CURRICULUM VITAE

IBRAHIM AHMED

Department of Energy
Politecnico di Milano
Via La Masa 34 (Building B12), 20156 Milano, Italy
(***Emails:*** ibrahim.ahmed@polimi.it ***Mobile:*** +393515303715)

PERSONAL INFORMATION

Surname	Ahmed
Given Name	Ibrahim
Nationality	Nigerian
Gender	Male
Mobile	+393515303715
E-mail	ibrahim.ahmed@polimi.it; ibroah777@gmail.com

SUMMARY OF QUALIFICATIONS

The followings summarized qualifications and research performed, resulting to several publications including patents, journals, and conference proceedings:

- Study, development and application of artificial intelligence techniques for modeling burn-in of manufactured semiconductor devices for quality prediction and estimation of device early-life failure rates;
- Study, development and application of risk-informed approach for safety and reliability analysis of the reactor protection system (RPS) of the nuclear reactors;
- Study, development and application of machine learning techniques for sensor validation during normal but transient operation (i.e., startup, shutdown and load following mode of operations) of nuclear power plant (NPP);
- Accident diagnosis (such as LOCA, SGTR, SLB), fault detection and diagnosis of NPP using machine learning and deep learning techniques;
- Most of the programming implementations of the developed machine learning techniques were carried out using Python and R programming language and relevant R packages, such as keras package, an R interface to keras – a deep learning tool;
- Study and analysis of nuclear instrumentation and control (I&C) systems, particularly safety-critical RPS of the NPP;
- Study, design and implementation of field programmable gate array (FPGA) based RPS of the NPP using enhanced functional flow block diagram (EFFBD) models, finite state machine with data path (FSMD) models, hardware description language (HDL) – Very high speed integrated circuit HDL (VHDL), MATLAB/SIMULINK and FPGA chip devices.

MOST RELEVANT CONTRIBUTIONS AND CORRESPONDING WORKS

Topic	Contribution	Description	Publication
Risk	**Dependence analysis and important components identification and improvement**	Development of methods of risk-informed approaches for dependence analysis and safety improvement in nuclear power plants	I. Ahmed, E. Zio, and G. Heo, "*Risk-informed approach to the safety improvement of the reactor protection system of the AGN-201K research reactor*", Nuclear Engineering and technology, Vol. 52, pp. 764-775, 2020.
Reliability	**Prognostics and health management for condition-based and predictive maintenance.**	Development of data-driven techniques of signal and data analysis for fault detection in nuclear and other industrial/process plants.	I. Ahmed, G. Heo, and E. Zio, "*On-line process monitoring during transient operations using weighted distance Auto Associative Bilateral Kernel Regression*", ISA Transactions, Vol. 92, pp. 191-212, 2019. G. Heo, I. Ahmed, and G. Ha, "*Apparatus and Method for Online Signal Data Validation via Auto Associative Bilateral Kernel Regression*", Korea Patent, Patent No. 10-2199695, Korea, 2021.
		Development of data-driven techniques of signal and data analysis for fault diagnostics in nuclear power plants.	I. Ahmed, S. Lee, and G. Heo, "*Classification of Abnormal Conditions: A Data-driven Aid for the Selection of Abnormal Operating Procedures in NPPs*", Proceedings of International Symposium on Future I&C for Nuclear Power Plant (ISOFIC), Gyeongju, Korea, November 26-30, 2017. G. Ha, I. Ahmed, and G. Heo, "*Development of an Improved Data-Driven Diagnostic Platform for Process Plants: Case Study of Feedwater Heater Leakage*", Proceedings of International Symposium on Future I&C for Nuclear Power Plant (ISOFIC), Gyeongju, Korea, November 26-30, 2017.
	Quality and Reliability Enhancement in Industry 4.0	Development of data-driven techniques of signal and data analysis for quality prediction in semiconductor industries.	P. Baraldi, S. Medici, I. Ahmed, E. Zio, and H. Lewitschnig, "*A Method based on Gaussian Process Regression for Modelling Burn-in of Semiconductor Devices*", Accepted conference paper: Proceedings of the 31th European Safety and Reliability Conference, Angers, France, September 19-23, 2021.

ACADEMIC QUALIFICATIONS

1. **Ph.D. Degree in Nuclear Engineering**,
KYUNG HEE UNIVERSITY, Yongin-si, Republic of Korea.
   - Ph.D. THESIS TITLE: "Bilateral Kernel Methods for Time-series States Validation in Process Systems."
   - CGPA of 4.04 out of maximum of 4.3.

March 2nd 2016 to February 19th 2020

2. **MSc Degree in Nuclear Power Plant (NPP) Engineering**,
KEPCO INTERNATIONAL NUCLEAR GRADUATE SCHOOL (KINGS), Ulsan, Republic of Korea.
   - MSc THESIS TITLE: "Design Verification Enhancement of FPGA-based Plant Protection System Trip Functions for Nuclear Power Plant."
   - GPA of 3.78 out of maximum of 4.3

February 28th 2014 to January 20th 2016

3. **B.Eng. Degree in Electrical and Computer Engineering**,
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, Nigeria.
   - B. ENG. PROJECT TITILE: "Design and Construction of Microcontroller-based Automatic School Bell."
   - CGPA of 4.67 out of maximum of 5 (**First Class Honors**)

January 1st 2004 to April 28th 2010

4. **Senior School Certificate Examination (SSCE)**,
Government Science College, Izom, Niger State, Nigeria.
   - May/June National Examination Council (NECO)

June 2002

ACADEMIC/RESEARCH EXPERIENCE

1. **Postdoctoral Research Fellow**, Department of Energy, Politecnico di Milano, Milan, Italy.
   - Research Project Title: Intelligent Reliability 4.0 (iRel40).

June 2020 to date (1 year, on-going)

2. **Ph.D. Candidate and Research Assistant**, Department of Nuclear Engineering, Kyung Hee University, Yongin-si, Republic of Korea.
   - Research Project Title 1: Development of Advanced Early Warning Techniques on Domain Conversion;
   - Research Project Title 2: Development of Artificial Intelligence and Open Test-bed for Automation of Abnormal Situations in Nuclear Power Plants;
   - Research Project Title 3: Research on the Future Advanced Basic Technologies Using Zero Power Reactor.

March, 2016 To February, 2020 (4 years)

3.	**MSc Student and Research Assistant**, Department of Nuclear Power Plant Engineering, KEPCO International Nuclear graduate School (KINGS), Ulsan, Republic of Korea. ▪ Research Topic: Design, Development and Verification of Field Programmable Gate Array (FPGA) based Reactor Protection System for Nuclear Power Plant.	February, 2014 to January, 2016 (2 years)
4.	**Graduate Assistant**, Department of Telecommunication Engineering, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, Nigeria.	January 2012 to October, 2012 (10 months)

TEACHING EXPERIENCE

1.	Seminar presentation, titled *Quality and Reliability Enhancement in Industry 4.0: The iRel4.0 Project* organized for master students in Nuclear Engineering and Energy Engineering of Politecnico Di Milano within the course "RELIABILITY, SAFETY AND RISK ANALYSIS A+B".Department of Energy, Politecnico di Milano, Milan, Italy.	March 5th 2021
2.	Teaching/Training (Invited Lecturer) of master students of the Instrumentation and Control (I&C) Lab, Department of Nuclear Power Engineering, KEPCO International Nuclear graduate School (KINGS), Ulsan, Republic of Korea. ▪ *Design and Implementation of the FPGA-based I&C systems for Nuclear Power Plants: from VHDL coding to verification and Testing.*	July, 2016 (4 days)
3.	Teaching (Graduate Assistant) of undergraduate level courses in Department of Telecommunication Engineering, Federal University of Technology, Minna, Nigeria. ▪ *Data Communication and Network I* ▪ *Data Communication and Network II*	January 2012 to October, 2012 (2 Semesters)

WORK/INDUSTRIAL EXPERIENCE

1.	**Administrative Assistance (AA)**, Department of Nuclear Power Plant Engineering, KEPCO International Nuclear graduate School (KINGS), Ulsan, Republic of Korea.	March, 2014 to December, 2015 (2 hours per working day)

2. **Scientific Officer**, Nuclear Power Plant Development (NPPD) Directorate, NIGERIA ATOMIC ENERGY COMMISSION (NAEC), Abuja, Nigeria. Key activities performed:
   - Development and implementation of national nuclear power programme. This includes NPP siting, review of National Strategic Plan, Radioactive Waste Management Strategy and the Public Awareness and Communication Strategy.
   - Planning and preparatory work for IAEA INIR Mission Milestone.

October, 2012 to May, 2020

3. **Industrial work experience as National Youth Service Corps (NYSC)**, Maintenance Department, PIPELINE AND PRODUCT MARKETING COMPANY (PPMC) – a subsidiary of NIGERIAN NATIONAL PETROLEUM CORPORATION (NNPC), Kaduna Area Office, Kaduna State, Nigeria. Key activities performed:
   - Worked under Instrumentation and Control (I&C) unit;
   - Carried out tests and record effects of varying process conditions such as temperature, pressure, liquid flow and level;
   - Selected, calibrated and installed instrument equipment, such as pressure and temperature gauges, switches and transmitters using Dead Weight Tester;
   - Checked and troubleshot telemetry panels and recording instruments for faults using drawing circuit diagrams;
   - Troubleshot, repaired and performed preventive maintenance on test apparatus (such as dead weight tester), equipment (control, measuring and protective devices), and relay logics panels.

August, 2010 to June, 2011 (10 months)

4. **Industrial training (Student's Industrial Work Experience (SIWES))**, Power Plant and Utilities (PPU) Department, KADUNA REFINING & PETROCHEMICAL COMPANY (KRPC) – a subsidiary of NNPC, Kaduna State, Nigeria. Key activities performed:
   - Carried out preparation for boiler start-up operation;
   - Started high boiler feed water pumps (steam deriving);
   - Took readings of temperature, pressure and speed of the operating equipment in the plant, from the installed measuring instruments;
   - Took feed water samples of the boilers under operation to the laboratory, in order to test for silicate contents and P^H level.

July, 2008 to December, 2008 (6 months)

PROFESSIONAL QUALIFICATIONS/TRAININGS

- Confirmation of Attendance (XXI Edition of the One-week Professional Training Course on "RAM/PHM 4.0: Advanced Methods for Reliability, Availability, Maintainability, Prognostics and Health Management of Industrial Equipment"), Polytechnic of Milan, Italy.

10 – 13 December, 2018

- Certificate of Participation (World Nuclear University Short Course: "The Nuclear Industry Today"), Seoul, Republic of Korea. — 6 – 8 July, 2016
- Certificate of Participation (Training Workshop on the "Design, Installation, Harvesting, and Maintenance of Solar Power System"), National Directorate of Employment, Minna, Nigeria. — 23 – 27 January, 2012
- Certificate of Participation (Workshop on "Artificial Intelligence Systems Using MATLAB"), Federal University of technology, Minna, Nigeria. — 19 – 23 March, 2012
- Proficiency Certificate in Management- Nigerian Institute of Management (NIM), Nigeria. — October 18, 2011
- Certificate of Participation (International Training Workshop on "Renewable Energy Technology for Policy Makers, Practitioners and Youth Corpers"), Abuja, Nigeria. — 2 – 6 August, 2010
- Certificate of Proficiency (Computer Fundamentals, Internet Applications, Windows XP and Microsoft Offices 2007), Federal University of Technology, Minna, Nigeria. — 2009
- Certificate of Attendance (Fire and Safety Induction Course in NNPC/KRPC, Kaduna), Kaduna, Nigeria. — 9 – 10 July, 2008

RESEARCH/PUBLICATIONS

Patent

[1] G. Heo, **I. Ahmed**, and G. Ha, "Apparatus and Method for Authenticating Time-Varying Signal in Online via Kernel Regression Model", *Korea Patent*, Patent No. 10-1967524, Korea, 2019, DOI: https://doi.org/10.8080/1020170047774?urlappend=en.

[2] G. Heo, **I. Ahmed**, and G. Ha, "Apparatus and Method for Online Signal Data Validation via Auto Associative Bilateral Kernel Regression", *Korea Patent*, Patent No. 10-2199695, Korea, 2021, DOI: https://doi.org/10.8080/1020180170632?urlappend=en.

[3] G. Heo and **I. Ahmed**, "Apparatus and Method for Searching the Best Temporal Kernel in a Weighted Distance Auto Associative Bilateral Kernel Regression", *Korea Patent Application*, Application No. 10-2020-0013131, Korea, 2020.

Journal

[1] **I. Ahmed**, E. Zio, and G. Heo, "Risk-informed approach to the safety improvement of the reactor protection system of the AGN-201K research reactor", *Nuclear Engineering and technology*, Vol. 52, pp. 764-775, 2020.

[2] **I. Ahmed**, G. Heo, and E. Zio, "On-line process monitoring during transient operations using weighted distance Auto Associative Bilateral Kernel Regression", *ISA Transactions,* Vol. 92, pp. 191-212, 2019.

[3] **I. Ahmed**, JC. Jung, and G. Heo, "Design Verification Enhancement of Field Programmable Gate Array-based Safety-Critical I&C System of Nuclear Power Plant", *Nuclear Engineering and Design,* Vol. 317, pp. 232-241, 2017.

[4] JC. Jung and **I. Ahmed**, "Development of field Programmable gate Array-based Reactor Trip Functions Using Systems Engineering Approach", *Nuclear Engineering and technology* Vol. 48, Issue 4, pp. 1047-1057, 2016.

[5] H. O. Ohize, E. N. Onwuka, and **I. Ahmed**, "Design of Microcontroller-Based Automatic School Bell", *AU Journal of Technology* Vol. 15(2), pp. 121-128, October, 2011.

Conference Proceedings

[1] P. Baraldi, S. Medici, **I. Ahmed**, E. Zio, and H. Lewitschnig, "A Method based on Gaussian Process Regression for Modelling Burn-in of Semiconductor Devices", Accepted conference paper: *Proceedings of the 31th European Safety and Reliability Conference, Angers, France,* September 19-23, 2021.

[2] J. Jeong, G. Heo, and **I. Ahmed**, "Availability Analysis of RPS with Multiple Platforms(PLC, FPGA)", *Proceedings of the Asian Symposium on Risk Assessment and Management, Virtual Conference, Online (ASRAM2020),* November 30-December 2, 2020.

[3] **I. Ahmed**, S. Lee**,** and G. Heo, "Classification of Abnormal Conditions: A Data-driven Aid for the Selection of Abnormal Operating Procedures in NPPs", *Proceedings of International Symposium on Future I&C for Nuclear Power Plant (ISOFIC), Gyeongju, Korea,* November 26-30, 2017.

[4] G. Ha, **I. Ahmed**, and G. Heo, "Development of an Improved Data-Driven Diagnostic Platform for Process Plants: Case Study of Feedwater Heater Leakage", *Proceedings of International Symposium on Future I&C for Nuclear Power Plant (ISOFIC), Gyeongju, Korea,* November 26-30, 2017.

[5] **I. Ahmed** and G. Heo, "Development of a Transient Signal Validation Technique via a Modified Kernel Regression Model", *10th International Embedded Topical Meeting on Nuclear Plant Instrumentation, Control, & Human-Machine Interface Technologies NPIC&HMIT 2017, San Francisco, CA, USA,* pp.1943-1951, June 11-15, 2017.

[6] **I. Ahmed**, G. Heo, and M. Kassim, "Fault Detection and Diagnosis of Nuclear Power Plant Using Deep Learning Architecture", *Transaction of Korean Nuclear Society Spring Meeting, Jeju, Korea,* May 18-19, 2017.

[7] **I. Ahmed** and G. Heo, "Gaussian Process-based Methods for Process States Validation", *Transaction of Korean Nuclear Society Autumn Meeting, Goyang, Korea,* October 24-25, 2019.

[8] **I. Ahmed** and G. Heo, "A Deep Long Short-Term Memory Neural Network based Autoencoders for Signal Validation", *Transaction of Korean Nuclear Society Autumn Meeting, Goyang, Korea,* October 24-25, 2019.

[9] **I. Ahmed** and G. Heo, "Weighted-distance AABKR: A Transient Monitoring Approach for Nuclear Power Plant Components", *Korea PHM Conference (PHM KOREA-2019), Seoul, Korea,* April 10-12, 2019.

[10] **I. Ahmed** and G. Heo, "Risk-Informed Safety Improvement for AGN-201K Research Reactor Shutdown System", *International HANARO Symposium (HANARO-2019), Daejeon, Korea,* April 10-12, 2019.

[11] **I. Ahmed** and G. Heo, "Preliminary Unavailability Analysis of Shutdown System for AGN-201K Research Reactor", *Research Reactor Fuel Management (RRFM/IGORR-2019) Transactions, Dead Sea, Jordan,* March 24-28, 2019.

[12] **I. Ahmed** and G. Heo, "On-line Condition Monitoring in Transient Operation of NPP Using Auto Associative Bilateral Kernel Regression", *Transaction of Korean Nuclear Society Spring Meeting, Jeju, Korea,* May 17-18, 2018.

[13] **I. Ahmed** and G. Heo, "Development of a Modified Kernel Regression Model for a Robust Signal Reconstruction", *Transaction of Korean Nuclear Society Autumn Meeting, Gyeongju, Korea,* October 27-28, 2016.

[14] **I. Ahmed**, JC. Jung, and G. Heo, "Application of Integrated Verification Approach to FPGA-based Safety-Critical I&C System of Nuclear Power Plant", *Transaction of Korean Nuclear Society Autumn Meeting, Gyeongju, Korea,* October 27-28, 2016.

[15] **I. Ahmed**, JC. Jung, and G. Heo, "Design Verification Enhancement of FPGA-based Plant Protection System Trip Logics for Nuclear Power Plant", *Transaction of Korean Nuclear Society Spring Meeting, Jeju, Korea,* May 12-13, 2016.

[16] **I. Ahmed** and JC. Jung, "Development of FPGA-based Reactor Trip Functions", *9th Asia-Pacific Conference on Systems Engineering (APCOSE**C** 2015), Seoul, Korea.* October 13-15, 2015.

[17] **I. Ahmed** and JC. Jung, "A Systematic Approach to FPGA Design Methodology for Reactor Protection system", P*roceedings of STSS/ISSNP 2015*, Kyoto, Japan, August 25-28, 2015.

Research Interest

Data analysis, data mining, artificial intelligence and machine learning for health management (condition monitoring, signal validations, accident/Fault Detection, Diagnosis & Prognosis) of Industrial/Process and Complex Systems such as NPPs; Nuclear reactor protection and monitoring; Intelligent Reliability, Safety and Resilience Analysis of critical systems; Automations and Intelligent Design of Instrumentation and control (I&C) for safety-critical systems; and Field Programmable Gate Array (FPGA) applications in I&C systems.

ACADEMIC AWARDS

[1] **Best Paper Presentation Award:** award for the paper presentation entitled *Development of an Improved Data-Driven Diagnostic Platform for Process Plants: Case Study of Feedwater Heater Leakage*, as the best paper presentation of *International Symposium on Future I&C for Nuclear Power Plant (ISOFIC), Gyeongju, Korea,* November 26-30, 2017.

[2] **Best Paper Award:** award for the paper entitled *Design Verification Enhancement of FPGA-based Plant Protection System trip Logics for Nuclear Power Plant*, as the best paper of the 2016 Korean Nuclear Society Spring Conference (Received on October 27, 2016).

[3] **Scholarship Student Award** of the 2015 Korean Nuclear Society (May 7, 2015).

[4] **Dean's List** awards for academic performance in all levels 100-500, School of Engineering and Engineering Technology, Federal University of Technology, Minna, Nigeria (2005-2009).

PROFESSIONAL MEMBERSHIP

- IEEE Young Professionals Membership — Jan – Dec 2016
- Membership of Professional body – Korean Nuclear Society, Republic of Korea. — Aug. 2016 – Present
- Membership of Professional body – Nigeria Institute of Management (Chartered), Nigeria. — Nov. 2011 – Present

OTHER RELEVANT SKILLS

Computer Applications

- Microsoft Office tool;
- Windows;
- AIMS PSA tool;
- MARS-KS computer code.

Programming Skills

- R (very good);
- C++ (average);
- MATLAB (average);
- Python (good);
- Assembly language of 8051 microcontrollers (good);
- VHDL (Very high speed integrated circuit Hardware Description Language) (good).

Practical/Technical Skills

- Design, programming, and construction of 8051 microcontrollers based devices and systems.
- Design, programming, and implementation of digital Field Programmable Gate Array (FPGA) based devices and systems;
- Proper understanding of the working principles and uses of relay logics as a means of control and protection as well as troubleshooting of common faults using wiring diagrams;
- Identify, read, calibrate, and install pressure and temperature switches, gauges and transmitters in the Oil and Gas Sector;
- Electrical building Installations;
- Design implementation and troubleshooting of most electrical power equipment, particularly inverters, UPS;
- Design, implement and install solar electricity (Photovoltaic Cells/Modules).