2021 Engineering Colloquium – Presenter's Topics and Bios

Presentation 1: Ratio-Based Frequency Support Through MTDC Grids : Stability & Performance Analysis

Abstract:
It is envisaged that Multiterminal DC (MTDC) grid will be a key cornerstone of the sustainable future of our planet. MTDC grids are planned in and around Europe to integrate significant amount of offshore wind energy and onshore solar energy to the Pan-European AC grid and two pilot MTDC projects are already operational in China. In this talk, the speaker will lay out some of the key challenges facing DC grid systems and focus on the frequency support issue among AC grids interconnected by the DC network. These AC grids are 'asynchronous' in nature, and as a result, they do not have a natural way of exchanging frequency support. Since in each AC area the inertia is progressively reducing due to replacement of conventional generation by inverter-interfaced renewables, they are experiencing deeper frequency nadir and higher rate-of-change-of-frequency following a generation loss, which can lead to underfrequency load shedding issues among others. This talk will briefly touch upon modeling of such AC-MTDC systems and then the speaker will delve deeper into the control challenges of such grids in providing exchange of frequency support in a controlled manner. The speaker will demonstrate the viability of a new ratio-based inertial and primary frequency support framework that has the promise for a new market mechanism in future. Finally, analytical stability constraints will be established in the inertial and primary frequency droop coefficient spaces.

Bio: Prof. (Dr.) Nilanjan Ray Chaudhuri (Penn State University)

Nilanjan Ray Chaudhuri received his Ph.D. degree from Imperial College London, London, UK in 2011 in Power Systems. From 2005-2007, he worked in General Electric (GE) John F. Welch Technology Center. He came back to GE and worked in GE Global Research Center, NY, USA as a Lead Engineer during 2011-2014. Presently, he is an Associate Professor with the School of Electrical Engineering and Computer Science at Penn State, University Park, PA. He was an Assistant Professor with North Dakota State University, Fargo, ND, USA during 2014-2016. He is a member of the IEEE and IEEE PES. Dr. Ray Chaudhuri is the lead author of the book Multi-terminal Direct Current Grids: Modeling, Analysis, and Control (Wiley/IEEE Press, 2014), and served as an Associate Editor of the IEEE TRANSACTIONS ON POWER DELIVERY (2013 – 2019) and IEEE PES LETTERS (2016 - present). Dr. Ray Chaudhuri was the recipient of the National Science Foundation Early Faculty CAREER Award in 2016 and Joel and Ruth Spira Excellence in Teaching Award in 2019.

Presentation 2: Real-Time Controller Hardware-in-the-Loop (RT CHIL) Analysis of Ground Fault Overvoltages (GFOVs) in inverter based Distributed Energy Resources

Abstract:
Single-line-to-ground (SLG) faults can lead to a significant overvoltage on the unfaulted phases of a 3 phase system that is fed by a synchronous generator. In order to mitigate such ground-fault overvoltages (GFOV) certain effective grounding techniques are employed in the system. However, for systems fed by inverter based Distributed Energy Resources (DER) the GFOV phenomenon has not be studied in detail. Moreover, whether or not conventional overvoltage mitigation techniques like effective grounding techniques are suitable for overvoltage mitigation for inverter based DERs, also needs significant exploration. In this paper a controller-hardware-in-the-loop (CHIL) setup was utilized to

carry out experiments which investigate how the circuit configuration impacts the overvoltage for DERs under SLG and how conventional grounding techniques can be utilized to mitigate such overvoltages.

Bios: Prof. (Dr.) Luigi Vanfretti and Prottay Adhikari (Rensselaer Polytechnic Institute)

Luigi Vanfretti (SMIEEE'14) obtained the M.Sc. and Ph.D. degrees in electric power engineering at Rensselaer Polytechnic Institute, Troy, NY, USA, in 2007 and 2009, respectively. He was with KTH Royal Institute of Technology, Stockholm, Sweden, as Assistant 2010-2013), and Associate Professor (Tenured) and Docent (2013-2017/August); where he lead the SmarTS Lab and research group. He also worked at Statnett SF, the Norwegian electric power transmission system operator, as consultant (2011 - 2012), and Special Advisor in R&D (2013 - 2016). He joined Rensselaer Polytechnic Institute in August 2017, to continue to develop his research at ALSETLab. His research interests are in the area of synchrophasor technology applications, and cyber-physical power system modeling, simulation, stability and control.

Prottay Adhikari is currently a final year doctoral student in the Department of Electrical, Computer, and Systems Engineering at Renssalaer Polytechnic Institute (RPI). Prior to joining RPI, Prottay completed his bachelor's in Electrical Engineering from IIEST Shibpur and Masters' in Electrical Engineering from IIT Bombay while working as a research assistant at EmSys Lab. He has worked for ARM from 2016 to 2017. Prottay works in ALSET Lab and his current research under professor Luigi Vanfretti, lies broadly on the interface of Smart Grid Technology, Real-time simulation, and Embedded Systems. He is spending the summer of 2021, working as a research intern for Electric Power Research Institute (EPRI).

Presentation 3: Offshore Wind Turbine Generators: A Grid Perspective…

Abstract:
In this presentation state of the art of wind turbine generator technologies in offshore will be discussed focusing on grid support. Key differences between AC and VSC-HVDC interconnection will be highlighted with relative pros and cons. Control concept during normal operation and fault ride through will be described in details. The concept of plan level controls and some special controls e.g. grid forming WTGs. Inertial response from wind turbine generators will be touched on with some field experience.

Bio: Dr. Rajat Majumder (Siemens Gamesa Renewable Energy)

Rajat Majumder is a key senior expert in Siemens Gamesa Renewable Energy in US. He received his PhD degree in Electrical Power systems from Imperial College London, UK in 2006. He has published several papers and holds a number of patents in field of power electronics applications in power systems. He works closely with global headquarters in Europe influencing technical road map in the North America region. He acts as subject matter expert to internal and external stake holders such as plant owner's engineers, transmission owners and various regulatory bodies.

Presentation 4: Design of Offshore Wind Farms

Abstract:
In this presentation we will provide an overview of the steps involved in designing an offshore wind farm. Giga Watt scale offshore wind farms today are a reality and in the United States most coastal states have mandates to build several giga watts of offshore wind farms in the next decade. Building these large power plants in the ocean brings in some of its own unique design challenges. Some of these

challenges are driven by the coastal location and others by the type of technology that is used in generating and transporting electricity to the shore. This presentation focuses mainly on the offshore generation design and provides some insights into onshore grid connection requirements.

Bio: Dr. Divya Kurthakoti (Ørsted)

Dr. Divya Kurthakoti has over 14 years of academic and industrial experience working on large scale wind power integration, modeling, analysis, designing controls and converter topologies. Currently she is working at Orsted as a grid connection manager and responsible for grid connection of offshore wind farms in the mid-Atlantic region for Orsted, USA. Prior to that she worked at Siemens PTI modeling wind turbines and inverter based devices in PSS/E® . Before joining Siemens PTI, she worked at Siemens corporate technology on high power converter topology, controls and testing. She was an adjunct faculty at the Columbia university in the city of New York, USA and taught a course on Renewable Power Systems. Prior to that she worked at GE global research center and was a part of the team that developed WindINERTIA™ controls for GE wind turbines. She has several peer reviewed publications and patents on several aspects of renewable power technology including modeling, grid integration controls and model validation testing. She is a senior member of the IEEE.

Presentation 5: Rise of the Digital Workforce in the Utilities

Bio: Kedaar Raman and Neal Addison (New York Power Authority)

Kedaar Raman, P.E., CSPO is the Director of Digital Transformation and Digital Workforce with the New York Power Authority (NYPA). His current focus is optimizing the digital transformation portfolio, evaluating emerging technologies and vendors and untethering power plant & transmission field workers to work more safely, more effectively and more efficiently.
Previously, he worked as a Program Manager, First-Line Supervisor, & Electrical Engineer at NYPA. He holds a B.S. in Electrical & Computer Engineering from Norwich University as well as an M.S. in Electrical Engineering from Rensselaer Polytechnic Institute (RPI). He is a licensed P.E. in Vermont and New York and a Certified Scrum Product Owner.

Neal Addison, CSPO works on Digital Solutions Delivery as part of the Digital Workforce Program at NYPA. His focus is on deploying meaningful digital solutions to the NYPA workforce with a focus on mobility and access to information. Prior to NYPA, he was a Business Development Manager for a company that manufactured cable crimping and cutting tools used in the electric utility industry. He holds a B.S. in Electrical Engineering from Villanova University and is a Certified Scrum Product Owner.

Presentation 6: Communications, Data Hardening, and the Smart Grid

Abstract:
The Smart Grid continues to expand and gather new functions as needs expand. Automated metering, relay operation, RTU operation, electric management systems, remedial action schemes, SCADA, field reclosers, Synchrophasors, remote access, weather, and earthquake monitoring and future needs still yet to be identified. All these operations require low latency, low jitter communications network. The data being transported and the devices functioning on the network require a secure, authenticated and guarded system to operate. Data hardening implies that the data moving across the system is protected and monitored to ensure transmission of mission critical operational information.

Bio: Dominic Iadonisi (iS5 Communications)

Dominic has been in IT since 1994. He has been deeply involved with Industrial communication standards and high reliability networking since 2002 while designing and installing one of the worlds largest plant floor networks across General Motors in a successful effort to reduce the use of proprietary serial-based networks and utilize Ethernet for flexible and reliable communications. He was also a Senior IT Engineer at Pacific Gas & Electric providing support for over 2200 substations.

Presentation 7: Energy Storage Resource Integration in the NYISO Markets

Abstract:
This presentation will give an overview of the opportunities for energy storage resource's participation in the NYISO's markets. It will also go over the NYISO's compliance with FERC Order no 841. The benefits and challenges of integrating storage into the NYISOs systems will be discussed. Finally, the potential impact of storage to provide reliable and cost-effective supply to customers in light of increasingly aggressive New York State decarbonization and clean energy policies will be discussed.

Bio: Pallavi Jain (New York ISO)

Pallavi Jain is an Energy Market Design Specialist in for the New York Independent System Operator (NYISO), which operates New York's high-voltage transmission system, manages the state's competitive wholesale electricity markets, and conducts comprehensive power system planning.

In her role at the NYISO, Ms. Jain is responsible for advancing energy market design initiatives from the investigative phase through to deployment, working collaboratively with both internal and external stakeholders. Elements of the market design process for which she is responsible include research, analyzing market simulation results, collaboration with stakeholders and regulators, and developing tariff revisions for filing with FERC.

Ms. Jain has led a number of energy market initiatives at the NYISO. Her efforts have resulted in increasing convergence between the real-time commitment and dispatch processes, improving NYISO and ISO-NE Coordination for Emergency Energy Settlements, developing a market design for Energy Storage resources to participate in the NYSIO markets and designing market rules to better reflect the value of ancillary services in a future with increased weather-dependent resources.

Pallavi holds both a Master's degree in Electrical Engineering from Arizona State University in Tempe, Arizona and a Bachelor's degree in Electrical Engineering from Manipal University in Manipal, India.

Presentation 8: Battery Energy Storage Systems: An Industrial Perspective

Bio: Dr. Ahmed Elasser (GE Research)
Ahmed Elasser received his MS & PhD degrees in Electric Power & Power Electronics in 1993 & 1996 respectively from Rensselaer Polytechnic Institute. He is a Principal Systems Engineer at GE Research in the areas of Electric Power, Power Electronics, and Power Semiconductor Devices. He worked on Power Devices, Solar Energy, Power Conversion Systems, and is currently leading the Battery Energy Storage Systems Power Conversion. He published over 40 papers and has 36 issued patents. He is a Senior IEEE Member. Dr. Elasser is the recipient of numerous GE Awards for his contributions and innovations over his 26 years career.

2021 Engineering Colloquium – Presenter's Topics and Bios

<u>Presentation 9:</u> Fire Safety Issues in Grid-Scale Battery Technology

<u>Abstract:</u>
In 2021, Battery Energy Storage Systems have gone through a few generations of design, and much like solar 10 years ago we are starting to reach a point where these systems are well-known enough on a practical level to understand their best overall design, strategies for deployment, and true life cycle. This presentation will deal with issues of code and practical implementation that come up as these systems go in the field and attempt to solve real world power system issues.

- Augmentation strategies and real world facilities
- NEC code – NEC 706 misapplications for large-scale BESS
- Fire code – what's required, and what the best practical mitigation is for real world utility scale and C&I systems
- Cyber issues – Canbus, Modbus, EMS
-

<u>Bio:</u> Tim Corrigan (Convergent Energy)

Tim is responsible for high level system design, feasibility, and code compliance for Convergent's energy storage assets. He also provides technical support to the project execution team in matters from electrical safety and relay setting design to energy management system control schemes.

Tim came to Convergent with 15 years of engineering project experience, with roles in utility O&M, developer facing EPC engineering, and utility P&C consulting fields. From 2011 to 2015 Tim worked at NYPA's Blenheim Gilboa pump hydro plant as an electrical engineer and technician supervisor. Tim also served as secretary of the New York Power Authority's Protective Relay Committee concentrating on NERC CIP cybersecurity issues for transmission system relays and intelligent devices. Moving to the EPC consulting world, he worked with CG Power Solutions as the lead engineer for a 125MW solar power facility in Colorado, and designed and programmed an automatic cap bank switching scheme for a 180MW wind farm in Texas. With TRC Companies Tim worked in a staff augmentation role for National Grid doing studies on wind and solar interconnections, and created settings for transmission facilities across the United States. Tim was then TRC's lead engineer for NYPA's first transmission connected battery asset and consulted with various utilities and developers on microgrid and BESS implementation strategies.

Tim served as chairman for the IEEE Power Engineering Society in the capital district of New York from 2018 to 2020, and has a MS in engineering from Rensselaer Polytechnic Institute and a BSEE from City College of New York. Tim is a professional engineer in the states of New York and Maine.