ADEDOTUN J. AGBEMUKO

PERSONAL DATA

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EDUCATION

Ph.D. | **Universitat Politecnica de Catalunya (UPC)**, Barcelona, Spain
Electrical Power Systems, *Cum Laude* (with note of excellence), November 2019

Modelling & Control Strategies for Hybrid AC/DC Grids
Brief Summary: Power electronic interfaced Hybrid AC/DC grids are beginning to emerge as key components of future electric power systems. The exponential adoption of these devices is resulting to bulk changes in the behaviour of the electric power system as it is known today. At the current pace of integration, the complexities introduced by these devices are evolving faster than proposed solutions can keep track. New phenomena being detected include interactions within and between subnetworks of hybrid AC/DC grids for which traditional methods of analysis are beginning to show inadequacies. Therefore, this thesis focuses on modelling of hybrid AC/DC grids for system-level interaction detection—both between and within subnetworks, stability, and dynamic behaviour improvement through robust control strategies. Importantly, methodologies proposed for interaction detection and mitigation are modular, generalizable, and scalable to any arbitrary AC/DC grid, regardless of the technologies adopted.

Supervisors: **José Luis Domínguez-García** and **Oriol Gomis-Bellmunt**

MSc. | **Delft University of Technology (TU Delft)**, Delft, the Netherlands
Electrical Engineering (Power Systems), July 2016

A Computational Intelligence Approach to Voltage and Power Control in MTDC grids

B. Eng | **Federal University of Technology**, Minna, Nigeria

Electrical Engineering (Power Systems), November 2012

APPOINTMENTS

SEP 2019 | **Postdoctoral research associate** at IREC, Barcelona, Spain
H2020 Research and Innovation Action (COREWIND Project)
H2020 Research and Innovation Action (SUPER PV Project)
Real-time digital verification of control strategies (HIL, SIL)
H2020 Research and Innovation Action (RESCCUE Project)

RESEARCH EXPERIENCE

Sep 2016 - Sep 2019 | **Marie Skłodowska-Curie Doctoral Fellow** at IREC, Barcelona, Spain
Supervisor: José Luis Domínguez-García

- Modelling of voltage source converter (VSC) interfaced hybrid AC/DC grids for AC-AC, AC-DC, DC-DC interaction detection and mitigation.
- Interaction analysis and robust control design for multi-vendor VSC-HVDC grids.
- Advanced control of VSCs connected to extremely weak AC grids.
- Complex systems approach to modelling and analysis of large-scale VSC-HVDC grids.
- Interconnection requirements for grid connected VSCs.
- Coordinated control of hybrid AC/DC grids.
- Harmonic analysis and mitigation.

Jan 2019 - Apr 2019 | **Visiting Research Fellow** at ABB Corporate Research, Västerås, Sweden
Supervisor: Lennart Harnefors

- Passivity-based analysis and control design of VSCs connected to AC grids of arbitrary strength.
- Dynamic characterization of the VSC under different conditions.

Jan 2018 - Apr 2018 | **Visiting Research Fellow** at G2eLab, Grenoble, France
Supervisor: Nicolas Retière

- Advanced molecular physics approach to aggregate modelling and analysis of coherency and collective behaviour of large-scale HVDC grids.
- Macroscopic characterization of coherency in HVDC grids to dynamic and structural perturbations.

Nov 2015 - Jul 2016 | **MSc. Thesis** at TU Delft the Netherlands

Proposed a more intuitive control strategy based on fuzzy control and GA (Genetic Algorithm) for voltage and power control in HV-MTDC (High voltage multi-terminal DC Grids).

Jul 2015 - Nov 2015 | **Research Intern** at Philips Lighting Global R&D Professional Lighting Systems

- Thorough research into lightning phenomena and attendant surges in low voltage outdoor lighting systems.
- Detailed modeling and simulation of the phenomena using EMT software.
- Conclusions and recommendations to Philips Lighting on how to effectively mitigate the phenomena in outdoor systems.

AWARDS & FELLOWSHIPS

SEP 2018 Best conference paper (IFAC Conference, Tokyo, Japan)
SEP 2016 Marie Skłodowska-Curie Doctoral Fellowship

PUBLICATIONS

Published Journals

2019 **Agbemuko**, **A.J.**, Domínguez-García, J.L., Prieto-Araujo, E. and Gomis-Bellmunt, O. Dynamic modelling and interaction analysis of multi-terminal VSC-HVDC grids through an impedance-based approach.
International Journal of Electrical Power & Energy Systems, 113, pp.874-887

2019 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
Impedance-Based Modelling of Hybrid AC/DC Grids with Synchronous Generator for Interaction Study and Dynamic Improvement.
Electric Power System Research

2018 **Agbemuko**, **A.J.**, Domínguez-García, J.L., Prieto-Araujo, E. and Gomis-Bellmunt, O. Impedance modelling and parametric sensitivity of a VSC-HVDC system: New insights on resonances and interactions.
Energies 11, no. 4 (2018): 845

Journals Currently under Review

2019 **Agbemuko**, **A.J.**, Domínguez-García, J.L., Prieto-Araujo, E. and Gomis-Bellmunt, O. Advanced Impedance-based Control Design for Decoupling Multi-Vendor Converter HVDC Grids.
IEEE Transactions on Power Delivery

2019 **Agbemuko**, **A.J.**, Domínguez-García, J.L., Gomis-Bellmunt, O., Harnefors L.
Passivity-Based Analysis and Performance Enhancement of a Vector Controlled VSC Connected to Weak AC Grids.
IEEE Transactions on Power Delivery

2019 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
Robust Decentralized Approach to Interaction Mitigation in VSC-HVDC Grids Through Impedance Minimization.
Journal of Control Engineering Practice

Working Papers

2019 **Agbemuko**, **A.J.**, Domínguez-García, J.L., Gomis-Bellmunt, O., Retiere, N.
A Statistical Physics Approach to Dynamic Coherency in Large-scale HVDC Grids
Proposed Journal: *IEEE Transactions on Power Systems*

Conferences

2019 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
An Impedance-based Robust Supplementary Controller Design for Offshore HV-MTDC Grids.
Cigré Symposium, Aalborg, Denmark, pp. 1-11. 2019.

2018 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
An integrated approach to understanding the impact of network resonances and control on dynamic responses in VSC-HVdc networks.
IFAC Symposium, Tokyo, Japan. IFAC-PapersOnLine 51, no. 28 (2018): 344-349.

2018 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
Impedance-based Modelling of a Hybrid AC/DC Grid with Z-bus Approach.
IEEE Power & Energy Society General Meeting (PESGM), Portland, USA.

2018 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
Impedance-Based Modelling of Hybrid AC/DC Grids with Synchronous Generator for Interaction Study and Dynamic Improvement.
IET MedPower Conference, Cavtat, Croatia.

2017 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
Harmonic stability and interactions in meshed vsc-hvdc dominated power systems.
International Wind Integration Workshop, Berlin, Germany.

2016 **Agbemuko**, **A.J.**, Ndreko, M., Popov, M., Rueda-Torres, J.L. and van der Meijden, M.A.
A knowledge-based approach to voltage and power control in hv-mtdc grids.
IEEE PES Innovative Smart Grid Technologies Conference Europe (ISGT-Europe)

Invited Presentations

2019 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
Impacts of Operating Point and Active Power Capability Improvement of a VSC Connected to Very Weak Grids.
Wind Energy Science Conference, Cork, Ireland.

2018 **Agbemuko**, **A.J.**, Domínguez-García, J.L. and Gomis-Bellmunt, O.
Multivariable Impedance modelling of Meshed Hybrid AC/DC Grids with Synchronous Generation
HVDC Doctoral Colloquium

Book Chapters

2018 | **Agbemuko**, **A.J.**, Ndreko, M., Popov, M., Rueda-Torres, J.L. and van der Meijden, M.A.
Knowledge-Based Primary and Optimization-Based Secondary Control of Multi-terminal HVDC Grids.
In Dynamic Vulnerability Assessment and Intelligent Control: For Sustainable Power Systems, p.233.

2018 | **Agbemuko**, **A.**, van Meurs, J., and van Driel W. D.
Lightning Effects on LED-Based Luminaires.
In Solid State Lighting Reliability Part 2, pp. 573-583. Springer, Cham, 2018.

TECHNICAL COMPETENCIES (Advanced User)

MATLAB/SIMULINK
DigSilent Power Factory
PSCAD
MAPLE
Opal-RT Test Bench
ATP-EMTP

CAREER DEVELOPMENT: Trainings, Seminars, and Workshops

Advanced systems and algorithms	TU Delft, Netherlands
Fault diagnosis of complex systems	UPC, Barcelona Spain
Mathematics of energy Systems	TU Eindhoven
Project management and funding application	UPC, Barcelona Spain
Technology transfer	UniBo, Bologna Italy
Non-scientific communication	CSIC-UPF, Barcelona Spain
Start-up and entrepreneurship	EFACEC, Oporto Portugal
Patent application process	UniBo, Bologna Italy

Professional Service

Reviewer

IEEE Transactions on Power Delivery
IEEE Transactions on Industrial Electronics
IEEE Access
Energies, MDPI
Electrical Engineering, Springer

ADMINISTRATIVE DUTIES

Student representative, supervisory board (INCITE EU project)

ACTIVE MEMBERSHIPS

IEEE Power and Energy Society
IEEE Control System Society
IEEE Power Electronic Society
CIGRÉ

LANGUAGES

English	Bilingual
Yoruba	Native
Spanish	B1
Dutch	A1