

Early-Career Researcher Webinar

Host – PELS UK and Ireland Chapter

Sponsor– N-ZEEE Network

Date and Time

12:50 pm – 14:50 pm BST, Friday, 24 October 2025

Teams Meeting Link

[IEEE PELS UK & Ireland Chapter Early-Career Researcher Webinar | Meeting-Join | Microsoft Teams](#)

Event Chairs

Dr. Jinlei Chen (Chapter Secretary), Dr. Sheng Wang (Chapter Chair)

Agenda Details

12:50 pm – 13:00 pm: *Welcome and Introduction to PELS UK&I Chapter*
Speaker: **Dr. Sheng Wang (Senior Lecturer, University of Glasgow)**

13:00 pm – 13:10 pm: *Net-Zero Enabling Electrical Engineering (N-ZEEE) network+ support for ECRs*

Speaker: **Bianca Winter (N-ZEEE Network Manager, Durham University)**

13:10 pm – 13:35 pm: *Proactive Attack Detection and Impact Mitigation in Cyber-Physical Microgrids*

Speaker: **Dr. Mengxiang Liu (Lecturer, University of Bristol)**

Abstract: The smart grid is undergoing rapid energy transition to integrate high-penetration renewable generation resources. To manage the large number of digitally connected power converters in this transition, advanced information and communication technologies (ICTs) are widely adopted. However, the resulting convergence of information technology (IT) and operational technology (OT) expands potential attack surfaces, thereby elevating cybersecurity risks. Towards this end, this talk focuses on proactively detecting and mitigating intelligent false data injection (FDI) attacks in cyber-physical microgrids by strategically embedding perturbations into control layers. Specifically, it introduces three perturbation schemes—control gain alteration, additive watermarking, and matrix coding—along with analytical analyses of control and detection performance, and the design of optimal perturbation strength. Furthermore, the talk establishes detection-triggered impact mitigation methods, which recursively estimate the injected bias from detection residuals to counteract attack impacts. Finally, the effectiveness of the proposed methods is validated using real-time cyber-physical co-simulation testbeds.

13:35 pm – 14:00 pm: *Grid-Forming Control for Inverter-Based Resources: Enhancing System Operation, Stability, and Future Readiness*

Speaker: **Dr. Musa Khan (Senior Power System Engineer, WSP)**

Abstract: The increasing integration of inverter based resources (IBR) in the power system has a significant multi-faceted impact on the power system operation and stability. Various control approaches are proposed for IBRs, broadly categorized into grid-following and grid-forming (GFM) control strategies. While the GFL has been in operation for some time, the relatively new GFMs are rarely deployed in the IBRs. This presentation aims to provide an understanding of the working principles and distinguish between these two control strategies. A survey of the recent GFM control approaches is also delivered here, expanding the existing classification. It also explores the role of GFM control and its types in power system dynamics and stability like voltage, frequency etc. Practical insight into these stabilities is provided using case studies. Lacking elsewhere, the GFMs' real-world demonstrations and their applications in several IBRs like wind farms, photovoltaic power generation stations etc., are also analysed. Finally, the research gaps are identified, and the prospect of GFM is presented based on the system needs, informed by GFM real-world projects. This work is a potential road map for the GFM large-scale deployment in the decarbonized IBR-based bulk power system.

14:00 pm – 14:25 pm: *Hybrid Gas Engine and BESS Integration: Practical Experience and Grid Assessment in Distributed Generation Systems*

Speaker: **Dr. Yidan Zhang (Electrical Engineer, Clarke Energy)**

Abstract: As the UK electricity system transitions toward a net-zero future, distributed generation and hybrid power systems are playing an increasingly important role in delivering reliability and flexibility. This presentation provides an overview of Clarke Energy's recent work on gas engine-based generation and battery energy storage system (BESS) projects, including applications in combined heat and power (CHP), peaking plants, and microgrids. From a power electronics and grid integration perspective, the talk will discuss how inverter and control system design, grid compliance assessment, and energy management strategies are implemented in real engineering practice. Drawing on recent UK projects, the presentation aims to bridge academic research and industrial implementation, highlighting current challenges and opportunities for hybrid distributed generation.

14:25 pm – 14:50 pm: *Resilient Current Control Design for Grid-Following Inverter-Based Resources*

Speaker: **Dr. Mahmood Jamali (Research Assistant, Newcastle University)**

Abstract: Smart inverters, which form the backbone of inverter-based resources, are particularly vulnerable to cyberattacks because of their critical role in modern power systems. Computations within the cyber layers and control loops rely on seamless data and command exchange between the cyber and physical domains. Attackers may manipulate, intercept, or falsify control commands and sensor data within these loops. Zero-level control is especially vulnerable when the control block directly depends on sensor measurements, embedded software, or any data path that can be influenced by an adversary. Practical attack vectors include malicious firmware updates and exploitation of weakly protected fieldbuses or protocols used inside the devices. The risk is further amplified for devices with remote-access capabilities or unsecured communication protocols. This underscores the importance of developing resilient control schemes at the primary control layer. Such schemes are essential to ensure that inverter-based resources can withstand cyberattacks and maintain stable operation. This presentation introduces a resilient current control design for grid-following inverter-based resources, focusing on mitigating cyber-physical risks and enhancing system resilience under uncertainties and adversarial conditions.

Invited Guests' Biographies

Bianca Winter serves as the research network manager - based at Durham University - and member of the N-ZEEE network's leadership team. Bianca's career spans different sectors - visual arts, theatre, talent development, technology (SaS), and now research. She has a track record of communicating research, building relationships and developing talent.

Dr. Mengxiang Liu received the B.Sc. degree in Automation from Tongji University, Shanghai, in 2017 and the Ph.D. degree in Cyberspace Security from Zhejiang University, Hangzhou, in 2022. From 2023 to 2024, he was a Research Associate in Power Systems Engineering with the School of Electrical and Electronic Engineering, University of Sheffield, Sheffield, UK. He is currently an MSCA Postdoctoral Fellow with the Department of Electrical and Electronic Engineering, Imperial College London, London, UK. His research interests include smart grid, cyber-physical security and resilience, and cyber-physical co-simulation.

Dr. Musa Khan received the M.Sc. and Ph.D. degrees in Electrical Engineering from Huazhong University of Science and Technology (HUST), Wuhan, China, in 2016 and 2021, respectively. From 2021 to 2023, he was a Research Assistant with Tsinghua University, Beijing, China, and from 2023 to 2025, he was a Research Associate with Cardiff University, Cardiff, U.K. He is currently a Senior Power System Engineer with WSP, U.K., where he works on projects for utility companies and transmission and distribution operators. His research interests include power system dynamics and stability, frequency control, vehicle-to-grid (V2G) integration, and grid-forming and grid-following control strategies.

Dr. Yidan Zhang received the B.Sc., M.Sc. and Ph.D. degrees in Electrical Engineering from the University of Edinburgh, where she focused on power electronics and control for renewable energy systems. She is currently an Electrical Engineer at Clarke Energy UK, specialising in distributed generation, gas engine systems, battery energy storage (BESS) integration, and grid integration assessment.

Dr. Mahmood Jamali received the M.Sc. degree in Control Engineering from Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran. He recently completed his Ph.D. in School of Electrical and Electronic Engineering at the University of Sheffield, United Kingdom. He is currently a Research Assistant at the School of Engineering, Newcastle University, Newcastle upon Tyne, United Kingdom. His current work is part of the Supergen Energy Networks Hub (SEN) research project, which aims to improve the capacity and efficiency of low-voltage electrical power distribution networks through the development of advanced power electronic devices. His research interests include resilient control of inverter-based resources, cyber-physical security in power systems, and optimization-based control of distribution networks.