OMAR ALI BEG

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KEY QUALIFICATIONS

Dr. Omar Ali Beg is an Assistant Professor of Electrical Engineering at the University of Texas Permian Basin. Previously, he was with the University of Texas at Arlington as an Assistant Professor of Research where he worked on projects funded by the Office of Naval Research. He earned his Ph.D. degree in electrical engineering from the same school. His research interests include cyber-attack detection and resilience in cyber-physical power systems using formal methods and artificial intelligence. He was a recipient of the U.S. Air Force Research Laboratory Summer Research Fellowship in 2015. He is also the recipient of the Rising STARs (Science and Technology Acquisition and Retention) grant by the UT System. This STARs grant will help establish a research laboratory at UT Permian Basin to promote research and education on smart grids and resilient power systems. Dr. Beg has following key qualifications:

- Over twenty years of teaching, research, and development experience in electric power and energy systems (including smart grid, cyber-security, software-controlled power electronics, and distributed energy resources)
- Extensive experience of advising and guiding students and novice engineers towards successful careers

EDUCATION AND CERTIFICATIONS

2017 **Doctor of Philosophy in Electrical Engineering (CGPA: 4.0/4.0)**, *The University of Texas at Arlington*, Arlington, TX
- Dissertation: *Formal Verification of DC Distribution Networks*
- Advisers: Ali Davoudi (Adviser), Taylor T. Johnson (Co-Adviser)

2013 **Project Management Professional (PMP)**, *Project Management Institute (PMI)*, USA
Earned the certification based on the experience acquired through three research projects in defense pertaining to power sources for Autonomous Underwater Vehicles.

2012 **Diploma in Project Management**, *National University of Sciences and Technology*

2006 **Masters in Electrical Engineering (CGPA: 3.5/4.0)**, *National University of Sciences and Technology*
- Thesis: *P*arameter Estimation Methods for Identification of Linear Time-Invariant Systems
- Adviser: Vali Uddin

1998 **BSEE, Electrical Engineering**, *National University of Sciences and Technology*
- Final year project: *D*esign and Development of the Heart Beat Monitor
- Adviser: S. M. Babur

PROFESSIONAL AND RESEARCH EXPERIENCE

8/2019 – Present **Assistant Professor**, *The University of Texas Permian Basin,* Odessa, TX
- Transformed two face-to-face courses, namely, fundamentals of circuit analysis and signals and systems to online during COVID-19 emergent situation
- Taught courses/labs pertaining to digital circuit design, fundamentals of circuits analysis, and electromagnetic fields in line with the ABET guidelines
- During these courses, taught the students about National Instruments (NI) Multisim simulation software for electrical and digital circuits, NI ELVIS-III prototyping board, internet-based NI Measurements Live virtual utility, and java-based software for simulation and analysis of electromagnetic fields
- Collaborated with the members of VeriVITAL: The Verification and Validation for Intelligent and Trustworthy Autonomy Laboratory at Vanderbilt University on the reachability analysis of power systems
- Collaborated with the research groups/scholars in four universities that have significant research activities, including the University of Pennsylvania, the University of Texas at Arlington, and the University of Texas at San Antonio on cyber-physical anomaly detection in power systems
- Three research papers have been submitted and one is under preparation as a result of collaborations
- Led and advised a research project for Semester Undergraduate Research in Engineering (SURE) program and supervised an undergraduate student during Fall 2019 and Spring 2020
- Member of UTPB Intellectual Property committee and served in two faculty/staff search committees
- Participated in the departmental ABET committee and curriculum review committee meetings to bring the courses in line with ABET guidelines
- Actively participated in the outreach activities arranged for the students of local schools and community colleges, prepared the presentations and talked about the importance of engineering, conducted the lab tours and answered the questions of students and parents

2017 – 2019 **Assistant Professor of Research/Faculty Associate Researcher**, *The University of Texas at Arlington,* Arlington, TX

- Performed research activities at the Complex Power Electronics Laboratory on the research projects funded by the Office of Naval Research
- Mentored the graduate students in the laboratory, advised them on power electronics-based systems research, and guided about the technical writing of their research papers

2014 – 2017 **Graduate Teaching/Research Assistant**, *The University of Texas at Arlington,* Arlington, TX

- Worked on the research projects funded by the US Air Force Research Laboratory, Air Force Office of Scientific Research, the Office of Naval Research, and National Science Foundation
- Member of VeriVITAL: The Verification and Validation for Intelligent and Trustworthy Autonomy Laboratory
- Installation and commissioning of cyber-physical power systems test bed composed of dSPACE and Typhoon HIL Systems at Complex Power Electronics Laboratory
- Arranged, facilitated, and conducted outreach activities for local schools in 2016 and 2017

Summer 2015 **Graduate Research Intern**, *Air Force Research Laboratory, Information Directorate*, Air Force Office of Scientific Research (AFOSR), Summer Faculty Fellowship Program (SFFP), Rome, NY

1998 – 2004 & 2008 – 2013 **Electrical Engineer and Training Officer**, *Pakistan Navy*

- Initiated, compiled, and submitted the research grant proposals to the funding agencies for first three projects and led all the projects till completion:
  - Research Project 1: *D*evelopment of DC Power Sources for Autonomous Underwater Vehicles (AUVs)
  - Research Project 2: *R*efurbishment of the Discharge Station for DC Power Sources of AUVs
  - Research Project 3: *D*evelopment of the Charging Station for DC Power Sources of AUVs
  - Establishment Project 4: *C*onstruction of the Electronics Testing Facility for AUVs
- Led the engineering team to smoothly transition the developed products from R & D prototypes to full production that met the performance, reliability, and cost targets
- Documented the systems and subsystems level control requirements from functional specifications and the safety aspects in collaboration with all the stakeholders
- Developed and executed the systems validation and test plans to meet the documented requirements
- Led the team during harbor acceptance trials of the prototypes, conducted Failure Mode and Effects Analysis (FMEA) and identified the root causes of the failures, implemented technical solutions, provided design and documentation review through problem solving, resulting improved prototypes that passed the harbor acceptance trials
- Developed sea acceptance trials program for prototypes in coordination with all the stakeholders, and managed and conducted successful sea acceptance trials
- Prepared the technical progress reports for higher authorities
- Provided mentoring and prepared comprehensive training programs for novice engineers and technicians to familiarize them with the professional environment and safe industrial practices
- Actively participated in curriculum and lesson plans development for electrical engineering courses in the naval training school and taught courses pertaining to control systems, power electronics, and management for engineers

2006 – 2008 **Faculty of Electrical Engineering**, *National University of Sciences and Technology*

- Taught courses pertaining to control systems, power electronics, and circuit analysis
- Performed ISO audit of the education processes and procedures
- Organized three open house (job fair) sessions for local industry
- Organized an international conference in collaboration with IEEE
- Participated in accreditation of the college from engineering accreditation authority
- Provided mentoring to the electrical engineering students
- Arranged and led the industrial visits for the engineering students

AWARDS AND HONORS

Fall 2019 **Rising STARs (Science and Technology Acquisition and Retention) Award**, The University of Texas System

Summer 2015 **Graduate Research Intern**, *Air Force Research Laboratory, Information Directorate*, Air Force Office of Scientific Research (AFOSR), Summer Faculty Fellowship Program (SFFP), Rome, NY

2017 **PhD Dissertation Fellowship at The University of Texas at Arlington**, *Arlington, TX*

2015 **NSF Travel Awards for the PhD student forum at Formal Methods in Computer-Aided Design (FMCAD - 2015) Conference**, *Austin, TX*

2017 **NSF Travel Awards for Cyber-Physical Systems Week - 2017 (CPS - 2017)**, *Pittsburg, PA*

PROFESSIONAL ASSOCIATIONS

Member of the following professional associations:

- Institute of Electrical and Electronics Engineers (IEEE), Fort Worth Chapter, USA
- Project Management Institute (PMI), Fort Worth Chapter, USA
- National Center for Faculty Development and Diversity, USA

SALIENT RESEARCH ACTIVITIES

RESEARCH PAPERS UNDER REVIEW/PREPARATION

[U4] Xiaodong Yang, ***Omar Ali Beg***, Matthew Kenigsberg, and Taylor T. Johnson, "Hybrid System Identification from Input-Output Traces", submitted to *18th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS 2020)*.

[U3] ***Omar Ali Beg***, Ajay P. Yadav, Taylor T. Johnson, and Ali Davoudi, "Formal Online Resiliency Monitoring in Microgrids", submitted to *IEEE Resilience Week 2020*.

[U2] ***Omar Ali Beg***, Luan V. Nguyen, Taylor T. Johnson, and Ali Davoudi, "Cyber-Physical Anomaly Detection in Microgrids Using Parametric Time-Frequency Logic", submitted to *IEEE Access*.

[U1] Asad Ali Khan, Sara Ahmed, and ***Omar Ali Beg***, "Intelligent Fault Detection in Neural Network Controlled Inverter-based Systems". (Under preparation)

REFEREED JOURNAL ARTICLES

[J5] Shan Zuo, ***Omar Ali Beg***, Ali Davoudi, and Frank L. Lewis, "Resilient Networked AC Microgrids Under Unbounded Cyber Attacks", in *IEEE Transactions on Smart Grid*, March 2020, DOI: 10.1109/TSG.2020.2984266.

[J4] ***Omar Ali Beg***, Luan V. Nguyen, Taylor T. Johnson, and Ali Davoudi, "Signal Temporal Logic-based Attack Detection in DC Microgrids," in *IEEE Transactions on Smart Grid*, vol. 10, no. 4, pp. 3585-3595, July 2019.

[J3] ***Omar Ali Beg***, Houssam Abbas, Taylor T. Johnson, and Ali Davoudi, "Model Validation of PWM DC-DC Converters," in *IEEE Transactions on Industrial Electronics*, vol. 64, no. 9, pp. 7049-7059, Sept. 2017.

[J2] ***Omar Ali Beg***, Taylor T. Johnson, and Ali Davoudi, "Detection of False-data Injection Attacks in Cyber-Physical DC Microgrids," in *IEEE Transactions on Industrial Informatics*, vol. 13, no. 5, pp. 2693-2703, Oct. 2017.

[J1] Stanley Bak, ***Omar Ali Beg***, Sergiy Bogomolov, Taylor T. Johnson, Luan V. Nguyen, and Christian Schilling, "Hybrid Automata: From Verification to Implementation", in International Journal on Software Tools for Technology Transfer, vol. 21, no. 1, pp. 87-104 Feb. 2019 (Online Since Jun. 2017).

REFEREED CONFERENCE/WORKSHOP PROCEEDINGS PAPERS

[C3] ***Omar Ali Beg***, Luan V. Nguyen, Ali Davoudi, and Taylor T. Johnson, "Computer-Aided Formal Verification of Power Electronics Circuits," IEEE Frontiers in Analog CAD (FAC), Frankfurt, Germany, July 2017.

[C2] ***Omar Ali Beg***, Ali Davoudi, and Taylor T. Johnson, "Reachability Analysis of Transformer-Isolated DC-DC Converters (Benchmark Proposal)," 4th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2017), Co-located with the Cyber-Physical Systems Week 2017, Pittsburgh, PA, April 2017.

[C1] ***Omar Ali Beg***, Ali Davoudi, and Taylor T. Johnson, "Charge Pump Phase-Locked Loops and Full Wave Rectifiers for Reachability Analysis (Benchmark Proposal)," 3rd International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2016), Co-located with the Cyber-Physical Systems Week 2016, Vienna, Austria, April 2016.

PRESENTATION AND TALKS

[P5] ***Omar Ali Beg***, "Scalable Formal Verification of Resilient Converter-dominated MVDC Networks", in the Office of Naval Research Controls Workshop at the University of Virginia, Blacksburg, VA, 2019.

[P4] ***Omar Ali Beg***, Shankar Abhinav, and Ali Davoudi, "Resilient Microgrid Control", in the Office of Naval Research Controls Workshop, Arlington, TX, 2018.

[P3] ***Omar Ali Beg***, Ali Davoudi, and Taylor T. Johnson, "Detecting and Mitigating Cyber-Physical Attacks with Invariant Inference and Runtime Assurance", poster presentation at US Air Force Research Laboratory, Rome, NY, 2015.

[P2] ***Omar Ali Beg***, Ali Davoudi, and Taylor T. Johnson, "Formal Verification of Software-controlled Power Electronics", in US Air Force Research Laboratory Safe and Secure Systems and Software Symposium, Dayton, OH, 2015.

[P1] ***Omar Ali Beg***, Ali Davoudi, and Taylor T. Johnson, "Computer Aided Formal Verification of Power Electronics Based Cyber-physical Systems", in Formal Methods in Computer Aided Design, Austin, TX, 2015.

RESEARCH GRANTS SUBMITTED

Fall 2019 **Rising STARs (Science and Technology Acquisition and Retention) Award**, The University of Texas System

Rising STARs grant was awarded by the University of Texas System to setup a research lab at the College of Engineering UTPB.

2019 **Engineering Research Center for Water Energy Nexus (WEN)**, National Science Foundation

As a Co-PI, I contributed to write the planning grant proposal for Engineering Research Center for Water Energy Nexus (WEN) at UTPB and submitted it to NSF. This grant proposal has not been accepted and has been received back with some comments.

VOLUNTEER ACTIVITIES

2015 – Present Reviewer of the following technical journals:

- IEEE Transactions on Smart Grid
- IEEE Transactions on Power Electronics
- IEEE Journal of Emerging and Selected Topics in Power Electronics
- IEEE Transactions on Power Systems
- IEEE Transactions on Energy Conversion
- IEEE Transactions on Circuits and Systems - I
- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Industrial Electronics
- IET Control Theory and Applications
- IET Generation, Transmission, and Distribution
- IET Power Electronics
- IEEE Access

2016 – 2017 Conducted the outreach activities at The University of Texas at Arlington for local schools of the Arlington Independent School District to apprise the school kids about the importance of science, technology, and engineering education and develop their interest in this profession

Fall 2019 Actively participated in the outreach activities at The University of Texas Permian Basin for the students of local schools and colleges to apprise and attract them towards UTPB engineering

TECHNICAL AND SOFTWARE SKILLS

Proficient in following skills developed over the past 20 years:

- Mathematical modeling, simulation, analysis, and emulation of power electronics
- Pulse width modulation techniques and associated controllers for power electronics devices
- Formal verification and validation of software-controlled power electronics devices. This skill involves verifying that a given device meets the documented specification/requirement
- Distributed cooperative control methodology in power systems with distributed sources
- MATLAB programming, SIMULINK/Stateflow modeling, PLECS simulation software, and Hardware-in-the-Loop (HIL) analysis for power electronics controls
- National Instruments (NI) Multisim software, NI ELVIS-III protyping board, NI Measurements Live internet-based virtual utility
- Installation, systems integration, and commissioning of power systems testbed
- Correct-by-construction technique, automatic model generation, and automatic implementation of the software-based controllers on embedded systems through C-code
- Design of experiments for newly developed electrical power sources in defense
- Computer-Automated Measurement & Control (CAMAC) and GW-Basic programming
- Working knowledge of the electrical motor drives used in defense
- Research grant proposal preparation experience for technical projects
- Sound technical writing skills – Published four research papers in quality journals and three workshop papers
- Communication Skills – Presented research work in conferences/symposiums/workshops organized by US Air Force Research Lab, Office of the Naval Research, and the University of Texas at Austin, Austin, TX