



# SUMMER SCHOOL

## Real-Time Applications for Enabling Massive Penetration of Renewable Energy Sources -From Simulation to Prototyping via HIL-

**DATE: September 9-13, 2024**

**VENUE: University of Belgrade, School of Electrical Engineering**

This four-day summer school brings together experts, academics, and students to explore advanced techniques and hands-on applications in the field of modern power systems.

Participants will delve into topics such as protection relay testing, transmission system protection, modeling and control of voltage source converters (VSCs), and the use of *Control Hardware in the Loop* for real-time simulation and validation. This summer school emphasizes validation on an experimental prototype, distinguishing it from other programs. Participants will be introduced to a robust, reliable, and secure methodology for prototyping using C-HIL

The program includes lectures, practical sessions, and a tour of the Nikola Tesla Museum.

This summer school aims to enhance understanding and skills in integrating renewable energy sources into power systems, leveraging model-based engineering solutions, and advancing the digitalization of grid infrastructures.

**Participants:** Open to MS and PhD students, postdocs, researchers, and industry professionals.

**Price:** No course fee, meals are included, but participants must cover their own travel and accommodation.

**Deadlines:** Registration deadline is June 30, 2024. Notification of acceptance will be sent by July 7, 2024.

For more information and registration go to:



## # Summer School Topics

- Protection relay testing using real-time simulators
- Distribution and transmission system protection
- Influence of renewable generation in protection systems
- Automating substation protection testing
- Modeling and control of voltage source converters: grid-following and grid-forming
- Higher-level controllers in renewable energy systems: virtual inertia, primary frequency response or voltage support
- Control Hardware in the Loop simulations through Typhoon-HIL- Experimental validation of a STATCOM in the SUNRISE prototype

This summer school is organized and sponsored by **SUNRISE project**. **SUNRISE** aims to leverage the scientific excellence and research and administrative capacity of the University of Belgrade through knowledge transfer and the exchange of best practices with well-established research institutions.

### PARTNERS

- School of Electrical Engineering, University of Belgrade



- Technische Universiteit Delft, Faculty of Electrical Engineering, Mathematics and Computer Science



- University of Seville



- University of the Basque Country, Faculty of Engineering in Bilbao

enhorri zabal zazu



This project has received funding from the European Union's HORIZON-WIDERA-2021-ACCESS-03 under Grant Agreement No. 101079200.



# LECTURERS



Prof. Dr. Aleksandar Kavagic has been with Typhoon HIL since 2015, initially in the capacity of a project manager in charge of running Horizon 2020 and Horizon Europe, as well as forming new consortia and project proposal, mostly in the domain of grid modernization and smart control of large portfolios of inverter-based DERs for demand response and community energy systems. He is currently the head of EAA (Europe Asia and Africa) academic outreach team.



Dr. Caio Osório joined Typhoon HIL in 2021 as an Applications Engineer, working in the development of high-fidelity model-based testing solutions for various industrial and academic partners worldwide. As Head of HIL Academy Programs, Caio is committed to advancing environmentally sustainable power technologies through comprehensive training and education initiatives.



Simisa Simic is a Power Systems Engineer who has been contributing to the field since 2018. He joined Typhoon HIL, Inc. as an Application Engineer, focusing on high-fidelity Hardware-in-the-Loop (HIL) real-time emulators. In his role, Simisa has been involved in developing and testing advanced protection schemes for real-world applications, studying power system behavior under various operating conditions and disturbances, and exploring the potential of artificial intelligence for grid monitoring, fault detection, and predictive maintenance. He has also worked on integrating new technologies like digital relays and renewable energy sources into the power grid.



Oihane Abarrategi is a Telecommunications Engineer (2002, University of Deusto) and PhD in Industrial Engineering (2012, UPV/EHU). She has conducted research stays at Imperial College (London, UK) and ISET (Kassel, Germany). Currently, she is an Associate Professor in the Department of Electrical Engineering at UPV/EHU and a researcher with the GISEL group. She has participated in 11 research projects at the regional, national, and European levels. She is the co-author of 10 articles in indexed journals, 2 patents, and 38 conference presentations. Her research activities focus on optimization methodologies for smart grids and the integration of renewable energies, as well as HVDC.



Pablo Eguia Lopez is associate professor in power systems engineering at the University of the Basque Country since 2013. He is principal researcher of GISEL research group and the University of the Basque Country coordinator of the interuniversity PhD program in “Electrical Energy Systems”. He is Spanish member of the group of EU SET Plan on HVDC and DC Technologies. He has been principal researcher of several industrial and scientific projects in the area of integration of renewable energy into power systems, HVDC and FACTS and power system protection. He works as consultant for different manufacturing companies of power converters and protection relays. He has authored more than 200 journals and conferences papers.



Marene Larruskain obtained her PhD in Industrial Engineering from the University of the Basque Country UPV/EHU in 2012. She worked at Siemen S.A. for over three years. Since 2003 she has been at the University of the Basque Country UPV/EHU, where she currently holds a position as an associate professor in the Electrical Engineering Department. She is a member of GISEL research group. Her research activity has been focused on HVDC systems protection and distributed generation integration. She has authored 37 scientific articles in specialized journals, two patents and over 50 contributions to conferences.



Dr. Maza-Ortega received an Industrial Engineering degree, major in Electrical Engineering, in 1996, and a Doctor Engineering and European Doctor degrees in 2001, both from the University of Seville, Spain. Since 1997 he has been with the Department of Electrical Engineering of the University of Sevilla, holding currently a Professor position. His academic activity has focused in the following degrees: Industrial Engineering, Telecommunications Engineering, Management Engineering and Chemical Engineering. In addition, he is member of the teaching staff of the post-graduate Master Degree “Electric Power Systems”. Finally, he is Head of the Joint Ph.D. Program “Electric Power Systems” shared by the University of Sevilla, University of Málaga, Polytechnic University of Catalonia and University of the Basque Country. He has also participated in several short courses for the industry about different aspects of power engineering.

His research activity is developed within the research group “Electric Power Systems” led by Prof. Antonio Gómez-Expósito. He has participated in more than 60 R+D projects both publicly and privately funded, being principal investigator in 20 of them. Most of those projects have been developed in close cooperation with the major national and European companies of the electrical sector. He is coauthor of more than 95 technical papers, including 40 papers in high impact journals indexed in the Journal Citation Report (JCR), and 2 patents. He is also co-founder of the start-up Ingelectus –Innovative Electrical Solutions devoted to commercialize new solutions for the power grid of the XXI century.



Dr. Manuel Barragán-Villarejo is an Industrial Engineer (2008) and PhD in Electric Power Systems (2014) from the Universidad de Sevilla where he currently works as an Associate Professor attached to the Department of Electrical Engineering. His research career focuses since his beginnings within the TEP-196 group "Electrical Energy Systems" in the field of power electronics application to the distribution networks to favor the distributed energy resources integration, with a notable emphasis on the experimental validation and use of the real time simulators like OPAL-RT, SpeedGoat and Typhoon HIL. He has participated in more than 20 R&D projects with public funding and several private R&D contracts with companies in the electrical and industrial sectors, including several projects funded by the European Union. As an indicator of the quality of research activity, he has published more than 20 papers in international journals indexed in the JCR and 20 papers at international conferences. He has participated in training and summer school activities explaining the benefits of using C-HIL to accelerate the prototyping of VSCs.



Juan Manuel Mauricio (Senior Member, IEEE) was born in Argentina, in 1977. He received the degree in electrical engineering from the National University of Comahue, Neuquén, Argentina, in 2003, and the master's and Dr. Eng. degrees from the University of Seville, Seville, Spain, in 2007 and 2009, respectively. Since 2004, he has been with the Department of Electrical Engineering, University of Seville, where he is currently an Assistant Professor. His primary research interests include power systems and electrical machine control, renewable generation, voltage source converters-based applications, and electrical vehicles.