



## RESEARCH PRODUCTIVITY (2017)

### 2017 List of Research Publications

#### Book and Book Chapter

- [1] S. Y. Khan and I E Davidson. "Underground Pumped Hydroelectric Energy Storage in South Africa using Aquifers and Existing Infrastructure", in Book: "NEIS Conference 2016", pp.119-122, Chapter · March 2017, DOI: 10.1007/978-3-658-15029-7\_19. Springer. <http://www.springer.com/978-3-658-15028-0>. ISBN: 978-3-658-1028-0. Editor Prof (Dr) D Schulz.

#### Keynote and Invited Presentations

- [1] Innocent Davidson, Timothy Akindeji, Eamon Bussy and Navin Rampersadh, "Application of Cost-Effective Grid-Scale Battery Storage as an Enabler of Network Integration of Renewable Energy", Paper S1-5 presented at the 17<sup>th</sup> IERE General meeting and Canada Forum, Vancouver BC, Canada, 16-19 May 2017.
- [2] Rodney Reuben, Innocent Davidson and Sizwe Dhlamini, "Renewable Energy Zones in Queensland: A means to Integrate Transmission and Generation Infrastructure Development", Paper S4-7 presented at the 17<sup>th</sup> IERE General meeting and Canada Forum, Vancouver BC, Canada, 16-19 May 2017.
- [3] I E Davidson, "Quality Engineering Education through University-Industry Partnerships in Eastern and Southern Africa (A Royal Academy of Engineering HEPSSA Project) - Project Implementation Strategy for Durban University of Technology (DUT)" Proceedings of the 2017 Inception Workshop, Windhoek, Namibia, 23 May 2017.
- [4] I E Davidson, "Environmental Sustainability with a focus on Renewable Energy", Panelist Address at the 2<sup>nd</sup> Mangosuthu University of Technology Research Innovation and Engagement Week, Inter-national Convention Centre, Durban, South Africa July 10 – 14, 2017.

#### DHET Accredited Journal Papers

- [1] Dayahalen Chetty, Mobolaji Bello and Innocent E Davidson, "Performance Evaluation of Traction and Utility Network Interface: Fault Location and Protection Coordination". *Electric Power Systems Research Journal.*, Vol 156, pp.44-53, 2018.

- [2] P. T Ogunboyo, R. Tiako, I.E Davidson, "Application of Dynamic Voltage Restorer for Power Quality Improvement in Low Voltage Electrical Power Distribution Network: An Overview", *International Journal of Engineering Research in Africa*, Vol. 28, pp. 142-156, 2017.
- [3] Ester Hamatwi, Innocent Davidson and Michael Gitau, "Rotor Speed Control of a Direct-driven Permanent Magnet Synchronous Generator-based Wind Turbine using Phase-lag Compensators to Optimize Wind-Power Extraction", *Journal of Control Science and Engineering*, Vol. 2017. <https://doi.org/10.1155/2017/6375680>. Article ID 6375680

## Refereed Conference Proceedings

- [1] A.A. Adebisi, and K. T Akindeji: "Investigating the effect of static synchronous compensator (STATCOM) for voltage enhancement and transmission losses mitigation". Proceedings of the *IEEE PES-IAS PowerAfrica Conference, Accra, Ghana, 27-30 June 2017*. ISBN: 978-1-5090-4746-8/17.
- [2] T. S. Moodley and G. F. d'Almaine. "Substation Automation of 237 Rodger Sishi Road DSS". Poster Presentation at the *25<sup>th</sup> South African Universities Power Engineering Conference (SAUPEC)*, Cape Town, South Africa, 30 January – 1 February 2017.
- [3] M. Chamane, M.N. Gitau and I.E. Davidson, "A Study of the Performance of VSC-HVDC Transmission System during DC Faults". In *Proceedings of the 25<sup>th</sup> South African Universities Power Engineering Conference*, 30 January – 1<sup>st</sup> February 2017, Stellenbosch, South Africa, pp. 20-25, ISBN 978-0-620-74503-1.
- [4] O. Lasabi, A. Swanson and I.E. Davidson, "Surface Charge Accumulation on DC Insulators: An Overview". In *Proceedings of the 25<sup>th</sup> South African Universities Power Engineering Conference*, 30 January – 1<sup>st</sup> February 2017, Stellenbosch, South Africa, pp. 38-43, ISBN 978-0-620-74503-1.
- [5] G. Ininahazwe and I.E. Davidson, "A Numerical Investigation of the Effects of External Field on Electric Field Distribution around Glass Insulator". In *Proceedings of the 25<sup>th</sup> South African Universities Power Engineering Conference*, 30 January – 1<sup>st</sup> February 2017, Stellenbosch, South Africa, pp. 125-130, ISBN 978-0-620-74503-1.
- [6] E. Hamatwi, I. E. Davidson and M.N. Gitau, "Pitch-Angle Control of a Wind Turbine Equipped with a Permanent Magnet Synchronous Generator". In *Proceedings of the 25<sup>th</sup> South African Universities Power Engineering Conference*, 30 January – 1<sup>st</sup> February 2017, Stellenbosch, South Africa, pp. 200-205, ISBN 978-0-620-74503-1.
- [7] E. Hamatwi, I. E. Davidson and M.N. Gitau, "Control of a Wind Turbine Equipped with a Permanent Magnet Synchronous Generator for Maximum Power Point Tracking". In *Proceedings of the 25<sup>th</sup> South African Universities Power Engineering Conference*, 30 January – 1<sup>st</sup> February 2017, Stellenbosch, South Africa, pp. 206-214, ISBN 978-0-620-74503-1.
- [8] E. Singh, I.E. Davidson and G.K. Venayagamoorthy, "Methodology for Measuring and Enhancing Tower Footing Resistance for Lightning Protection in an 88KV Line". In *Proceedings of the 25<sup>th</sup> South African Universities Power Engineering Conference*, 30 January – 1<sup>st</sup> February 2017, Stellenbosch, South Africa, pp. 655-659, ISBN 978-0-620-74503-1.
- [9] O.E. Oni, N. Parus and I. E. Davidson, "Dynamic Analysis of Eskom Eastern Power Grid". In *Proceedings of the 25<sup>th</sup> South African Universities Power Engineering Conference*, 30 January – 1<sup>st</sup> February 2017, Stellenbosch, South Africa, pp. 824-830, ISBN 978-0-620-74503-1.
- [10] Mbalenhle Chamane, David Dorrell, Innocent Davidson, Njoroge Gitau and R. Vajeth, "A protection scheme for voltage source converter (VSC) based HVDC systems ". *Proceedings of the 4<sup>th</sup> Eskom Power Plant Engineering Institute Student Workshop*, Eskom Academy of Learning, Midrand, South Africa, 29 - 30 May 2017, pp. 34-35.
- [11] P. T Ogunboyo, R. Taiko and I. E. Davidson, "Enhancing Voltage Profile of Low Voltage 11/0.4 kV Electric Power Distribution Network using Dynamic Voltage Restorer". *Proceedings of the 4<sup>th</sup> Eskom Power Plant Engineering Institute Student Workshop*, Eskom Academy of Learning, Midrand, South Africa, 29 - 30 May 2017, pp. 56-57.
- [12] O.P. Taiwo, R. Taiko and I. E. Davidson, "An investigation of voltage unbalance quality in low voltage electrical power distribution network under normal operation mode". In *Proceedings of the EAI International Conference for Research, Innovation and Development for Africa (ACRID 2017)*, Victoria Falls, Zimbabwe, June 20–21, 2017.
- [13] E. Hamatwi, M.N. Gitau and I. E. Davidson, "Control of a Direct-driven Permanent Magnet Synchronous Generator-based Wind Turbine to Achieve Maximum Wind-Power Extraction". Proceedings of the *IEEE PES-IAS PowerAfrica Conference, Accra, Ghana, 27-30 June 2017*, pp. 65 - 74. ISBN: 978-1-5090-4746-8/17.
- [14] O.E. Oni and I. E. Davidson, "Technical Performance and Cost Analysis of a 600kV HVDC Link on South Africa's EHV Network". Proceedings of the *IEEE PES-IAS PowerAfrica Conference, Accra, Ghana, 27-30 June 2017*, pp. 88 - 94. ISBN: 978-1-5090-4746-8/17.
- [15] A. Maharaj and I. E. Davidson, "Lifecycle Cost Optimization of Electric Utility Transmission and Distribution Assets". Proceedings of the *IEEE PES-IAS PowerAfrica Conference, Accra, Ghana, 27-30 June 2017*, pp. 65 - 74. ISBN: 978-1-5090-4746-8/17.
- [16] S. Mludi and I. E. Davidson, "Dynamic Analysis of Southern Africa Power Pool (SAPP) Network". Proceedings of the *IEEE PES-IAS PowerAfrica Conference, Accra, Ghana, 27-30 June 2017*, pp. 109-114. ISBN: 978-1-5090-4746-8/17.
- [17] Navin Rampersadh and Innocent Davidson, "Grid Energy Storage Devices", Proceedings of the *IEEE PES-IAS PowerAfrica Conference, Accra, Ghana, 27-30 June 2017*, pp. 121 – 125. ISBN: 978-1-5090-4746-8/17.

- [18] O.P. Taiwo, R. Tiako and I. E. Davidson, "An Improvement of Voltage Unbalance in a Low Voltage 11/0.4 kV Electrical Power Distribution Network under 3-phase Unbalance Load Condition using Dynamic Voltage Restorer". Proceedings of the *IEEE PES-IAS PowerAfrica Conference*, Accra, Ghana, 27-30 June 2017, pp. 126 - 131. ISBN: 978-1-5090-4746-8/17.
- [19] Enyo Agbodo, Babatunde Adeyemo, Ashwin Maharaj and Innocent Davidson, "Transforming the West African Regional Electricity Market – Lessons and Experiences". Proceedings of the *IEEE PES-IAS PowerAfrica Conference*, Accra, Ghana, 27-30 June 2017, pp. 198-201. ISBN: 978-1-5090-4746-8/17.
- [20] Sanjeeth Sewchurran, Innocent Davidson and Olorunfemi Ojo, "Drivers, Barriers and a Method for Evaluating the Feasibility of Residential Rooftop Solar PV in Durban - Part 1". Proceedings of the *IEEE PES-IAS PowerAfrica Conference*, Accra, Ghana, 27-30 June 2017, pp. 208 - 213. ISBN: 978-1-5090-4746-8/17.
- [21] Sanjeeth Sewchurran, Innocent Davidson and Olorunfemi Ojo, "Drivers, Barriers and a Method for Evaluating the Feasibility of Residential Rooftop Solar PV in Durban - Part 2". Proceedings of the *IEEE PES-IAS PowerAfrica Conference*, Accra, Ghana, 27-30 June 2017, pp. 214 - 219. ISBN: 978-1-5090-4746-8/17.
- [22] Sanjeeth Sewchurran and Innocent Davidson, "Study of Renewable Energy Resources Found within Local Municipalities - An eThekweni Electricity Case Study". Proceedings of the *IEEE PES-IAS PowerAfrica Conference*, Accra, Ghana, 27-30 June 2017, pp. 220- 226. ISBN: 978-1-5090-4746-8/17.
- [23] Zama Gogo, Sanjeeth Sewchurran, Innocent Davidson and Olorunfemi Ojo, "An Assessment of Voltage Rise Phenomenon on Existing Low-Voltage Distribution Network in Durban, South Africa". Proceedings of the *IEEE PES-IAS PowerAfrica Conference*, Accra, Ghana, 27-30 June 2017, pp. 231 - 235. ISBN: 978-1-5090-4746-8/17.
- [24] Nsofwa Kangwa, Chitra Venugopal and Innocent Davidson, "A Review of the Performance Analysis of VSC-HVDC and MTDC Systems". Proceedings of the *IEEE PES-IAS PowerAfrica Conference*, Accra, Ghana, 27-30 June 2017, pp. 267 - 273. ISBN: 978-1-5090-4746-8/17.
- [25] Leonard Mukwekwe, Chitra Venugopal and Innocent Davidson, "A Review of the Impacts and Mitigation Strategies of High PV Penetration in Low Voltage Networks". Proceedings of the *IEEE PES-IAS PowerAfrica Conference*, Accra, Ghana, 27-30 June 2017, pp. 274 - 279. ISBN: 978-1-5090-4746-8/17.
- [26] Sizwe Dhlamini, Innocent Davidson and Zijun Gong, "Promoting access to grid electricity and water for communities by using energy efficient smart transformer components within the clean development mechanism", Proceedings of the *3<sup>rd</sup> IEEE Canada International Humanitarian Technology Conference (IHTC 2017)*, Toronto, Canada, July 20-21, 2017.
- [27] Usiholo Iruansi, Jules-Raymond Tapamo and Innocent Davidson, "Insulator condition using local binary patterns combined with support vector machines". Proceedings of the *IEEE Africon Conference*, Cape Town, South Africa, 18-20 September 2017, pp. 27-31. ISBN: 978-1-5386-2774-7/17.
- [28] P. T Ogunboyo, R. Taiko and I. E. Davidson, "Voltage Profile Enhancement in Low Voltage 11/0.4 kV Electric Power Distribution Network Using Dynamic Voltage Restorer under Three Phase Balance Load" Proceedings of the *IEEE Africon Conference*, Cape Town, South Africa, 18-20 September 2017, pp. 1034-1039. ISBN: 978-1-5386-2774-7/17.
- [29] S. Sewchurran and I. E. Davidson, "Introduction to the South African Renewable Energy Grid Code Version 2.9 Requirements (Part I - Introduction)". Proceedings of the *IEEE Africon Conference*, Cape Town, South Africa, 18-20 September 2017, pp. 1263-1267. ISBN: 978-1-5386-2774-7/17.
- [30] S. Sewchurran and I. E. Davidson, "Introduction to the South African Renewable Energy Grid Code Version 2.9 Requirements (Part II – Grid Code Technical Requirements)". Proceedings of the *IEEE Africon Conference*, Cape Town, South Africa, 18-20 September 2017, pp. 1268-1273. ISBN: 978-1-5386-2774-7/17.
- [31] S. Sewchurran and I. E. Davidson, "Introduction to the South African Renewable Energy Grid Code Version 2.9 Requirements (Part III – Discussions and Conclusions)". Proceedings of the *IEEE Africon Conference*, Cape Town, South Africa, 18-20 September 2017, pp. 1274-1278. ISBN: 978-1-5386-2774-7/17.
- [32] Rereloluwa O. Fatunmbi, Okezie O. Okoye, Olanrewaju A. Lasabi and Innocent E. Davidson, "FPGA Implementation of Open-Loop Controller for Five-Level Three Phase Multilevel Modular Converter". Proceedings of the *IEEE Africon Conference*, Cape Town, South Africa, 18-20 September 2017, pp. 1393-1398. ISBN: 978-1-5386-2774-7/17.
- [33] P. T. Ogunboyo, R. Tiako and I. E. Davidson, "Effectiveness of Dynamic Voltage Restorer in Enhancing Voltage Profile in Low Voltage Electric Power Distribution Networks under Normal Mode Operation". Proceedings of the *2017 IEEE 3<sup>rd</sup> International Conference on Electro-Technology for National Development (NIGERCON) Conference*, Owerri, Nigeria, 7-10 November 2017, pp. 839-847.
- [34] I. E. Davidson, O.A. Lasabi and P.T. Ogunboyo, "Assessment of a Two-Dimensional (2D) FEM Model of a 22 kV Silicon Rubber DC Insulator". Proceedings of the *2017 IEEE 3<sup>rd</sup> International Conference on Electro-Technology for National Development (NIGERCON) Conference*, Owerri, Nigeria, 7-10 November 2017, pp. 872 – 877.
- [35] P. T. Ogunboyo, R. Tiako and I. E. Davidson, "Investigation of Voltage Unbalance in Low Voltage Electric Power Distribution Network under Steady State Mode". Proceedings of the *2017 IEEE 3<sup>rd</sup> International Conference on Electro-Technology for National Development (NIGERCON) Conference*, Owerri, Nigeria, 7-10 November 2017, pp. 932-939.

## Higher Degrees Graduated in other Institutions (UKZN)

### Doctor of Philosophy (2017)

**Sewchurran**, Sanjeeth *BScEng, MScEng (UKZN)* ..... *Electrical Engineering*  
Dissertation: Modelling and Performance Analysis of the eThekweni Electricity Distribution Grid with Increased Embedded Generation Sources  
Supervisors: **Professor IE Davidson** and Professor Olorunfemi Ojo

### Master of Science in Engineering (2017)

**Bodlingwe**, Bridgete Afrodite, *BTech (Pret Tech)* ..... *Electrical Engineering*  
Dissertation: Practical Evaluation of Weak In-Feed Tripping Effectiveness on Eskom Network.  
Supervisors: Prof NM Ijumba and **Prof IE Davidson**

**Boodraj**, Dinesh, *BTech (MLS Tech)*..... *Electrical Engineering*  
Dissertation: Design and Prototype Development of a Remote Intelligent Electronic Devices Verification Platform  
Supervisor: **Prof IE Davidson** and Dr Remy Tiako

**Chetty**, Dayahalen, *BScEng* ..... *Electrical Engineering*  
Dissertation: The Application of Volt/VAr Optimisation on South African Distribution Power Networks: Solutions for Smart Grid Distribution Automation Applications  
Supervisor: **Prof IE Davidson** and Mr. M Bello

**Chetty**, Vasudevan, *BScEng* ..... *Electrical Engineering*  
Dissertation: Mitigating High Fault Current Levels in eThekweni HV Transmission System  
Supervisor: **Prof IE Davidson**

**De Lange**, Gerald, *BTech (Natal Tech)*..... *Electrical Engineering*  
Dissertation: Analyzing and Mitigating the Effects of Stray Currents on Underground Metal Pipelines  
Supervisor: **Prof IE Davidson** and Prof JT Agee

**Hamatwi**, Ester, *BScEng (UNamibia)* ..... *Electrical Engineering*  
Dissertation: Control of a Permanent Magnet Synchronous Generator-based Wind Energy Conversion System.  
Supervisors: **Prof IE Davidson** and Prof MN Gitau

**Maharaj**, Ashwin, *BTech (DUT)* ..... *Electrical Engineering*  
Dissertation: Technical Evaluation and Life Cycle Cost Analysis of Transmission and Distribution Assets  
Supervisor: **Prof IE Davidson**

**Mludi**, Shaibu Adam Ibu, *BEng (UMalawi)*..... *Electrical Engineering*  
Dissertation: Dynamic Analysis of the Southern African Power Pool (SAPP) Network  
Supervisor: **Prof IE Davidson**

**Oni, Oluwafemi Emmanuel, BEng (UAdo-Ekiti) ..... Electrical Engineering**  
Dissertation: Technical Performance and Stability Analysis of Eskom Power Network Using 600kV, 800kV, and 1000kV HVDC  
Supervisor: **Prof IE Davidson**

**Rampersadh, Navin, BTech (Natal Tech)..... Electrical Engineering**  
Dissertation: Grid Energy Storage Devices  
Supervisors: Prof IE Davidson and Dr Remy Tiako

**Reuben, Rodney, BTech (Natal Tech)..... Electrical Engineering**  
Dissertation: An Engineering Study and Design of a Renewable Energy Solar Park  
Supervisors: **Prof IE Davidson** and Dr Remy Tiako

## Research Grants

- [1] Principal Investigator: Mr Timothy Akindeji: Eskom TESP Grant (RTPSS Centre): R100 000.00.
- [2] Principal Investigator: Prof IE Davidson; Eskom TESP Grant (Smart Grids): R60 000.00; Eskom TESP Grant (HVDC): R80 000.00.
- [3] Co-Investigator: Prof IE Davidson; Royal Academy of Engineering United Kingdom Award (2017 – 2019); Grant Amount: £140 000.00.
- [4] DHET-Accredited Outputs Research Incentive Award 2017: Prof IE Davidson, Grant Amount: R36 855.38.

## Honours, Awards and Recognitions

- [1] Prof IE Davidson, 2017: Published News Article: "DUT Professor Elected to *Fellow* of the Institution of Engineering and Technology, London, UK" 11<sup>th</sup> May 2017.  
<http://www.dut.ac.za/dut-professor-elected-to-fellow-of-the-institution-of-engineering-and-technology-london-uk>

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