CURRICULUM VITAE

IBRAHIM AHMED

Laboratory of Signal and Risk Analysis (LASAR) Department of Energy Politecnico di Milano

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PERSONAL INFORMATION Surname Ahmed Given Name Ibrahim 20th October, 1986/Katcha, Niger State, Nigeria **Date and Place of Birth** Nationality Nigerian Gender Male **Marital Status** Married E-mail ibrahim.ahmed@polimi.it ACADEMIC QUALIFICATIONS Ph.D. Degree in Nuclear Engineering, March 2nd 2016 1. KYUNG HEE UNIVERSITY, Yongin-si, Republic of Korea. to February 19th 2020 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. MSc Degree in Nuclear Power Plant (NPP) Engineering, February 28th 2014 2. KEPCO INTERNATIONAL NUCLEAR GRADUATE SCHOOL (KINGS), to January 20th 2016 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 3. **B.Eng.** Degree in Electrical and Computer Engineering, January 1st 2004 FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, Nigeria. to April 28th 2010 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) Senior School Certificate Examination (SSCE), June 2002 4. Government Science College, Izom, Niger State, Nigeria. May/June National Examination Council (NECO)

ACADEMIC/RESEARCH EXPERIENCE

1.	 Assistant Professor (RTDa), at the LASAR, Department of Energy, Politecnico di Milano, Milan, Italy. <u>Scientific Disciplinary Area:</u> ING-IND/19 - Nuclear power plants <u>Development of Innovative Methodologies and Models</u> for the Reliability, Safety, Resilience, and Algorithms for Fault Diagnostics and Prognostics, and Maintenance of Complex Systems <u>Research Project Title:</u> Intelligent Reliability 4.0 (iRel40). 	November, 2021 To Date
2.	 Postdoctoral Research Fellow, at the LASAR, Department of Energy, Politecnico di Milano, Milan, Italy. <u>Research Project Title:</u> Intelligent Reliability 4.0 (iRel40). 	June 2020 to September, 2021
3.	 Ph.D. Candidate and Research Assistant, at the Mainformatics Laboratory, Department of Nuclear Engineering, Kyung Hee University, Yongin-si, Republic of Korea. <u>Research Project Title 1:</u> Development of Advanced Early Warning Techniques on Domain Conversion; <u>Research Project Title 2:</u> Development of Artificial Intelligence and Open Test-bed for Automation of Abnormal Situations in Nuclear Power Plants; <u>Research Project Title 3:</u> Research on the Future Advanced Basic Technologies Using Zero Power Reactor. 	(1 year, 4 months) March, 2016 to February, 2020 (4 years)
4.	 MSc Student and Research Assistant, at the Instrumentation and Control Laboratory, Department of Nuclear Power Plant Engineering, KEPCO International Nuclear graduate School (KINGS), Ulsan, Republic of Korea. <u>Research Topic:</u> 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)
5.	Graduate Assistant , Department of Telecommunication Engineering, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, Nigeria.	January 2012 to October, 2012 (10 months)
WOR	RK/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)
PR	OFESSIONAL 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),	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

Book Chapter

- I. Ahmed, F. Hosseinpour, P. Baraldi, E. Zio, H. Lewitschnig, "An Artificial Intelligence-Based Framework for Burn-in Reduction in the Semiconductor Manufacturing Industry", In: van Driel, W.D., Pressel, K., Soyturk, M. (eds) *Recent Advances in Microelectronics Reliability*. Springer, Cham., 2024. Doi: <u>https://doi.org/10.1007/978-3-031-59361-1_5</u>.
- I. Ahmed, E. Zio, and G. Heo, "Fault Detection by Signal Reconstruction in Nuclear Power Plants", In: C. L. Pope (ed.), *Nuclear Reactors - Spacecraft Propulsion, Research Reactors, and Reactor Analysis Topics*. London, United Kingdom: IntechOpen, 2021 [Online]. Available: https://www.intechopen.com/chapters/79671 doi: 10.5772/intechopen.101276.

Patent

- 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: <u>https://doi.org/10.8080/1020170047774?urlappend=en</u>.
- [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*, Patent No. 10-2286814, Korea, 2021, DOI: https://doi.org/10.8080/1020200013131?urlappend=en.

Journal

- [1] **I. Ahmed**, A. Croci, F. Antonello, E. Zio, "Integration of artificial intelligence within an advanced filtering framework for real-time system state estimation and risk prediction with application to a nuclear microreactor", *Nuclear Engineering and Technology*, In Press, Corrected Proof, 2024.
- [2] R. Z. Kahlid, I. Ahmed, A. Ullah, E. Zio, A. Khan, "Enhancing accuracy of prediction of critical heat flux in Circular channels by ensemble of deep sparse autoencoders and deep neural Networks", *Nuclear Engineering and Design*, 429, 113587, 2024.
- [3] C. Lai, I. Ahmed, E. Zio, W. Li, Y. Zhang, W. Yao, and J. Chen, "A Multistage Physics-Informed Neural Network for Fault Detection in Regulating Valves of Nuclear Power Plants", *Energies* 17, no. 11: 2647, 2024.
- [4] 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.
- [5] **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.
- [6] I. Ahmed, JC. Jung, and G. Heo, "Design Verification Enhancement of Field Programmable Gate Arraybased Safety-Critical I&C System of Nuclear Power Plant", *Nuclear Engineering and Design*, Vol. 317, pp. 232-241, 2017.
- [7] 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.

[8] 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] J. Figueroa, I. Ahmed, P. Baraldi, E. Zio, and H. Lewitschnig, "Multibranch Neural Network for Predicting Production Lot Quality in Semiconductor Industry", *Advances in Reliability, Safety and Security, Part 9, Proceedings of the 33rd European Safety and Reliability Conference (ESREL 2023), Cracow, Poland, 23-27 June 2024.*
- [2] I. Ahmed, P. Baraldi, E. Zio, and H. Lewitschnig, "Prediction of the Number of Defectives in a Production Batch of Semiconductor Devices", *Proceedings of the 33rd European Safety and Reliability Conference (ESREL 2023), Southampton, United Kingdom,* 3rd 7th September 2023.
- [3] I. Ahmed, E. Zio, W. Li, Y. Zhang, W. Yao and C. Juan, "A Grey-Box Digital Twin Approach for Real-Time Monitoring of Heat Exchangers in Nuclear Power Plants", *Proceedings of Asian Symposium on Risk Assessment and Management (ASRAM2022)*, 30 November – 2 December 2022, Daejeon, Korea.
- [4] C. Lai, I. Ahmed, E. Zio, W. Li, Y. Zhang, W. Yao and C. Juan, "A Physics-informed Recurrent Neural Network for Fault Detection in Regulating Valves of Nuclear Power Plants", *Proceedings of Asian Symposium on Risk Assessment and Management (ASRAM2022)*, 30 November – 2 December 2022, Daejeon, Korea.
- [5] B. Wang, I. Ahmed, E. Zio, W. Li, Y. Zhang, W. Yao and C. Juan, "LSTM-based Transfer Learning Method for Anomaly Detection in Multi-Modal Sensors of Nuclear Power Plants", *Proceedings of Asian Symposium on Risk Assessment and Management (ASRAM2022)*, 30 November – 2 December 2022, Daejeon, Korea.
- [6] M. N. Juybari, I. Ahmed, P. Baraldi, C. Lai, A. Del Cueto, J. Gil, S. Llorente and E. Zio, "Estimation of the Case Temperature of Insulated Gate Bipolar Transistors in Induction Cooktops by Deep Neural Network", *Proceedings of the 6th International Conference on System Reliability and Safety (ICSRS* 2022), Venice, Italy, 2022, pp. 259-263.
- [7] F. Hosseinpour, I. Ahmed, P. Baraldi, M. Behzad, E. Zio, and H. Lewitschnig, "An Unsupervised Method for Anomaly Detection in Multi-Stage Production Systems Based on LSTM Autoencoders", *Proceedings of the 32nd European Safety and Reliability Conference (ESREL 2022), Dublin, Ireland,* 28th August - 1st September 2022.
- [8] L. Miqueles, **I. Ahmed**, F. Di Maio, and E. Zio, "A Grey-Box Digital Twin-based Approach for Risk Monitoring of Nuclear Power Plants", *Proceedings of the 32nd European Safety and Reliability Conference (ESREL 2022), Dublin, Ireland,* 28th August 1st September 2022.
- [9] C. Lai, P. Baraldi, I. Ahmed, E. Zio, A. Del Cueto, J. Gil, and S. Llorente, "Monitoring Degradation of Insulated Gate Bipolar Transistors in Induction Cooktops by Artificial Neural Networks", *Proceedings* of the 32nd European Safety and Reliability Conference (ESREL 2022), Dublin, Ireland, 28th August -1st September 2022, pp.1338-1345.
- [10] 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", *Proceedings of the 31th European Safety* and Reliability Conference (ESREL 2021), Angers, France, September 19-23, 2021.

- [11] 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.
- [12] 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.
- [13] 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 1&C for Nuclear Power Plant (ISOFIC), Gyeongju, Korea,* November 26-30, 2017.
- [14] 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.
- [15] 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.
- [16] 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.
- [17] 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.
- [18] 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.
- [19] **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.*
- [20] 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.*
- [21] 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.
- [22] 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.
- [23] 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.
- [24] 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.
- [25] I. Ahmed and JC. Jung, "Development of FPGA-based Reactor Trip Functions", 9th Asia-Pacific Conference on Systems Engineering (APCOSEC 2015), Seoul, Korea. October 13-15, 2015.

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

Conference Presentations

- [27] I. Ahmed and E. Zio, "An Adaptive Empirical Model for Real-time Condition Monitoring of Nuclear Power Plant Components", Abstract Presentation at the PSAM 2023 Topical Conference on Artificial Intelligence & Risk Analysis for Probabilistic Safety/Security Assessment & Management, 23-25 October 2023 (Virtual).
- [28] L. Miqueles, I. Ahmed, F. Di Maio, and E. Zio, "Grey-Box Digital Twins of Nuclear Power Plants", Abstract Presentation at the PSAM 2023 Topical Conference on Artificial Intelligence & Risk Analysis for Probabilistic Safety/Security Assessment & Management, 23-25 October 2023 (Virtual).
- [29] I. Ahmed, P. Baraldi, F. Hosseinpour, E. Zio, and H. Lewitschnig, "Monitoring Semiconductor Manufacturing by Artificial Intelligence", *Abstract Presentation at the 6th International Conference on System Reliability and Safety (ICSRS 2022)*, Venice, Italy, November 23-25, 2022.
- [30] F. Hosseinpour, I. Ahmed, P. Baraldi, M. Behzad, E. Zio, and H. Lewitschnig, "Unsupervised Anomaly Detection in Semiconductor Manufacturing Systems Based on Stacked LSTM Autoencoders", *Abstract Presentation at the 6th International Conference on System Reliability and Safety (ICSRS 2022)*, Venice, Italy, November 23-25, 2022.
- [31] L. Miqueles, **I. Ahmed**, F. Di Maio, and E. Zio, "Risk Monitoring of Nuclear Power Plants by a Grey-Box Digital Twin Approach", *Abstract Presentation at the 6th International Conference on System Reliability and Safety (ICSRS 2022),* Venice, Italy, November 23-25, 2022.

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 Nuclear Power Plants; Nuclear reactor protection and monitoring; Intelligent Reliability, Safety and Resilience Analysis of complex systems and critical infrastructures; 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 Presentation Award:** award for the paper presentation entitled *Monitoring Semiconductor Manufacturing by Artificial Intelligence*, as the best presentation in a Session of 6th International *Conference on System Reliability and Safety (ICSRS), ICSRS2022, Venice, Italy,* November 23-25, 2022.
- [2] **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.
- [3] **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).
- [4] Scholarship Student Award of the 2015 Korean Nuclear Society (May 7, 2015).
- [5] **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. 2016 – Present
•	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;
- SAREX PSA tool;
- MARS-KS computer code.

Programming Skills

- R (very good);
- C++ (good);
- MATLAB/SIMULINK (Good);
- Python (good);
- Assembly language of 8051 microcontrollers (Very good);
- VHDL (Very high speed integrated circuit Hardware Description Language) (Very 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, and installation of solar electricity (Photovoltaic Cells/Modules).