



UNIVERSITÀ
DEL SALENTO



Innovative Tools for Cyber-Physical Energy Systems



Summer School 2024
**Dive into the Cyber-Physical Evolution of
Offshore Wind and Distribution Grids**

2.5 ECTS

9th to 13th of Sept. 2024

University of Salento

Lecce, Italy



Agenda



Monday 09.09.2024 – Offshore Wind: Power Quality, Stability, and Communication

Time	Activity	Presenter
9:00 – 9:30	Arrival and Summer School opening	
9:30 – 11:15	Towards autonomous software-defined Industrial IoT-Edge communication networks: A case of offshore wind farms	Agrippina Mwangi
11:30 – 13:00	Advanced Power Quality Disturbance Classification with Signal Processing and Deep Learning Techniques	Han Shao
13:00 – 14:30	Lunch break	
14:30 – 16:45	New Methodologies for Enhancing Grid Compliance and Stability of Wind Power Plants	Gabriel Guerreiro and Ramon Abritta

Tuesday 10.09.2024 – Control for Inverter-Based Resources in Energy Systems

Time	Activity	Presenter
9:00 – 9:15	Arrival and opening	
9:15 – 10:15	Keynote speech	To be announced
10:30 – 12:00	Framework to estimate IBR control parameters featuring time and frequency domain data	Kaio Vilerá
12:00 – 13:30	Lunch break	
13:30 – 16:30	Tutorial - Fundamentals on IBRs control: grid-forming, grid-following and stability analysis	Ali Arjomandi and Eder Baron-Prada

Wednesday 11.09.2024 – Energy Digitalization: Regulation and Data Management

Time	Activity	Presenter
9:00 – 9:15	Arrival and opening	
9:15 – 12:30	Tutorial - System Dynamics in Energy Digitalization: Enhancing Decision-Making and Regulatory Analysis	Jose A. Leiva V. and Roberto Monaco
12:30 – 14:00	Lunch break	
14:00 – 16:00	Approaches for Large-scale Data Management	Lunodzo Mwinuka

Thursday 12.09.2024 – Real-Time Simulation, Estimation, and Reliability in Power Systems

Time	Activity	Presenter
9:00 – 9:15	Arrival and opening	
9:15 – 10:00	Innovative Tools for the Reliability Predicting of Medium Voltage Cables	Konrad Sundsgaard
10:00 – 11:00	Tutorial - Building Predictive Reliability Models in Python	Konrad Sundsgaard
11:15 – 12:15	Modeling Smart Meter Data: Why and How?	Kutay Bölat
12:15 – 13:45	Lunch break	
13:45 – 14:30	Tutorial - Synthetic Smart Meter Data Generation using Variational Autoencoders	Kutay Bölat
14:45 – 15:45	Simulation testbed and Cyberattacks on virtualized IEDs in digital substations	Nadine Kabbara
16:00 – 17:00	Tutorial - Demo on RTDS with a virtual IED/ physical IED hybrid setup and cyberattack examples	Nadine Kabbara

Friday 13.09.2024 – Cyber Security and Data Privacy in Energy Systems

Time	Activity	Presenter
9:00 – 9:15	Arrival and opening	
9:15 – 11:15	Privacy-Preserving Load Forecasting Using Smart Meter Data	Mert Kesici
11:30 – 12:30	Cyber security threats, attacks, and mitigation in OT systems	Nicola Cibin
12:30 – 14:00	Lunch break	
14:00 – 15:00	Cyber security threats, attacks, and mitigation in OT systems	Nicola Cibin
15:15 – 16:15	Keynote speech	To be announced
16:15 – 16:30	Summer School closure	



Presenters



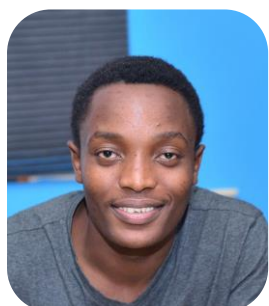
Agrippina Mwangi (Utrecht University) received her BSc. in Electrical and Electronic Engineering from Dedan Kimathi University of Technology and MSc. in Electrical and Computer Engineering from Carnegie Mellon University. She is pursuing a Ph.D. in the Energy & Resources Group at Copernicus Institute of Sustainable Development, Utrecht University (The Netherlands). Her research interests are IoT-Edge architectures, SDN/NFV, autonomous networks, AI/ML, and offshore wind.



Nadine Kabbara (Électricité de France, Utrecht University) received her MSc. degree in control and electrical engineering from Paris Saclay University. She is a third-year Industrial Ph.D. working with the French utility EDF in their R&D department. She is also part of the InnoCyPES European project on connected digital smart grids. Her research interests include virtualized digital substations, IEC 61850, virtualized IEDs, data modeling, and simulation frameworks.



Nicola Cibin (Delft University of Technology) received his B.Sc. degree in Information Engineering and his M.Sc. degree in Telecommunications Engineering from University of Padua, Italy, in 2019 and 2021, respectively. After working as a research assistant at Aalborg University, Denmark, from 2021 to 2023, he joined the Cyber Resilient Power Grids (CRPG) research group at TU Delft, Netherlands, as a PhD student. His research interests include telecommunication networks, cyber security, smart grids, and blockchain.



Lunodzo Justine Mwinuka (University of Salento) received his BSc. In Information Technology and Systems at Mzumbe University, Morogoro, Tanzania, and a master's degree in Wireless and Mobile Computing at Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania. He is currently a PhD student at the Higher Technical Institute of the University of Lisbon under the InnoCyPES project. His research focuses on exploring advanced methods to manage and process large-scale data using distributed systems with an interest in data integration, distributed queries, and security.



Kutay Bölät (Delft University of Technology) holds a double major bachelor's degree in Electronics and Communications Engineering and Control and Automation Engineering from Istanbul Technical University. He further specialized in Control and Automation Engineering during his master's at the same institution, where his thesis focused on interpretable low-dimensional data representations and uncertainty quantification using unsupervised deep generative models and fuzzy logic. Currently, Kutay is pursuing a PhD at TU Delft in the Electrical Sustainable Energy department, specifically within the Intelligent Electrical Power Grids group. His primary research interests lie in deep probabilistic modelling of smart meter data, aiming to generate privacy-preserving synthetic data and enhance data enrichment.



Ramon Abritta (Norwegian University of Science and Technology) received his B.Sc. and M.Sc. degrees in Electrical Engineering from Universidade Federal de Juiz de Fora (UFJF), Brazil. He is a Ph.D. candidate at the Norwegian University of Science and Technology (NTNU), Trondheim, Norway, taking part in the H2020 MSCA project InnoCyPES. His research interests include the integration of renewable energy sources, optimization problems in the domain of electrical engineering, and computational methods for analyzing IBR-penetrated power systems.



Han Shao (Norwegian University of Science and Technology) received her B.S. and M.S. degrees from Dalian Maritime University, Dalian, China, in 2018 and 2021, respectively. She is currently pursuing a Ph.D. at Norwegian University of Science and Technology, Trondheim, Norway. In addition, she is a Marie Skłodowska-Curie Early Stage Researcher taking part in the EU InnoCyPES project. Her research focuses on power quality monitoring, signal processing, deep learning, and data analysis.



Ali Arjomandi Nezhad (Imperial College London) received the B.Sc. degree in electrical engineering from Amirkabir University of Technology, Tehran, Iran, in 2016, and the M.Sc. degree in electrical engineering from Sharif University of Technology, Tehran, in 2018. In 2016, he ranked first in the Electrical Engineering Olympiad of Iran. He is currently an Early-Stage Researcher (Marie-Curie INT) and a PhD candidate at Imperial College London. His research interests include control, operation, and planning of modern power grids, especially grids with high-penetration of inverter-based resources.



Konrad Sundsgaard (Green Power Denmark, Technical University of Denmark) received his BSc in Industrial Engineering (Electrical Power Systems) at the University of Duisburg-Essen, partnering with Siemens Energy for his thesis and studying abroad at the IIT in India and ICAM in France. In 2018, he received his MSc in Industrial Engineering from TU Dortmund, while working for the German TSO Amprion. From 2018 to 2020, he participated in Innogy SE's (now E. ON's) international graduate program, being involved in international smart grid and substation conversion projects. Afterwards, he worked as a Special Engineer at

Westnetz GmbH, contributing to the smartification of low voltage grids in Western Germany. Currently, he is pursuing his PhD at the Technical University of Denmark (DTU) in corporation with Green Power Denmark, focusing on the development of reliability models of medium voltage cable networks. His research interests focus how Digitalization & AI can improve the operation and asset management of power distribution networks.



Mert Kesici (Imperial College London) received the B.Sc. degree in electrical engineering from Kocaeli University, Kocaeli, Turkey, in 2016, and the M.Sc. degree in electrical engineering from Istanbul Technical University, Istanbul, in 2019. He is currently a Marie Skłodowska-Curie Early-Stage Researcher and a PhD candidate at Imperial College London. His research interests include the cyber security of smart grids and the application of privacy-preserving machine learning algorithms to smart grids.



Eder Baron-Prada (Austrian Institute of Technology, Swiss Federal Institute of Technology) received the B.S. degree in electrical engineering and the M.S. degree in industrial automation from the Universidad Nacional de Colombia, Bogotá, Colombia, in 2016 and 2019, respectively. In 2022, he joined the Austrian Institute of Technology, Vienna, where he started his joint Ph.D. Project with the Automatic Control Laboratory, Swiss Federal Institute of Technology (ETH) Zurich, Switzerland. His main research interests include power electronics and control theory with applications to the power system.



Gabriel Miguel Gomes Guerreiro (Siemens Gamesa Renewable Energy, Technical University of Denmark) received his BSc degree from the Federal University of Itajubá (UNIFEI) in Brazil and MSc degree from the Royal Institute of Technology (KTH) in Sweden and has worked as an R&D Engineer for Hitachi Energy on the topic of power system protection between 2019 and 2021. Currently he is pursuing his Industrial PhD in Siemens Gamesa Renewable Energy and the Technical University of Denmark (DTU) on topics around grid compliance of wind turbines and power plants and integration with Machine Learning. Research interests include AI/ML, Stability

Analysis, Wind Turbine and Power Plants response, among others.



Kaio Vinícius Vilerá (Typhoon HIL, Technical University of Denmark) received his B.Sc. degree in Electrical Engineering from the Federal University of Mato Grosso, Brazil, in 2017, and studied Electrical and Computer Engineering at the University of Toronto (UofT), Canada, in 2015. He obtained his M.Sc. degree in Electrical Engineering from the Federal University of Santa Maria (UFSM), Brazil, in 2020, participating in the power electronics and control research group (GEPOC) with a focus on multilevel converters, distributed generation, and the control and modulation of static converters. He is an industrial Ph.D. in the InnoCyPES project in collaboration with Typhoon HIL and the Technical University of Denmark (DTU). Research interests include digital twins of power system components, real-time simulation applications, control parameter estimation, and control system identification.



Jose Angel Leiva Vilaplana (Technical University of Denmark) (Member IEEE) received a B.S. degree in energy engineering from the Polytechnic University of Valencia in 2018, and an M.Sc. joint degree in energy engineering and industrial engineering from the Polytechnic University of Catalonia in 2021, during which he carried out his M.Sc. thesis at the University of Colorado Boulder. From 2021, he is a Ph.D. at the Technical University of Denmark as part of the European H2020 project InnoCyPES, with multiple international stays in Norway, Portugal, Australia, and Canada. Since 2024, he has been a member of the Digitalization in Energy Task Force of the United Nations Economic Commission for Europe. His research interests include digitalization in the energy sector, cost-benefit analysis, system dynamics modeling, electricity distribution grids, and offshore wind.



Roberto Monaco (Technical University of Denmark) received a B.Sc. degree in Industrial Engineering from the University of Naples Federico II in 2018. He then specialized in Management Engineering and Innovation Management, earning a M.Sc. degree cum laude from the same university in 2021. During his academic career, he was awarded two Erasmus+ scholarships to study at the Data Science department of Leiden University in the Netherlands and completed his thesis at the Denmark Technical University (DTU). Since 2022, he is a Ph.D. at DTU, participating in the H2020 Marie-Curie project InnoCyPES. His work involves several international research stays, collaborating with regulatory authorities, universities, and prestigious industries in Australia, Canada, Norway, and France. In 2024, he joined the Task Force on Digitalization in Energy of the United Nations Economic Commission for Europe. His research interests include the digitalization of power distribution systems, analysis of energy regulations, incentive policies for energy operators, dynamic systems modeling, and sustainability.



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Beneficiaries and partners



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