ISE Project Navigator, Vivado, Logisim, Code Composer Studio (CSS), Origin, EasyEDA, Eagle, Fritzig

**Software - Statistics, Graphics & Media**
SPC, MS Excel, Minitab, Origin, Camtasia, OBS Studio

**Software - Thin Film Photovoltaic Technology**
SCAPS, AMPS, TF Calc

**Languages**
LaTeX, Verilog, C++, Python, Matlab, Arduino

**Learning Management Systems & Tools**
Blackboard, CANVAS, MS Teams, Slack

**Remote Learning**
Webex, Zoom, OBS Studio, StreamYard

## LANGUAGES

English
*Full Professional Proficiency*

Urdu
*Native or Bilingual Proficiency*

Hindi
*Full Professional Proficiency*

Arabic
*Limited Working Proficiency*

## INTERESTS

Fishing

Hiking

Traveling

YouTuber

Vlogging

Reading