

Curriculum Vitae

Jon Are Wold Suul

SINTEF Energy Research



PhD, Research Scientist

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EDUCATION

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| 2012 | PhD in Electric Power Engineering, Norwegian University of Science and Technology (NTNU), Trondheim, Norway
Thesis: "Control of Grid Integrated Voltage Source Converters under Unbalanced Conditions – Development of an On-line Frequency-adaptive Virtual Flux-based Approach" |
| 2006 MSc | Master of Science in Energy and Environmental Engineering
Norwegian University of Science and Technology (NTNU), Trondheim, Norway
Thesis: "Control of Variable Speed Pumped Storage Hydro Power Plant for Increased Utilization of Wind Energy in an Isolated Grid." |

KEY TECHNICAL QUALIFICATIONS

- Control of Power electronics for distributed generation and power system applications
- Converter topologies and control concepts for power electronic conversion systems
- Application of power electronic conversion systems for zero-emission transportation
- Application and control of power conversion systems in stand-alone MicroGrids
- Modelling, analysis and time domain simulations of power electronic converters, electric machinery and power systems

EMPLOYMENT RECORD

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| 2006 – | <u>SINTEF Energy Research, Energy Systems, Trondheim, Norway</u>
(On leave for PhD studies from October 2007 – December 2011)
Current position: PhD, Research Scientist |
| 2017 - | <u>NTNU – Norwegian University of Science and Technology, Trondheim, Norway</u>
Adjunct Professor, 20 % temporary position, Department of Engineering Cybernetics, from August 2017 |
| 2012 –2016 | <u>NTNU - Norwegian University of Science and Technology, Trondheim, Norway</u>
Part-time Post.doc. researcher, 50% temporary position, Department of Electric Power Engineering, from November 2012 to November 2016 |
| 2007–2011 | <u>NTNU - Norwegian University of Science and Technology, Trondheim, Norway</u>
PhD-candidate, Department of Electric Power Engineering |

PROJECT EXPERIENCE AT NTNU

- 2012-2014 **EU FP7 Project: "MARINA – Marine Renewable Integrated Application Platform"**
 Client: International consortium led by Acciona
- Participation in the preparation of a report from NTNU entitled "Transmission Capacity in the European Power System – A survey of existing studies"
 - Supervision of simulation work and participation in the preparation of NTNU's contribution to a joint report on "Integration of Marine Renewable Energy (MRE) in Power Systems," and in the associated separate report from NTNU entitled "Large-scale integration of marine energy – Offshore transmission system characteristics and dynamic challenges: Main case study report."

PROJECT EXPERIENCE IN SINTEF ENERGY RESEARCH

- 2016 **The Norwegian Road Authority: "Electric Infrastructure for Goods Transportation – ElinGO"**
 Innovation Project (IPN) supported by the Research Council of Norway (RCN), with a Nordic consortium, managed by SINTEF Building and Infrastructure
- Responsible for project activities at SINTEF Energy Research
 - The first main objective will be to provide review, evaluation and technical assessment of solutions for dynamic charging of electric vehicles, including concepts for both conductive and inductive power transfer to moving vehicles.
 - A second main objective will be to develop a small-scale demonstration of a concept for dynamic inductive charging of road vehicles.
- 2014- **EU FP7 Project: "BestPaths - Beyond State-of-the-art Technologies for Power AC Corridors and Multi-terminal HVDC Systems"**
 Client: International consortium led by Red Electrica Espanola
- Deputy project manager for activities at SINTEF Energy Research
 - Modelling, analysis and simulation of Modular Multilevel Converters in multi-terminal HVDC grids for power transmission and integration of large-scale offshore wind farms
- 2013 - **SINTEF: "Releasing the Potential of Virtual Synchronous Machines (ReViSM)"**
 Internal research project, funded through the Blue Sky Instrument of SINTEF Energy Research as a Strategic Institute Program financed by the Basic National Research Funding Scheme of Norway
- Deputy project manager
 - Design, stability analysis and experimental testing of control strategies for power electronic converters controlled as Virtual Synchronous Machines
- 2013 -2015 **Wärtsilä Norway AS: "Wireless high power battery charging for ships"**
 Innovation Project (IPN) supported by the Research Council of Norway (RCN), with a Norwegian consortium, managed by Wärtsilä Norway AS
- Project manager for activities at SINTEF Energy Research
 - The project objective was to verify feasibility and provide design basis for a 1 MW inductive battery charging system for ship applications. Based on theoretical analysis and control system design developed by the project team at SINTEF Energy Research, Wärtsilä Norway could demonstrate in full scale the operation of an inductive power transfer system with >1 MW power transfer capability in the continuous range from 15 cm to 50 cm air gap distance. This was unprecedented performance in terms of distance and power transfer capability from a single unit.
- 2012 - 2014 **Wärtsilä Norway AS: "Demonstration of zero emission and low emission technology for coastal traffic"**
 Industry funded project
- Analysis and simulation of power electronic converters and assessment of system configurations for battery charging and propulsion in ship power systems with main power supply from on-board batteries

- 2012 - **The Research Council of Norway: "Protection and Fault Handling in Offshore HVDC Grids (ProOfGrids)"**
 Client: International consortium established for Competence Project (KPN) supported by the Research Council of Norwegian (RCN)
- Deputy project manager
 - Design and analysis of control systems for power electronic converters in multi-terminal HVDC grids
 - Modelling, simulation, analysis and control of Modular Multilevel Converters for HVDC applications
 - Modelling of HVDC cables and converter stations for development of linearized small-signal state-space models for power system stability analysis
- 2012-2014 **The Research Council of Norway: "Power Electronics for Reliable and Energy Efficient Renewable Energy Systems – Offshore Power Electronics (OPE)"**
 Client: International consortium established for Competence Project (KPN) supported by the Research Council of Norway (RCN)
- Design and analysis of control systems for power electronic converters in grid connected and islanded applications
 - Control of power converters for loss minimization in grid connected applications
- 2007 **Statoil ASA: "Verification of voltage compensating equipment at the Kollsnes Gas Processing Plant"**
 Industry funded project
- Technical verification and simulation study of power electronic equipment for compensation of balanced and unbalanced voltage dips at the terminals of thyristor-controlled gas compressor drives
- 2006 –2007 **Wärtsilä Norway AS: "New Converter Solutions for Ship Propulsion"**
 Industry funded project
- Time domain simulations and analysis of power electronic converters in marine propulsion systems
 - Time domain simulation of isolated power systems for ship propulsion, including diesel generators, fuel cells, power electronic converters and associated control systems

PUBLICATIONS

Publication statistics according to Google Scholar, May 2017

- h-index: 22
- i10-index: 40
- Citations: 1727

International journal publications

- [1] Olve Mo, Salvatore D'Arco, **Jon Are Suul**, "Evaluation of Virtual Synchronous Machines with Dynamic or Quasi-stationary Machine Models," accepted for publication in *IEEE Transactions on Industrial Electronics*, December 2016
- [2] Giuseppe Guidi, **Jon Are Suul**, "Minimizing Converter Requirements of Inductive Power Transfer Systems with Constant Voltage Load and Variable Coupling Conditions," in *IEEE Transactions on Industrial Electronics*, Vol. 63, No. 11, November 2016, pp. 6835-6844
- [3] **Jon Are Suul**, Salvatore D'Arco, Giuseppe Guidi, "Virtual Synchronous Machine-based Control of a Single-phase Bi-directional Battery Charger for Providing Vehicle-to-Grid Services," in *IEEE Transactions on Industry Applications*, Vol. 52, No.4, July/August 2016, pp. 3234-3244
- [4] Espen Skjong, **Jon Are Suul**, Atle Rygg, Tor Arne Johansen, Marta Molinas, "System-Wide Harmonic Mitigation in a Diesel-Electric Ship by Model Predictive Control," in *IEEE Transactions on Industrial Electronics*, Vol. 63, No. 7, July 2016, pp. 4008-4019
- [5] Jef Beerten, Salvatore D'Arco, **Jon Are Suul**, "Frequency-Dependent Cable Modelling for Small-Signal Stability Analysis of VSC HVDC Systems," in *IET Generation Transmission & Distribution*, Vol. 10, No. 6, April 2016, pp. 1370-1381

- [6] **Jon Are Suul**, Salvatore D'Arco, Pedro Rodríguez, Marta Molinas, "Impedance-compensated grid synchronization for extending the stability range of weak grids with voltage source converters," in *IET Generation Transmission & Distribution*, Vol. 10, No 6, April 2016, pp. 1315-1326
- [7] Jef Beerten, Salvatore D'Arco, **Jon Are Suul**, "Identification and Small-Signal Analysis of Interaction Modes in VSC MTDC Systems," in *IEEE Transactions on Power Delivery*, Vol. 31, No. 2, April 2016, pp. 888-897
- [8] Salvatore D'Arco, **Jon Are Suul**, Olav. B. Fosso, "Small-signal modelling and parametric sensitivity of a Virtual Synchronous Machine in islanded operation," in *International Journal of Electric Power and Energy Systems*, Vol. 72, November 2015, pp. 3-15
- [9] Salvatore D'Arco, **Jon Are Suul**, Olav. B. Fosso, "A Virtual Synchronous Machine Implementation for Distributed Control of Power Converters in SmartGrids," in *Electric Power System Research*, Vol. 122, May 2015, pp. 180-197
- [10] Salvatore D'Arco, **Jon Are Suul**, Olav B. Fosso, "Automatic Tuning of Cascaded Controllers for Power Converters using Eigenvalue Parametric Sensitivities," in *IEEE Transactions on Industry Applications*, Vol. 51, No. 2, March/April 2015, pp. 1743-1753
- [11] Salvatore D'Arco, **Jon Are Suul**, "Equivalence of Virtual Synchronous Machines and Frequency-Droops for Converter-Based MicroGrids," in *IEEE Transactions on Smart Grid*, Vol. 5, No. 1, January 2014, pp. 394-395
- [12] **Jon Are Suul**, Alvaro Luna, Pedro Rodríguez, Tore Undeland, "Virtual-Flux-based Voltage-Sensor-less Power Control for Unbalanced Conditions," *IEEE Transactions on Power Electronics*, Vol. 27, No. 9, September 2012, pp. 4071-4087
- [13] **Jon Are Suul**, Alvaro Luna, Pedro Rodríguez, Tore Undeland, "Voltage Sensor-less Synchronization to Unbalanced Grids by Frequency-Adaptive Virtual Flux Estimation," in *IEEE Transactions on Industrial Electronics*, Vol. 59, No. 7, July 2012, pp. 2910-2923
- [14] **Jon Are Suul**, Kjell Ljøkelsøy, Tarjei Midtsund, Tore Undeland, "Synchronous Reference Frame Hysteresis Current Control for Grid Converter Applications," in *IEEE Transactions on Industry Applications*, Vol. 47, No. 5, September/October 2011, pp. 2183-2194
- [15] **Jon Are Suul**, Marta Molinas, Tore Undeland, "STATCOM-Based Indirect Torque Control of Induction Machines During Voltage Recovery After Grid Faults," in *IEEE Transactions on Power Electronics*, Vol. 25, No. 5, May 2010, pp. 1240-1250
- [16] Steinar Danielsen, Olav B. Fosso, Marta Molinas, **Jon Are Suul**, Trond Toftevaag, "Simplified models of single-phase power electronic inverter for railway power system stability analysis – Development and evaluation," in *Electric Power System Research*, Vol. 80, No. 2, February 2010, pp. 204-214
- [17] Marta Molinas, **Jon Are Suul**, Tore Undeland, "Extending the Life of Gear Box in Wind Generators by Smoothing Transient Torques With STATCOM," in *IEEE Transactions on Industrial Electronics*, Vol. 57, No. 2, February 2010, pp. 476-484
- [18] Marta Molinas, **Jon Are Suul**, Tore Undeland, "Low Voltage Ride Through of Wind Farms With Cage Generators: STATCOM Versus SVC", *IEEE Transactions on Power Electronics*, Vol. 23, No. 3, May 2008, pp. 1104-1117

Book Chapters

- [1] **Jon Are Suul**: "Variable speed pumped storage hydropower plants for grid integration of wind power in isolated grids," in *Renewable Energy*, Hammons, T. J., Ed., pp. 553-580, INTECH, Vukovar, Croatia, December 2009, ISBN 978-953-7619-52-7

Conference Papers/Proceedings

- [1] Julian Freytes, Gilbert Bergna, **Jon Are Suul**, Salvatore D'Arco, Hani Saad, Xavier Guillaud, "State-space modelling with Steady-State Time Invariant Representation of Energy Based Controllers for Modular Multilevel Converters," accepted for presentation at the 12th IEEE PES PowerTech Conference, Manchester, UK, 18-22 June 2017

- [2] Salvatore D'Arco, Jef Beerten, **Jon Are Suul**, "Classification and analysis of impact on small-signal dynamics and stability from expansion of VSC-HVDC systems to multi-terminal HVDC grids," in *Proceedings of the 13th IET International conference on AC and DC Power Transmission*, ACDC 2017, Manchester, UK, 14-16 February 2017, 8 pp.
- [3] Julian Freytes, Gilbert Bergna, **Jon Are Suul**, Salvatore D'Arco, Hani Saad, Xavier Guillaud, "Small-Signal Model Analysis of Droop-controlled Modular Multilevel Converters with Circulating Current Suppressing Controller," in *Proceedings of the 13th IET International conference on AC and DC Power Transmission*, ACDC 2017, Manchester, UK, 14-16 February 2017, 8 pp.
- [4] Salvatore D'Arco, **Jon Are Suul**, "Small-Signal Analysis of an Isolated Power System controlled by a Virtual Synchronous Machine," in *Proceedings of the IEEE 17th International Conference on Power Electronics and Motion Control*, PEMC 2016, Varna, Bulgaria, 25-30 September 2016, pp. 462-469
- [5] Gilbert Bergna, Salvatore D'Arco, **Jon Are Suul**, "Impact on Small-Signal Dynamics of Using Circulating Currents Instead of AC-Currents to Control the DC Voltage in MMC HVDC Terminals," in *Proceedings of the 2016 IEEE Energy Conversion Congress and Exposition*, ECCE 2016, Milwaukee, Wisconsin, USA, 18-22 September 2016, 8 pp.
- [6] Nurul Fazlin Roslan, **Jon Are Suul**, Ignacio Candela, Joan Rocabert, Alvaro Luna, Pedro Rodríguez, "A Comparative Study of Methods for Estimating Virtual Flux at the Point of Common Coupling in Grid Connected Voltage Source Converters with LCL Filter," in *Proceedings of the 2016 IEEE Energy Conversion Congress and Exposition*, ECCE 2016, Milwaukee, Wisconsin, USA, 18-22 September 2016, 6 pp.
- [7] Gilbert Bergna **Jon Are Suul**, Salvatore D'Arco, "State-Space Modeling of Modular Multilevel Converters for Constant Variables in Steady-State," in *Proceedings of the 17th IEEE Workshop on Control and Modeling for Power Electronics*, COMPEL 2016, Trondheim, Norway, 27-30 June 2016, 9 pp.
- [8] Gilbert Bergna, **Jon Are Suul**, Salvatore D'Arco, Magnar Hernes, "Analysis of Thermal Cycling for Semiconductor Devices in Modular Multilevel Converters," in *Proceedings of the 17th IEEE Workshop on Control and Modeling for Power Electronics*, COMPEL 2016, Trondheim, Norway, 27-30 June 2016, 7 pp.
- [9] Salvatore D'Arco, **Jon Are Suul**, Jef Beerten, "Analysis of Accuracy versus Model Order for Frequency-dependent pi-model of HVDC Cables," in *Proceedings of the 17th IEEE Workshop on Control and Modeling for Power Electronics*, COMPEL 2016, Trondheim, Norway, 27-30 June 2016, 8 pp.
- [10] Takanori Isobe, Long Zhang, Hiroshi Tadano, **Jon Are Suul**, Marta Molinas, "Control of DC-capacitor Peak Voltage in Reduced Capacitance Single-Phase STATCOM," in *Proceedings of the 17th IEEE Workshop on Control and Modeling for Power Electronics*, COMPEL 2016, Trondheim, Norway, 27-30 June 2016, 8 pp.
- [11] Salman Saeed Khan, **Jon Are Suul**, Elisabetta Tedeschi, Muhammad Jafar, "Blocking Capability for Switching Function and Average Value Models for Modular Multilevel Converters," in *Proceedings of the 16th IEEE International Conference on Environment and Electrical Engineering*, IEEIC 2016, Florence, Italy, 7-10 June 2016, 6 pp.
- [12] Espen Skjong, **Jon Are Suul**, Marta Molinas, Tor Arne Johansen, "Optimal Compensation of Harmonic Propagation in a Multi-Bus Microgrid," in *Proceedings of the International Conference on Renewable Energies and Power Quality*, ICREPQ'16, 4-6 May 2016, 6 pp.
- [13] Jef Beerten, Gilbert Bergna Diaz, Salvatore D'Arco, **Jon Are Suul**, "Comparison of Small-Signal Dynamics in MMC and Two-Level VSC HVDC Transmission Schemes," in *Proceedings of the 4th IEEE International Energy Conference*, ENERGYCON 2016, Leuven, Belgium, 4-8 April 2016, 6 pp.
- [14] Jorun Irene Marvik, Salvatore D'Arco, **Jon Are Suul**, "A two-layer detection strategy for protecting multi-terminal HVDC systems against faults within a wide range of impedances," in *Proceedings of the 13th IET International Conference on Developments in Power System Protection*, DPSP 2016, Edinburgh, UK, 7-10 March 2016, 6 pp.
- [15] Shihabudheen K. Kolparambath, **Jon Are Suul**, Elisabetta Tedeschi, "DC/DC Converters for Interconnecting Independent HVDC Systems into Multiterminal DC Grids," in *Proceedings of the 13th Brazilian Power Electronics Conference and the 1st Southern Power Electronics Conference*, COBEP – SPEC 2015, Fortaleza, Brazil, 29. November – 2. December 2015, 6 pp.

- [16] Nurul Fazlin Roslan, **Jon Are Suul**, Alvaro Luna, Ignacio Candela, Pedro Rodriguez, "A Simulation Study of Proportional Resonant Controller Based on the Implementation of Frequency-Adaptive Virtual Flux Estimation with the LCL Filter," in *Proceedings of the 41st Annual Conference of the IEEE Industrial Electronics Society*, IECON 2015, Yokohama, Japan, 9-12 November 2015, pp. 001934-001941
- [17] Gilbert Bergna Diaz, **Jon Are Suul**, Salvatore D'Arco, "Small-Signal State-Space Modeling of Modular Multilevel Converters for System Stability Analysis," in *Proceedings of the 2015 IEEE Energy Conversion Congress and Exposition*, ECCE 2015, Montreal, Quebec, Canada, 20-24 September 2015, pp. 5822-5829
- [18] Florian Thams, **Jon Are Suul**, Salvatore D'Arco, Marta Molinas, Friedrich W. Fuchs, "Stability of DC Voltage Droop Controllers in VSC HVDC Systems," in *Proceedings of the IEEE PowerTech Eindhoven 2015 – Towards Future Power Systems and Emerging Technologies*, Eindhoven, The Netherlands, 29 June – 2 July 2015, 7 pp.
- [19] Shihabudheen K. Kolparambath, **Jon Are Suul**, Elisabetta Tedeschi, "Analysis of DC/DC Converters in Multiterminal HVDC Systems for Large Offshore Wind Farms," in *Proceedings of the 2015 IEEE International Conference on Technological Advances in Power & Energy*, TAP Energy 2015, Amritapuri, Kerala, India, 24-26 June 2015, pp. 415-420
- [20] Salvatore D'Arco, **Jon Are Suul**, "A Synchronization Controller for Grid Reconnection of Islanded Virtual Synchronous Machines," in *Proceedings of the IEEE 6th International Symposium on Power Electronics for Distributed Generation*, PEDG 2015, Aachen, Germany, 22-25 June 2015, 8 pp.
- [21] Giuseppe Guidi, **Jon Are Suul**, "Minimization of Converter Ratings for MW-scale Inductive Charger Operated under Widely Variable Coupling Conditions," in *Proceedings of the IEEE PELS Workshop on Emerging Technologies: Wireless Power*, 2015 WoW, Daejeon, Korea, 5-6 June 2015, 7 pp.
- [22] **Jon Are Suul**, Salvatore D'Arco, Giuseppe Guidi, "Virtual Synchronous Machine-based Control of a Single-phase Bi-directional Battery Charger for Providing Vehicle-to-Grid Services," in *Proceedings of the 9th International Conference on Power Electronics – ICPE 2015-ECCE Asia*, Seoul, Korea, 1-5 June 2015, pp. 742-749
- [23] Miguel Ochoa-Gimenez, Salvatore D'Arco, **Jon Are Suul**, "Voltage Saturation Anti-Windup for Harmonic Controllers in Multiple Reference Frames," in *Proceedings of the 2015 IEEE International Conference on Industrial Technology*, ICIT 2015, Seville, Spain, 17-19 March 2015, pp. 2139-2144
- [24] **Jon Are Suul**, Salvatore D'Arco, Pedro Rodríguez, Marta Molinas, "Extended stability range of weak grids with voltage source converters through impedance-conditioned grid synchronization," in *Proceedings of the 11th IET International Conference on AC and DC Power Transmission*, ACDC 2015, Birmingham, UK, 10-12 February 2015, 10 pp.
- [25] Jef Beerten, Salvatore D'Arco, **Jon Are Suul**, "Cable model order reduction for HVDC systems interoperability analysis," in *Proceedings of the 11th IET International Conference on AC and DC Power Transmission*, ACDC 2015, Birmingham, UK, 10-12 February 2015, 10 pp.
- [26] Jorun Irene Marvik, Salvatore D'Arco, **Jon Are Suul**, "Communication-less fault detection in radial multi-terminal offshore HVDC grids," in *Proceedings of the 11th IET International Conference on AC and DC Power Transmission*, ACDC 2015, Birmingham, UK, 10-12 February 2015, 8 pp.
- [27] Mohammad Amin, **Jon Are Suul**, Salvatore D'Arco, Elisabetta Tedeschi, Marta Molinas, "Impact of state-space modeling fidelity on the small-signal dynamics of VSC-HVDC systems," in *Proceedings of the 11th IET International Conference on AC and DC Power Transmission*, ACDC 2015, Birmingham, UK, 10-12 February 2015, 9 pp.
- [28] Ingerid Zeiner, **Jon Are Suul**, Marta Molinas, "Competitiveness of Grid Connected Photovoltaic Power Supply for a Desalination Plant under a Prospective Power Market in Paraguay," in *Proceedings of The 2nd IEEE Conference on Power Engineering and Renewable Energy*, ICPERE 2014, Kuta, Bali, Indonesia, 9-11 December 2014, pp. 114-119
- [29] Salvatore D'Arco, **Jon Are Suul**, Marta Molinas, "Implementation and Analysis of a Control Scheme for Damping of Oscillations in VSC-based HVDC Grids," in *Proceedings of the 16th International Power Electronics and Motion Control Conference and Exposition*, PEMC 2014, Antalya, Turkey, 21-24 September 2014, pp. 586-593
- [30] Mohammad Amin, Mehdi Karbalaye Zadeh, **Jon Are Suul**, Elisabetta Tedeschi, Marta Molinas, Olav B. Fosso, "Stability analysis of interconnected AC power systems with multi-terminal DC grids based on the Cigré DC grid test system," in *Proceedings of the 3rd Renewable Power Generation Conference*, RPG 2014, Naples, Italy, 24-25 September 2014, 6 pp.

- [31] Gilbert Bergna, **Jon Are Suul**, Erik Berne, Jean-Claude Vannier, Marta Molinas, "MMC Circulating Current Reference Calculation in ABC Frame by means of Lagrange Multipliers for Ensuring Constant DC Power under Unbalanced Grid Conditions," in *Proceedings of the 16th European Conference on Power Electronics and Applications*, EPE'14 ECCE Europe, Lappeenranta, Finland, 26-28 August 2014, 10 pp.
- [32] Mehdi Karbalaye Zadeh, Mohammad Amin, **Jon Are Suul**, Marta Molinas, Olav B. Fosso, "Small-Signal Stability Study of the Cigré DC Grid Test System with Analysis of Participation Factors and Parameter Sensitivity of Oscillatory Modes," in *Proceedings of the 18th Power Systems Computation Conference*, PSCC 2014, Wrocław, Poland, 18-22 August 2014, 8 pp.
- [33] Salvatore D'Arco, **Jon Are Suul**, Olav B. Fosso, "Small-Signal Modeling and Parametric Sensitivity of a Virtual Synchronous Machine," in *Proceedings of the 18th Power Systems Computation Conference*, PSCC 2014, Wrocław, Poland, 18-22 August 2014, 9 pp.
- [34] Salvatore D'Arco, **Jon Are Suul**, "Generalized Implementations of Piecewise Linear Control Characteristics for Multiterminal HVDC," in *Proceedings of the 22nd International Symposium on Power Electronics, Electrical Drives, Automation and Motion*, SPEEDAM 2014, Ischia, Italy, 18-20 June 2014, pp. 66-72
- [35] **Jon Are Suul**, Salvatore D'Arco, Giuseppe Guidi, "A Single-Phase Virtual Synchronous Machine for Providing Vehicle-to-Grid Serviced from Electric Vehicle Battery Chargers," in *Proceedings of the International Electric Vehicle Technology Conference & Automotive Power Electronics*, EVTeC & APE Japan, Yokohama, Japan, 22-24 May 2014, 7 pp.
- [36] Salvatore D'Arco, Giuseppe Guidi, **Jon Are Suul**, "Embedded Limitations and Protections for Droop-based Control Schemes with Cascaded Loops in the Synchronous Reference Frame," in *Proceedings of the 2014 International Power Electronics Conference*, IPEC-Hiroshima 2014 – ECCE Asia, Hiroshima, Japan, 18-21 May 2014, pp. 1544-1551
- [37] Marte Løtveit, **Jon Are Suul**, Elisabetta Tedeschi, Marta Molinas, "A Study of Biomass in a Hybrid Stand-Alone Micro-Grid for the Rural Village of Wawashang, Nicaragua," in *Proceedings of the 2014 Ninth International Conference on Ecological Vehicles and Renewable Energies*, EVER 2014, Monte-Carlo, Monaco, 25-27 March 2014, 7 pp.
- [38] Ingerid Zeiner, **Jon Are Suul**, Aldo Marcos, Marta Molinas, "System Design and Load Profile Shaping for a Reverse Osmosis Desalination Plant Powered by a Stand-Alone PV System in Pozo Colorado Paraguay," in *Proceedings of the 2014 Ninth International Conference on Ecological Vehicles and Renewable Energies*, EVER 2014, Monte-Carlo, Monaco, 25-27 March 2014, 7 pp.
- [39] Gilbert Bergna, **Jon Are Suul**, Alejandro Garcés, Erik Berne, Philippe Egrot, Amir Arzandé, Jean-Claude Vannier, Marta Molinas, "Improving the Dynamics of Lagrange-based MMC Controllers by means of Adaptive Filters for Single-Phase Voltage, Power and Energy Estimation," in *Proceedings of the 39th Annual Conference of the IEEE Industrial Electronics Society*, IECON 2013, Vienna, Austria, 10-13 November 2013, pp. 6237-6242
- [40] Gilbert Bergna, **Jon Are Suul**, Erik Berne, Philippe Egrot, Jean-Claude Vannier, Marta Molinas, "Analysis of Modular Multilevel Converters under Unbalanced Grid Conditions with different Load Current Control Strategies and Lagrange-based Differential Current Control," in *Proceedings of the 1st International Future Energy Electronics Conference*, IFEEC 2013, Tainan, Taiwan, 3-6 November 2013, pp. 669-674
- [41] Salvatore D'Arco, **Jon Are Suul**, Olav B. Fosso, "Control System Tuning and Stability Analysis of Virtual Synchronous Machines," in *Proceedings of the 2013 IEEE Energy Conversion Congress and Exposition*, ECCE 2013, Denver, Colorado, USA, 15-19 September 2013, pp. 2664-2671
- [42] Salvatore D'Arco, **Jon Are Suul**, "Estimation of sub-module capacitor voltages in Modular Multilevel Converters," in *Proceedings of the 15th European Conference on Power Electronics and Applications*, EPE'13 ECCE Europe, Lille, France, 3-5 September 2013, 10 pp.
- [43] Gilbert Bergna, **Jon Are Suul**, Erik Berne, Philippe Egrot, Jean-Claude Vannier, Marta Molinas, "Generalized ABC Frame Differential Current Control ensuring constant DC Power for Modular Multilevel Converters under Unbalanced Operation," in *Proceedings of the 15th European Conference on Power Electronics and Applications*, EPE'13 ECCE Europe, Lille, France, 3-5 September 2013, 10 pp.
- [44] Salvatore D'Arco, **Jon Are Suul**, "Virtual Synchronous Machines – Classification of Implementations and Analysis of Equivalence to Droop Controllers for Microgrids," in *Proceedings of IEEE PES PowerTech 2013*, Grenoble, France, 16-20 June 2013, 7 pp.

- [45] **Jon Are Suul**, Alvaro Luna, Pedro Rodríguez, "Power Control of VSC HVDC Converters for Limiting the Influence of AC Unbalanced Faults on Multi-Terminal HVDC Grids," in *Proceedings of the 10th International Conference on AC and DC Power Transmission*, ACDC 2012, Birmingham, UK, 4-6 December 2012, 7 pp.
- [46] Gilbert Bergna, **Jon Are Suul**, Erik Berne, Phillipe Egrot, Pierre Lefranc, Jean-Claude Vannier, Marta Molinas, "Mitigating DC-Side Power Oscillations and Negative Sequence Load Currents in Modular Multilevel Converters under Unbalanced Faults – First Approach using Resonant PI," in *Proceedings of the 38th Annual Conference of the IEEE Industrial Electronics Society*, IECON 2012, Montréal, Québec, Canada, 25-28 October 2012, pp. 537-542
- [47] **Jon Are Suul**, Marta Molinas, Pedro Rodríguez, "Exploring the Range of Impedance Conditioning by Virtual Inductance for Grid Connected Voltage Source Converters," in *Proceedings of the 2012 3rd IEEE PES International Conference and Exhibition on Innovative Smart Grid Technologies*, ISGT Europe, Berlin, Germany, 14-17 October 2012, 9 pp.
- [48] **Jon Are Suul**, Marta Molinas, "Properties of Reactive Current Injection by AC Power Electronic Systems for Loss Minimization," in *Proceedings of the 15th International Power Electronics and Motion Control Conference*, EPE-PEMC 2012 ECCE Europe, Novi Sad, Serbia, 3-6 September 2012, 8 pp.
- [49] **Jon Are Suul**, Tore Undeland: "Flexible Reference Frame Orientation of Virtual Flux-based Dual Frame Current Controllers for Operation in Weak Grids", in *Proceedings of the IEEE PES Trondheim PowerTech 2011*, Trondheim, Norway, 19-23 June 2011, 8 pp.
- [50] **Jon Are Suul**, Alvaro Luna, Pedro Rodríguez, Tore Undeland: "Frequency-adaptive Virtual Flux Estimation for Grid Synchronization under Unbalanced Conditions," in *Proceedings of the 36th Annual Conference of the IEEE Industrial Electronics Society*, IECON 2010, 7-10 November 2010, Glendale, Arizona, USA, pp. 486-492
- [51] **Jon Are Suul**, Kjell Ljøkelsøy, Tarjei Midtsund, Tore Undeland: "Synchronous Reference Frame Hysteresis Current Control for Grid Converter Applications," in *Proceedings of the 14th International Power Electronics and Motion Control Conference*, EPE-PEMC 2010, Ohrid, Republic of Macedonia, 6-8 September 2010, pp T3-111–T3-119
- [52] **Jon Are Suul**, Tore Undeland: "Impact of Virtual Flux Reference Frame Orientation on Voltage Source Inverters in Weak Grids," in *Proceedings of the 2010 International Power Electronics Conference – ECCE Asia – IPEC-Sapporo 2010*, Sapporo, Japan, 21-24 June 2010, pp. 368-375
- [53] Tarjei Midtsund, **Jon Are Suul**, Tore Undeland: "Evaluation of Current Controller Performance and Stability for Voltage Source Converters Connected to a Weak Grid," in *Proceedings of the 2nd International Symposium on Power Electronics for Distributed Generation Systems*, Hefei, China, 16-18 June 2010, 7 pp.
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- [55] **Jon Are Suul**, Marta Molinas, Lars Norum, Tore Undeland: "Tuning of Control Loops for Grid Connected Voltage Source Converters," in *Proceedings of the 2nd IEEE International Power and Energy Conference*, PECon 2008, Johor Bahru, Malaysia, 1-3 December, 2008, pp. 797-802
- [56] **Jon Are Suul**, Kjetil Uhlen, Tore Undeland: "Wind Power Integration in Isolated Grids enabled by Variable Speed Pumped Storage Hydropower Plant," *Proceedings of the IEEE International Conference on Sustainable Energy Technologies*, ICSET 2008, Singapore, 24-27 November 2008, pp. 399-404
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INVITED LECTURES AND WORKSHOP PRESENTATIONS

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| 2016 | <p>Norwegian Union for Automation (Norsk Forening for Automatisering – NFA) 13th Conference on Advanced Vessels (Avanserte Fartøyer), Trondheim, Norway, 16-17 November 2016,
 "Status and Development Trends for Power Electronic Converter Technology"
 Tsukuba Global Science Week 2016, Tsukuba, Japan, 17-19 September 2016,
 "Control of Grid Connected Power Electronic Converters,"
 Japan-Norway joint workshop on Design and control of power converters for future sustainable power systems, The University of Tokyo, Kashiwanoha Campus, 23 February 2016, Workshop supported by the Research Council of Norway for cooperation between Norwegian Research Projects funded by the EnergiX programme and Japanese research teams supported by the Japanese Science and Technology Agency (JST) CREST programme,
 "Virtual Synchronous Machines for Grid Friendly Connection of Distributed Loads and Renewable Sources"</p> <p>Kyoto-Norway Workshop on Offshore Energy Systems: Wind Power and HVDC Grids, University of Kyoto, Kyoto, Japan, 19 February 2016, Workshop supported by the Research Council of Norway for cooperation between Norwegian Research Projects funded by the EnergiX programme and Japanese research teams
 "Virtual Synchronous Machines for Control of Converters in HVDC Systems"</p> |
| 2015 | <p>Japan Norway Energy Science Week, Tokyo, Japan, 27-28 May 2015:
 "Functionalities of Power Electronic Converters in the context of SmartGrids,"
 JST-NSF-DFG-RCN Workshop on Distributed Energy Management Systems, Arlington, Virginia, USA, 20-22 April 2015, Joint workshop organized by the Japanese Science and Technology Agency (JST), the US National Science Foundation (NSF), The German Research Council (Deutsche Forschungsgemeinschaft – DFG) and the Research Council of Norway (RCN)
 "Virtual Synchronous Machines for Supporting Flexible Operation of Distribution Systems"</p> |

	The Energy Challenge of the Global South, Seminar organized by University of Oslo, UiO Energy, Oslo, Norway, 11 th of March 2015, "Converting Knowledge into Action: From NTNU to three villages in South America, Africa and Asia" (joint presentation on behalf of Prof. Marta Molinas, NTNU)
2014	EERA Workshop on Ancillary Services and System Stability, Kassel, Germany, 1-2 December 2014 "Virtual Synchronous Machines for supporting power system stability and enabling large-scale offshore wind farms with multi-infeed HVDC-transmission," Tsukuba Global Science Week 2014, Tsukuba, Japan, 28-30 September 2014, "Challenges for Operation and Control of Grid Connected Power Converters," The 11 th Deep Sea Offshore Wind R&D Conference - EERA DeepWind 2014, Trondheim, Norway, 22-24 January 2014 "Operation of power electronic converters in offshore wind farms as Virtual Synchronous Machines,"

INTERNATIONAL EXPERIENCE

2010	Technical University of Catalonia (UPC), Terrassa, Spain Visiting PhD student during two months at the Research Centre on Renewable Electrical Energy Systems (REES) within the Department of Electrical Engineering,
2008	National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan Two months stay as guest PhD student at the Energy Technology Research Institute (ETRI)

AWARDS

2006	Norwegian Electro-technical Society (NEF); The NEF-prize for the best Master Thesis in Electric Power Engineering at the Norwegian University of Science and Technology during 2006
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TEACHING EXPERIENCE

2010 - 2016	Advisor / co-supervisor for multiple MSc projects at the Department of Electric Power Engineering, Norwegian University of Science and Technology (NTNU), Trondheim, Norway
April 2008	Scientific assistant in subject on Electric Motor Drives, Norwegian University of Science and Technology (NTNU), Trondheim, Norway
Oct. –Dec. 2007 Aug.–Dec. 2008	Scientific assistant in subject on Electric Circuit Analysis, Norwegian University of Science and Technology (NTNU), Trondheim, Norway
2006	Student assistant in subject on Electric Motor Drives, Norwegian University of Science and Technology (NTNU), Trondheim, Norway

TECHNICAL AND SCIENTIFIC EVALUATIONS

2016	Member on Advisory Panels for evaluation of two different project applications to Innovation Norway
March 2015	Politecnico di Milano, external evaluation of PhD candidate Stefano Mandelli, Thesis title, "Strategies for Access to Energy in Developing Countries: Methods and Models for Off-Grid Power Systems Design"

PROFESSIONAL SOCIETY SERVICES

2016-2017	IEEE Journal of Emerging and Selected Topics in Power Electronics, Guest Associate Editor for special issue on "Power Electronics & Systems: Modeling, Analysis, Control, and Stability"
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- 2017 IEEE Energy Conversion Congress and Exposition, ECCE 2017, Cincinnati, Ohio, USA, 1-5 October 2017:
Member of the Organizational Sub-committee on "Smart Grid & Utility Applications" as **sub-topic review chair for "Renewable energy grid integration"**
Member of the Organizational Sub-committee on "Control, Modelling and Optimization of Power Converters" as **sub-topic review chair for "Other topics in control, modeling and optimization of power converters"**
- 2016 IEEE Energy Conversion Congress and Exposition, ECCE 2016, Milwaukee, Wisconsin, USA, 18-22 September 2016:
Member of the Organizational Sub-committee on "Control, Modelling and Optimization of Power Converters" as **sub-topic review chair for "Power converter control"**
- 2016 The 17th IEEE Workshop on Control and Modeling for Power Electronics, COMPEL 2016, Trondheim, Norway,
Publication Chair and Chair of the Technical Committee
- 2016 IEEE Industrial Application Society,
Member of the Review Committee for the IEEE Transactions on Industrial Applications Prize Paper award for 2015
- 2015 IEEE Energy Conversion Congress and Exposition, ECCE 2015, Montreal, Québec, Canada, 20-24 September 2015:
Member of the Organizational Sub-committee on "Power Converter Topologies" as sub-topic review chair for "DC-AC Multi-phase Power Converter Topologies"
- 2013 IEEE Energy Conversion Congress and Exposition, ECCE 2013, Denver, Colorado, USA, 15-19 September 2013:
Vice Chair of the Organizational Sub-committee on "Smart Grid and Utility Applications," with responsibility for the sub-topics, "DC distribution and DC micro-grids," "Electronic transformer and other grid devices," "V2G and G2V," and "Stability and power quality"
- 2012 IEEE Energy Conversion Congress and Exposition, ECCE 2012, Raleigh, North Carolina, USA, 15-20 September 2012:
Member of the Organizational Sub-committee on "Smart Grid and Utility applications" as **Sub-topic review chair for "DC distribution and DC micro-grids"**
- 2008 – **Peer Reviews:**
For Journals: IEEE Transactions on Power Electronics, IEEE Transactions on Industrial Electronics, IEEE Transactions on Industry Applications, IEEE Transactions on Power Delivery, IEEE Transactions on Power Systems, IEEE Journal of Emerging and Selected Topics in Power Electronics, IEEE Transactions on Energy Conversion, IEEE Transactions on Smart Grid, IEEE Transactions on Sustainable Energy, IEEE Transactions on Control System Technology, IEEE Power Engineering Letters, IEEE Access, IET Generation, Transmission & Distribution, IET Power Electronics, IET Renewable Power Generation, IET Electric Power Applications, IET Electronic Letters, Elsevier – International Journal of Electric Power and Energy Systems, Elsevier – Sustainable Energy, Grids and Networks, Springer - Journal of Zhejiang University Science C (Computers & Electronics), Taylor & Francis – Journal of the Chinese Institute of Engineers, AIP - Journal of Renewable and Sustainable Energy, MDPI – Energies
For conferences: ISIE 2009, ISIE 2010, IECON 2011, ECCE 2012, PCon 2012, ECCE 2013, AFRICON 2013, IFEEC 2013, IPEC 2014, ISGT Asia 2014, ISIE 2014, PSCC 2014, ECCE 2014, CENCON 2014, ICIT 2015, ICPE 2015, ECCE 2015, IFEEC 2015, CENCON 2015, ENERGYCON 2016, PSCC 2016, ECCE 2016, PowerTech 2017, IFEEC – ECCE Asia 2017, ECCE 2017
Reviewer for the IEEE International Future Energy Challenge (IFEC) competition, 2015
- 2006 Sensor in subject on Power Electronics, Norwegian University of Science and Technology (NTNU)

LANGUAGES

Norwegian (mother tongue); English (fluent); German (basic)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Institute of Electrical and Electronics Engineers, IEEE; Member of the Power Electronics, the Industrial Electronics, the Power and Energy Systems, the Industry Applications and the Control Engineering Societies

The Norwegian Society of Chartered Technical and Scientific Professionals (Tekna)