ANNUAL RESEARCH AND INNOVATION REPORT 2021

The Department

According to our ENVISION2030 strategy, DUT's DNA has two strands, namely 'people-centred and engaged' and 'innovative and entrepreneurial'. These are interwoven intrinsically by a number of double pairs consisting of 'values and principles' that bind our double-helix together. The extrinsic expression of our DNA is via The DUT Way; which demonstrates our collective character and behaviour. The Department of Electrical Power Engineering's ultimate goal, similar to the University's, is to contribute towards improving the lives and livelihoods of all its people, both internal and external. This is particularly relevant, since Engineering is a profession committed to the improvement of living standards in society through building critical infrastructure through which economic growth and success occur in society. Our local problems require home-grown solutions. We need to address amongst others, the critical challenges of economic growth; tackle the problem of unemployment and deal with the perennial national problem of loadshedding, ensuring security of electricity supplies, and improving on the quality of life in society. With dynamic and creative leadership, we are poised to undertake their greatest challenge to transform our economy from a resource based to manufacturing and knowledge-based economy. This will involve taking full charge of our resources, integrating our markets, building infrastructure, investing in human capital and creating an enabling environment for domestic and foreign direct investments to thrive in South Africa. A key strategy is for our national government to continue investing extensively in human capital while building a critical mass of skills and enable us become a major player in the global arena. This is what informs and catalyses the Department's activities in teaching, training, and research in modern electric power systems engineering, to make clean, renewable and sustainable electricity the preferred energy source for serving industrial, commercial and domestic loads.

Africa's population has increased sharply from 364 million in 1970 to 1.3 billion in 2020 and is expected to reach 2.0 billion by 2050, representing the world's largest labour pool. Africa has been projected to become the next big global manufacturing hub, overtaking China. The rapidly growing African population, generation capacity constraints, belated investment in electricity infrastructure, low economic growth over the last three decades, load growth in unplanned areas, poor maintenance of existing electric power assets are critical challenges. These have resulted in the demand outstripping available power generation capacity, leading to electricity shortages, load shedding, a backlog of unserved customers, and impeding economic growth. Hitherto, Africa has had the lowest energy per capita in the world. This makes energy poverty one of the major causes of under-development in the continent. Since electricity is the engine of economic growth and development, it is imperative that concerted efforts and aggressive investments made in

human development, and infrastructure that will facilitate trade and investments across the continent with a "Smart Integrated African Electric Power Super Grid" driven by modern tools and advances of HVDC Engineering and FACTS Technology, which is central in supporting Africa's sustained economic growth and development. The earnest anticipation of the Department, as we labour together, is to see the realization of a Smart Integrated African Electric Power Super Grid, built on the cornerstone of green energy and harnessing untapped gigawatts potential of Africa's clean renewable hydro-electric power as a share of a vast energy mix made of conventional and alternative energy resources.

The Department sees its students as treasures for the future, and intrinsically believes in its students as endowed with abilities and talents to make a laudable contribution to the society. Our mission in teaching, education and technical training is to co-labour with students, to seek their professional development and equip them to actualise their purpose with exemplary mentorship. Through such service, they can realise their full potential as well-informed, competent and confident professionals. We therefore strive to train, develop and supply the local and African marketplace with highly motivated, marketable and very competent professionals who understand the new and existing issues concerning the profession, namely: the generation, transportation, distribution and utilization of electrical energy to serve consumers in an efficient, safe, economic and reliable manner, in a changing smart utility environment. Academic courses are creatively presented using available state-of-the-art teaching and educational tools and resources, in blended mode, with emphasis on concepts, application and sustainability. Attendance at lectures and participation in discussions is very important. Good dialogue, effective communication and interaction are highly encouraged among students and staff. Course requirements and regulations are strictly adhered to and enforced with optimum professionalism. Our engineering projects and research activity seek to address skill requirements and meet local needs by providing solutions to problems facing local industry, electric utilities, business enterprises and society, such as cost-effective energy supplies, smart electric delivery systems; electromechanical and electromagnetic devices for sustainable development of local communities, while matching international intellectual standards for education and scholarship.

The Department of Electrical Power Engineering at DUT is engaged in research in technology relating to HVDC, power systems (including lines) and power electronics relating to AC systems in a smart grid utility environment.

The focus is on:

- ***Building Capacity in Electric Power and HVDC Engineering***
- ***Smart Grids and Renewable Energy Technologies***
- ***Research, Independent Testing & Verification Services***
- ***Power System Solutions and Smart Utility services***

We are positioned to be a co-builder of South Africa and Africa's future, and towards a Smart Integrated African Electric Power Super Grid driven by HVDC engineering and FACTS technology in a smart utility era; in partnership with our regional electricity distributor, eThekwini Electricity, and championed by Africa's largest electric utility ESKOM and supported by Africa's foremost economic giant, the Republic of South Africa.

Research Activities - Department of Electrical Power Engineering

- **Book and Book Chapters**
- **Keynote Address, Tutorial and Invited Presentations**
- **DHET Accredited Journal Articles**
- **Non-DHET Accredited Journal Articles**
- **Peer-Refereed Conference Proceedings**

Book and Book Chapter

[1] **Adebiyi A.A**., **Lazarus I.J**., Saha A.K., **Ojo E.E.** An Experimental Analysis of the Impact of a Grid-Tied Photovoltaic System on Harmonic Distortion. In: Subramani C., Vijayakumar K., Dakyo B., Dash S.S. (eds) Proceedings of International Conference on Power Electronics and Renewable Energy Systems. Lecture Notes in Electrical Engineering, vol 795. 2021, Springer, Singapore. https://doi.org/10.1007/978-981-16-4943-1_40

[2] **Jonas Don-yelee Dakora**, **Innocent E. Davidson**, **Gulshan Sharma**, Conceptual Design and Analysis of Modern Space Solar Power Satellite and Rectenna Systems. In: Bauk S., Ilčev S.D. (eds) The 1st International Conference on Maritime Education and Development. Chapter 40, pages 427-436, Springer, Cham. https://doi.org/10.1007/978-3-030-64088-0_40, 25 March 2021. ISBN 978-3-030-64087-3, Online ISBN 978-3-030-64088-0.

[3] **Bheki Madonsela**, **Innocent Davidson**, Chrispin Mulangu, The Analysis of Global Navigation Satellite Systems (GNSS) and the Numerical Estimation of Multipath Propagation. In: Bauk S., Ilčev S.D. (eds) The 1st International Conference on Maritime Education and Development. Chapter 39, pages 411-425, Springer, Cham. https://doi.org/10.1007/978-3-030-64088-0_39. 25 March 2021. ISBN 978-3-030-64087-3, Online ISBN 978-3-030-64088-0.

[4] M Kumawat, N Gupta, N Jain, V Shrivastava and **Gulshan Sharma**, "Applications of Meta-heuristics in Renewable Energy Systems", Metaheuristic and Evolutionary Computation: Algorithms and Applications, Studies in Computational Intelligence, Springer, pp. 253-282, 2021.

[5] **Innocent E. Davidson** and **Rodney Reddy**, Battery Energy Storage Systems and Rooftop Solar-Photovoltaics in Electric Power Distribution Networks [Online First]. In: Energy Storage Devices. 27 Aug 2021, IntechOpen, DOI: 10.5772/intechopen.99248. Available from: https://www.intechopen.com/online-first/78294

[6] **Sanjeeth Sewchurran**, **Innocent E Davidson**, and **Elutunji Buraimoh**, Comparative Analysis of Solar PV Production in Durban to Other Cities in South Africa. In: Subramani C., Vijayakumar K., Dakyo B., Dash S.S. (eds) Proceedings of International Conference on Power Electronics and Renewable Energy Systems. Lecture Notes in Electrical Engineering, vol 795. 2022. Springer, Singapore. https://doi.org/10.1007/978-981-16-4943-1_39

[7] **Elutunji Buraimoh** and **Innocent E. Davidson**, "Modeling and Fault Ride-Through Control of a Photovoltaic-Based Grid Supporting Microgrid Using a Secondary Control DSC Algorithm". NEIS 2021 - BÜCHER - VDE VERLAG. Conference on Sustainable Energy Supply and Energy Storage Systems Hamburg, 13 – 14 September 2021. 2021, 294 Seiten, Din A4, Broschur ISBN 978-3-8007-5651-3, E-Book: ISBN 978-3-8007-5652-0, www.vde-verlag.de. E-Book Available at: https://www.vde-verlag.de/buecher/565651/neis-2021.html

DHET Accredited Journal Articles

[1] **Elutunji Buraimoh** and **Innocent Davidson**, "Fault Ride-Through Analysis of Current and Voltage Source-Models of Grid Supporting Inverter-Based Microgrid", in *IEEE Canadian Journal of Electrical and Computer Engineering*, vol. 44, no. 2, pp. 189-198, Spring 2021, doi: 10.1109/ICJECE.2020.3035036.

[2] **Adebiyi, A. A**., **Lazarus, I. J.**, Saha, A. K., and **Ojo, E. E**. Performance analysis of grid-tied photovoltaic system under varying weather condition and load. *International Journal of Electrical and Computer Engineering* (IJECE), 11(1), 94. doi:10.11591/ijece.v11i1. pp94-106

[3] **Sanjeeth Sewchurran** and **Innocent E Davidson**, "Technical and Financial Analysis of Large-Scale Solar-PV in eThekwini Municipality: Residential, Business and Bulk Customers", *Energy Reports*, Volume 7, November 2021, Pages 4961-4976. https://doi.org/10.1016/j.egyr.2021.07.134

[4] Sudeep Tanwar, Nisarg P. Patel, Smit N. Patel, Jil R. Patel, **Gulshan Sharma**, **Innocent E. Davidson**, "Deep Learning-Based Cryptocurrency Price Prediction Scheme with Inter-Dependent Relations", *IEEE Access*, Volume: 9, 2021.

[5] **Patrobers Simiyu** and **Innocent E Davidson,** "MVDC Railway Traction Power Systems; State-of-the Art, Opportunities, and Challenges", *Energies* 2021, 14, 4156. https://doi.org/10.3390/en14144156.

[6] Sudeep Tanwar, Rajesh Gupta, Mohil Mahesh Patel, Arpit Shukla, **Gulshan Sharma**, and **Innocent Davidson**, "Blockchain and AI-empowered Social Distancing Scheme to Combat COVID-19 Situations, *IEEE Access*, September 2021. DOI: 10.1109/ACCESS.2021.3114098

[7] **Akinyemi Ayodeji Stephen**, **Kabeya Musasa** and **Innocent E Davidson**, "Voltage Rise Regulation with a Grid Connected Solar Photovoltaic System", *Energies* 2021, 14, 7510. https://doi.org/10.3390/en14227510

[8] Mekhla Sharma; Jaiteg Singh, Ankur Gupta, Sudeep Tanwar, **Gulshan Sharma** and **Innocent E. Davidson**, "Intercloud Resource Discovery using Blockchain". *IEEE Access*. Nov 30, 2021. DOI: 10.1109/ACCESS.2021.3131515

[9] Adhirath Kapoor, Ankur Gupta, Rajesh Gupta, Sudeep Tanwar, **Gulshan Sharma**, and **Innocent E. Davidson**, Ransomware Detection, Avoidance, and Mitigation Scheme: A Review and Future Directions. *Sustainability*, Vol. 14, No. 1. https://doi.org/10.3390/su14010008.

[10] Pronaya Bhattacharya, Deepti Saraswat, Amit Dave, Mohak Acharya, Sudeep Tanwar, **Gulshan Sharma**, and **Innocent E. Davidson**, "Coalition of 6G and Blockchain in AR/VR Space: Challenges and Future Directions", *IEEE Access*, pp. 1-30, Online ISSN: 2169-3536, 2021, DOI: 10.1109/ACCESS.2021.3136860.

[11] **Nexhat Kapidani**, **Sanja Bauk** and **Innocent E Davidson**, "Deploying Blockchain in Maritime: Developing Environments' Concerns", *Journal of Marine Science and Engineering* – an Open Access Journal by MDPI, J. Mar. Sci. Eng. 2021, 9, 1326. https://doi.org/10.3390/jmse9121326

[12] Vishakha K Ralegankar, Jagruti Bagul, Bhaumikkumar Thakkar, Rajesh Gupta, Sudeep Tanwar, **Gulshan Sharma**, and **Innocent E. Davidson**, "Quantum Cryptography-as-a-Service for Secure UAV Communication: Applications, Challenges, and Case Study", *IEEE Access*, Vol. 10, 2022, pp. 1475-1492, Print ISSN: 2169-3536, Online ISSN: 2169-3536, DOI: 10.1109/ACCESS.2021.3138753

[13] Nihith Koundinya Sistla Pavan Venkat Sai, Vignesh Shivkumar, Narayanan Krishnan, **Gulshan Sharma**, Tomonobu Senjyu, "Voltage stability analysis of distribution systems in presence of electric vehicle charging stations with coordinated charging scheme," *International Transactions on Electrical Energy Systems* (SCI Journal), WILEY, e13248, 2021.

[14] Prasanthini Senthilkumar, Sivasankari Samidurai, Vijithra Nedunchezian, Narayanan Krishnan, **Gulshan Sharma**, Tomonobu Senjyu, "Profit maximization in hybrid microgrid system incorporating demand response and plug in EV," *International Transactions on Electrical Energy Systems* (SCI Journal), WILEY, vol. 31, no. 12, e13260, 2021.

[15] **Gulshan Sharma**, N. Krishnan, Y. Arya, and A. Panwar, "Impact of ultracapacitor and redox flow battery with JAYA optimization for frequency stabilization in linked photovoltaic-thermal system," *International Transactions on Electrical Energy Systems* (SCI Journal), WILEY, e12883, 2021.

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[19] **Elutunji Buraimoh** and **Innocent Davidson** and Fernando Martinez-Rodrigo, "Decentralized Fast Delayed Signal Cancellation Secondary Control for Low Voltage Ride-Through Application in Grid Supporting Grid Feeding Microgrid", *Frontiers in Energy Research* Vol. 9, Issue 86, 2021. DOI:10.3389/fenrg.2021.643920

Non-DHET Accredited Journal Articles

Peer-Refereed Conference Proceedings

[1] **Bheki Madonsela**, **Innocent Davidson** and Chrispin Mulangu, "The Influence of the Signal Distortions on the Satellite Based Navigation Systems". In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi: 10.1109/SAUPEC/RobMech/PRASA52254.2021.9377223

[2] **Sanjeeth Sewchurran** and **Innocent E. Davidson**, "Why Solar PV is Such a Lucrative Option for South African Municipal Customers". In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi: 10.1109/SAUPEC/RobMech/PRASA52254.2021.9377024

[3] **Vasu Chetty**, **Innocent E. Davidson** and **Gulshan Sharma**, "The Recent Trend of Increasing Fault Current Levels and Mitigation Measures". In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi: 10.1109/SAUPEC/RobMech/PRASA52254.2021.9377226

[4] Aluko, A. O., Carpanen, R. P., Dorrell, D. G., and **Ojo, E. E.**. Vulnerability Analysis of False Data Injection Attacks on the Frequency Stability of Isolated Microgrids. In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021. doi:10.1109/saupec/robmech/prasa52254.2021.9377015

[5] **Mtukushe, N. F**., and **Ojo, E. E.** The Study of Electrical Power Generation from Tidal Energy in South Africa. In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi:10.1109/saupec/robmech/prasa52254.2021.9377011

[6] **Ayar, P**., **Akinrinde, O. A.**, and **Ojo, E. E**. Investigation and mitigation of temporary overvoltage caused by harmonic filters in an oil refinery. I In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi:10.1109/saupec/robmech/prasa52254.2021.9377227

[7] Onaolapo, A. K., Pillay-Carpanen, R., Dorrell, D. G., and **Ojo, E. E**. A Comparative Evaluation of Conventional and Computational Intelligence Techniques for Forecasting Electricity Outage. In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi:10.1109/saupec/robmech/prasa52254.2021.9377243

[8] **R. K. Behara**, **E. E. Ojo** and **T. K. Akindeji**, "The Investigations of the Impacts of the Integration of Wind Energy into Distribution Network," In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, pp. 1-6, doi: 10.1109/SAUPEC/RobMech/PRASA52254.2021.9377248

[9] **Sindisiwe C. Malanda** and **Innocent E. Davidson**, "Modeling and Simulation of Radial-Grid Topology Based on Multi-Terminal VSC-HVDC System". In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi: 10.1109/SAUPEC/RobMech/PRASA52254.2021.9377016

[10] **Sanjeeth Sewchurran** and **Innocent E. Davidson**, "Financial Feasibility of Solar PV within eThekwini Municipality- Residential Customers". In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi: 10.1109/SAUPEC/RobMech/PRASA52254.2021.9377220

[11] **Sanjeeth Sewchurran** and **Innocent E. Davidson**, "Financial Feasibility of Solar PV within eThekwini Municipality - Business Customers". In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi: 10.1109/SAUPEC/RobMech/PRASA52254.2021.9377214

[12] **Nomhle Loji**, **Kabulo Loji**, Remy Tiako, **Innocent E. Davidson** and **Timothy K. Akindeji**, "Loadability Assessment of a Photovoltaic Penetrated Grid to Offset Intermittency and Reduce Total Losses using Battery Energy Storage System". In *Proceedings of 2021 Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa*, Potchefstroom, South Africa, 27-29 Jan. 2021, doi: 10.1109/SAUPEC/RobMech/PRASA52254.2021.9377026.

[13] **Ayodeji S. Akinyemi**, **Musasa Kabeya** and **Innocent E. Davidson**, "Voltage Rise with Increase in Penetration Level of a Grid Connected Renewable Distribution Generation", In *Proceedings 2021 9th International Conference and Exhibition on Clean Energy (ICCE 2021),* Ottawa, Canada, 9 – 11 August 2021.

[14] **Ojo, E. E**., **Zulu, M. L. T**., and Akinrinde, A. O. The Modelling and Simulation of Power Flow and Fault Analysis for A Hybrid DC Microgrid. In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/powerafrica52236.2021.9543441

[15] **Behara, R. K.**, **Ojo, E. E.**, and **Akindeji, T. K**. The Experimental Study on the Impacts of the Integration of DFIG Connected Wind Turbine into Distribution Grid. In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI:10.1109/powerafrica52236.2021.9543157

[16] Aluko, A. O., Carpanen, R. P., Dorrell, D. G., and **Ojo, E. E**. Real-Time Dynamic Disturbance Estimation of Stand-Alone Microgrids Based on Unknown Input Observer for Frequency Regulation. In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI:10.1109/powerafrica52236.2021.9543142

[17] Onaolapo, A. K., Carpanen, R. P., Dorrell, D. G., and **Ojo, E. E.** Forecasting Electricity Outage in KwaZulu-Natal, South Africa using Trend Projection and Artificial Neural Networks Techniques. In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI:10.1109/powerafrica52236.2021.9543182

[18] **Anyanime Umoette**, Ogbonnaya Okoro and **Innocent Davidson**, "Performance Analysis of a 10hp Three phase Induction Motor Using Classical and Finite-Elements for Varying Load Conditions". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543149

[19] Sindisiwe Malanda and Innocent Davidson, "DC Pole-to-Ground Fault Analysis in a 4-Point VSC Multi-Terminal HVDC Transmission System". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543284

[20] **Emmanuel Abunike**, Ogbonnaya Okoro and Innocent Davidson, "Design Considerations and Performance Prediction of an External Rotor 6/10 Switched Reluctance Motor for Electric Vehicle Applications". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543331

[21] **Emmanuel Abunike**, Ogbonnaya Okoro and **Innocent Davidson**, "Thermal Analysis of an Optimized Switched Reluctance Motor for Enhanced Performance". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543275.

[22] **Patrobers Simiyu** and **Innocent Davidson**, "Modeling and Simulation of MVDC Traction Power System for High-Speed Rail Transportation". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543274.

[23] Njoke L Mbanda, **Patrobers Simiyu**, Zhongqun Wu and **Innocent Davidson**, "Tracking the Progress of Universal Access to Electricity in Africa: Status quo, Challenges and Opportunities". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543355

[24] **Nicky Mbaimbai** and **Innocent Davidson**, "Feasibility of Offshore Wind Power for Namibia". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543098.

[25] **Elutunji Buraimoh** and **Innocent Davidson**, "Simplified LCL Filter State Space Modeling and Small Signal Stability Analysis of Inverter Based Microgrid". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543452

[26] **Surprise Bongani Mthiyane**, **Elutunji Buraimoh** and **Innocent. E Davidson**, "Investigation of Fault Ride Through Capabilities of DFIG and PMSG Wind System". In *Proceedings 2021 IEEE PES/IAS Power Africa Virtual Conference*, 23 – 27 August 2021. DOI: 10.1109/PowerAfrica52236.2021.9543243

[27] **Anyanime Umoette**, Ogbonnaya Okoro and **Innocent Davidson**, "Implementation of Indirect Field Oriented Control of a 2.2kW Three-Phase Induction Motor Using MATLAB Simulink". In *Proceedings* of *IEEE AFRICON 2021 Conference,* Arusha, Tanzania, 13-15 September 2021. DOI: 10.1109/AFRICON51333.2021.9570873
[28] **Chiweta Abunike**, Ogbonnaya Okoro and **Innocent Davidson**, "Finite Element Design and Multi-objective Optimization of Four Pole Reluctance Motor Based on NSGA-II Intelligent Algorithm". In *Proceedings* of *IEEE AFRICON 2021 Conference,* Arusha, Tanzania, 13-15 Sept. 2021. DOI: 10.1109/AFRICON51333.2021.9570964
[29] **Bruno Lamiscarre**, **Sibusiso Moyo**, Luis Gustavo Zelaya Cruz, **Felix Mora-Camino** and **Innocent Davidson**, "Design of last mile logistics based on a hybrid solution", XI CONGRESO INTERNACIONAL DE LOGÍSTICA APLICADA Y VI CONGRESO INTERNACIONAL DE LOGÍSTICA AERONÁUTICA", Bogota, Columbia, 21-22 October 2021. ISSN: 2539-3251.
[30] Avinash Panwar, Vinesh Agarwal and **Gulshan Sharma**, "Studies on Frequency Regulation of Hydro System via New JAYA Optimized LQR Design," In *Proceedings of the International Conference on Artificial Intelligence, Big Data, Computing and Data Communication Systems* (icABCD 2021), Durban, South Africa. 5 - 6th August 2021, pp. 1-4. DOI: 10.1109/icABCD51485.2021.9519351
[31] Anurag Gautam, Ibraheem, and **Gulshan Sharma**, "Security Margin Enhancement in Deregulated Power System Implementing TCSC," In *Proceedings of the 4th International Conference on Recent Developments in Control, Automation and Power Engineering*, Noida, India, 7 - 8th Oct. 2021, pp. 127-132. DOI: 10.1109/RDCAPE52977.2021.9633486.
[32] Avinash Panwar, Vinesh Agarwal and **Gulshan Sharma**, "Frequency Control Studies of Hydro System using AI Applications," In *Proceedings of the International Conference on Artificial Intelligence, Big Data, Computing and Data Communication Systems*, Durban, South Africa. 5 - 6th August 202, pp. 1 - 5, DOI:10.1109/icABCD51485.2021.9519369

Other Research Output: Non-Peer Reviewed Conference Proceedings

Higher Degrees Graduated

Doctor of Engineering

Gumede, Makhosonke, *BTech, MEng, Electrical Engineering*
Dissertation: The extraction of power and fresh water from the ocean off the coast of KZN utilizing ocean thermal energy conversion (OTEC) techniques (2015)
Supervisor: Prof P Naidoo and F. D`Almaine.

Buraimoh, Elutunji, *BTech (LAUTECH), MScEng (OAU), Electrical Engineering*
Dissertation: Modelling and Fault Ride-Through Control of Grid Supporting Inverter Based Micro Grid (2018)
Supervisor: **Prof IE Davidson**

Adebiyi, Abayomi, *BEng (Hons), MEng, Electrical Engineering*
Dissertation: Investigation of the Impart Photovoltaic System on the Distribution Grid (2017)
Supervisor(s): **Assoc. Professor I. Lazarus,** Assoc. Professor A. Saha and **Dr E.E. Ojo**

Master of Engineering

Leholo, Sempe, *BTech, Electrical Engineering*
Dissertation: Modelling and Optimization of Hybrid Micro-grid System for LTE Base Station. (2018)
Supervisor: Prof P A Owolawi and **Mr. K.T. Akindeji**

Sewnarain, Shikhar, *BTech, Electrical Engineering*
Dissertation: Harnessing Tidal Energy for Power Generation in South Africa. (2017)
Supervisor: Dr. C. Onunka and **Mr K.T. Akindeji**

Joshi, Milan, *BTech, Electrical Engineering*
Dissertation: Load frequency control of a hydro dominating interconnected power system. (2019)
Supervisor: Dr G Sharma and **Prof IE Davidson**

Reddy, Rodney, *BTech Electrical Engineering*
Dissertation: Network Optimization with High Penetration of Roof-top Solar-PV (2018).
Supervisor: **Prof IE Davidson**

Ndaba, Iren Sindi, *BTech Electrical Engineering*
Dissertation: A Technical and Financial Analysis of Smart Prepaid Split Meters on Eskom Electric Power Distribution (2018).
Supervisor: **Prof IE Davidson**

Malanda, Sindisiwe Cindy, *BTech, Electrical Engineering*
Dissertation: Transient Fault Analysis of a VSC-Based Multi-Terminal HVDC Scheme. (2018)
Supervisor: **Prof IE Davidson** and Dr Grain Adam.

Chetty, Nelson, *BTech, Electrical Engineering*
Dissertation: Optimal Control of Power Systems with Renewable Energy Sources. (2019)
Supervisor: **Dr G Sharma** and **Prof IE Davidson**

Masikane, Sboniso B, *BTech, Electrical Engineering*
Dissertation: Voltage stability in distribution network. (2019)
Supervisor: **Dr. G. Sharma** and **Mr. K.T. Akindeji**

Goolam, Hoosen Nadneem, *BTech Electrical Engineering*
Dissertation: Controlled Switching of 11kV Vacuum Circuit Breaker for Fault Interruption. (2018)
Supervisor: **Dr E.E. Ojo** and Prof N.M. Ijumba

Estrice, Milton, *BTech, Electrical Engineering*
Dissertation: Investigating the mitigation technique of frequency control for load stability of interconnected power system. (2019)
Supervisor: **Dr. G. Sharma** and Mr K.T. Akindeji

Zulu, Musawenkosi Lethumcebe Thanduxolo, *BTech, Electrical Engineering*
Dissertation: Power Flow and Fault Analysis of a Hybrid DC Microgrid: PV System and Wind Energy System. (2019)
Supervisor: **Dr E.E. Ojo**

Mtukushe, Namhla Faith, *BTech Electrical Engineering*
Dissertation: The analytical study on the establishment of a tidal power plant in South Africa. (2019)
Supervisor: **Dr E.E. Ojo**

Ayar, Prenushka, *BTech Electrical Engineering*
Dissertation: Investigation and Mitigation of Temporary Overvoltage caused by Filters, Correcting Harmonics Produced by Motor Drives. (2019)
Supervisor: Dr. O. Akinrinde and **Dr. E.E. Ojo**

Bahara, R.K., *BTech, Electrical Engineering*
Dissertation: Numerical and Experimental Investigations of the impacts of the integration of wind energy. (2019)
Supervisor: **Dr. E.E. Ojo** and **Mr. Timothy Akindeji**

Pillay, Caleb Jordache, *BTech, Electrical Engineering*
Dissertation: Performance and Cost Evaluation of Multi-Terminal HVAC and HVDC Transmission Systems (2020).
Supervisor: **Dr M. Kabeya** and **Prof IE Davidson**

Higher Degrees Graduated in other Institutions

Master of Engineering (2021)

Muheme Musole Innocent, BSc-Eng., Electromechanical Engineering
Dissertation: A Novel Controller Design for a Pure Battery Electric Vehicle (University of Johannesburg/ Auckland Park, 2018)
Supervisor: Prof Nwulu Nnamdi and **Dr M Kabeya**

Higher Degrees under Examination

Doctor of Philosophy (UKZN)

Akindeji, Kayode Timothy, *BScEng, MScEng Electrical Engineering*
Dissertation: Performance and Cost Benefit Analysis of University Campus Microgrid
Supervisors: Dr Remy Tiako and **Professor IE Davidson**

Master of Engineering

Loji, Nomhle, *BTech, Electrical Engineering*
Dissertation: Evaluation of grid-scale battery energy storage system as an enabler of large-scale renewable energy integration (2017)
Supervisor: **Prof IE Davidson** and **Mr. K.T. Akindeji**

Mbaimbai, Nicky Kamwi, *BTech, Electrical Engineering*
Dissertation: Design and integration of African Power Grids into a Smart African Super-Grid. (2020)
Supervisor: **Prof IE Davidson**

Higher Degrees under Supervision

Doctor of Engineering

Dakora, Jonas Don-Yelee, *BTech (CPUT), MEng (DUT) Electrical Engineering*
Dissertation: Analysis of Modern Space Solar Power Satellite Systems and Space Rectenna. (2019)
Supervisors: **Professor IE Davidson** and Dr C. Mulangu

Akinyemi, Ayodeji Stephen, *OND, HND, PGD, MSc (UCT) Electrical Engineering*
Dissertation: Voltage rise mitigation at the Point of Common Coupling (PCC) of Large Renewable Distributed Generation (RDG) and Distribution Network. (2019)
Supervisor(s): **Dr M. Kabeya** and **Prof IE Davidson**

Madonsela, Bhekinkosi, *BTech MEng (DUT) Electrical Engineering*
Dissertation: Evaluating the Communications, Navigation and DSurveillnce (CNS) Capabilities for the Future Air Traffic Controlling Systems (2020)
Supervisor: **Prof IE Davidson** and Dr C. Mulangu.

Rampith, Viren, *BTech, MTech, Electrical Engineering*
Dissertation: A Smart Grid for a Smart City: Technical and Financial Analysis of a Sustainable eThekwini Municipality. (2020)
Supervisor: **Prof IE Davidson**

Chetty, Vasudevan, *BTech, MScEng, Electrical Engineering*
Dissertation: Planning a Smart High Voltage Power System to enabling a Smart City. (2020)
Supervisor: **Prof IE Davidson** and **Dr G Sharma**

Kapidani, Nexhat, *BEng, MPhil, Electrical and Electronic Engineering*
Dissertation: Intelligent use of maritime info-communication systems in developing environments. (2020)
Supervisor: Prof S. Bauk, Prof DS Ilcev and **Prof IE Davidson**

Gwatidzo, Ngoni, *BTech, MEng, Electrical Engineering*
Dissertation: Grid Stability with High Level of RE Penetration and Fault Ride Through Capability of Inverter. (2020)
Supervisor: **Prof IE Davidson**

Master of Engineering

Nampoya, Crispin, *BTech, Electrical Engineering*
Dissertation: Performance analysis of industrial traction drive systems. (2018)
Supervisor: **Prof IE Davidson**

Mazibuko, Ntombenhle, *BTech, Electrical Engineering*
Dissertation: Modeling and Performance Analysis of Artifical Intelligence Controllers for the Automatic Voltage Regulator of Power Systems (2018)
Supervisor: **Dr G Sharma**

Shezi, Siphesihle Brian, *BTech Electrical Engineering*
Dissertation: The study of the upgrade and improvement of power electronics protection system for locomotives. (2019)
Supervisor: **Dr E.E. Ojo**

Moma, Christophe, *BTech Electrical Engineering*
Dissertation: Modern power electronic technology for the grid integration of renewable energy sources. (2019)
Supervisor: **Dr M. Kabeya** and **Prof IE Davidson**

Hlatshwayo, Ntokozo Victor, *BTech, Electrical Engineering*
Dissertation: Distributed Hybrid Supercapacitor Network in 48V DC Microgrid. (2020)
Supervisor: **Prof IE Davidson** and **Mr. Rathilall Sewsunker**.

Nguefack, Louis, *BTech, Electrical Engineering*
Dissertation: Power Quality Enhancement Using DSTATCOM on Grid-tied Photovoltaic System. (2020)
Supervisor: **Prof IE Davidson** and **Dr A. Adebiyi**

Ntombela, Mlungisi Eric, *BTech Electrical Engineering*
Dissertation: Algorithm for power losses and efficiency evaluation for power distribution systems. (2020)
Supervisor: **Dr M. Kabeya**

Nel, Jacques j, *BTech Electrical Engineering*
Dissertation: Designing off-grid hybrid renewable power generation system for rural electrification. (2020)
Supervisor: **Dr E.E. Ojo** and **Mr C. Leoaneka**

Khumalo, Simanga Wonder, *BTech Electrical Engineering*
Dissertation: Investigating the impact of induction motor starting techniques on power quality. (2020)
Supervisor: **Dr M. Kabeya** and Dr B. Rigby

Buthelezi, Kwanele M, *BTech Electrical Engineering*
Dissertation: Analysis of Fault Location Algorithms in Transmission Grid Lines. (2020)
Supervisor: **Dr M. Kabeya** and Dr B Rigby

Magenuka, Kenneth Thand'uxolo K, *BTech Electrical Engineering*
Dissertation: Kernel estimation modelling and optimization of hybrid power system for a typical South African rural area (2020).
Supervisor: **Dr M. Kabeya** and **Mr K.T. Akindeji**

Ndlela, Nomihla W, *BTech, Electrical Engineering*
Dissertation: Design and integration of African Power Grids into a Smart African Super-Grid. (2020)
Supervisor: **Prof IE Davidson**

Ntlela, Sinmphiwe A, *BTech, Electrical Engineering*
Dissertation: Solar Energy-Battery Storage Optimization for Satellite-to-Ground Communication. (2020)
Supervisor: **Prof IE Davidson** and Dr C Mulangu

Mthiyane, Surprise Bongani, *BTech, Electrical Engineering*
Dissertation: Fault Ride Through Capability Assessment and Improvement of PMSG Wind Turbine Using Fuzzy Logic Control (2020).
Supervisor: **Prof IE Davidson** and **Dr E. Buraimoh**

Mhlongo, Phumelele Bridgett, *BTech, Electrical Engineering*
Dissertation: Droop Control Technique for Embedded Distribution Generator in Smart Grid Applications (2020).
Supervisor: **Dr M. Kabeya** and **Dr E. Buraimoh**

Muland, Steve Musans, *BTech, Computer System Engineering*
Dissertation: Optimal power sharing in a DC microgrid. (2020)
Supervisor: **Dr N. Pillay, Prof IE Davidson** and **Mr. Rathilall Sewsunker.**

Jiyane, Muziwenkosi, *BTech, Electrical Engineering*
Dissertation: Standalone DC microgrid energy optimization. (2020)
Supervisor: **Prof IE Davidson** and **Mr. Rathilall Sewsunker.**

Simanga Wonder Khumalo, *BTech, Electrical Engineering*
Dissertation: Impact of Induction Motor Starting Techniques on Power Quality: Performance Analysis and Model Development. (2020)
Supervisor: **Dr M Kabeya**

Madikizela Andile, *BTech, Electrical Engineering*
Dissertation: Soil Seasonal Corrective Factor for Optimal Substation Earth Grid Design in Eastern Cape (2019)
Supervisor: **Dr M Kabeya**

Thand'Ukolo Kenneth Madgenuka, *BTech, Electrical Engineering*
Dissertation: Kernel Estimation Modelling and Optimization of Hybrid Power System for a typical South African Rural Area (2019)
Supervisor: **Dr M Kabeya**

Kwanele Mthokozisi Buthelezi, *BTech, Electrical Engineering*
Dissertation: Fault Location Algorithms for Transmission Systems (2020)
Supervisor: **Dr M Kabeya**

Phumelelel B Mhlongo, *BTech, Electrical Engineering*
Dissertation: Modelling and Comparative Study of Droop and Virtual Synchronous Generator Techniques for Grid Forming Applications in Low Inertia Micro-grids. (2020)
Supervisor: **Dr M Kabeya**

Mlungisi Eric Ntombela, *BTech, Electrical Engineering*
Dissertation: Power loss minimization and voltage profile improvement in the distribution network using new network reconfiguration algorithm. (2020)
Supervisor: **Dr M Kabeya**

David Rapuleng Sehloho, *BTech, Electrical Engineering*
Dissertation: The Effects of Switching Transients on High Voltage Capacitor Bank Cans, for Different Capacitor Banks Configurations-Eskom Transmission Cases Studies. (2021)
Supervisor: **Dr M Kabeya**

Dlamini Themba, *BTech, Electrical Engineering*
Dissertation: Optimization analysis on the energy saving control for Sappi Tugena Mill Company with modern engineering algorithms
Supervisor: **Dr M Kabeya**

Welcome K Ntuli, *BTech, Electrical Engineering*
Dissertation: Development of control strategies for grid connected wind generator. (2021)
Supervisor: **Dr G Sharma** and **Dr M Kabeya**

Mohammed Ozayr Abdul Kader
Dissertation: Coordinated control of conventional power sources and PHEVs for a renewable power system
Supervisor: **Mr Timothy Akindeji**

Ntombenhle Mazibuko, *BTech, Electrical Engineering*
Dissertation: Modelling and performance analysis of AI based controllers for AVR of a power system
Supervisor: **Mr. Timothy Akindeji** and **Dr Gulshan Sharma.**

Nokuzola Mdluli, *BTech, Electrical Engineering*
Dissertation: Development of short-term solar radiation forecasting using artificial intelligence techniques
Supervisor: **Mr. Timothy Akindeji**

New Qualifications Obtained and Skills Training Programs

Qualification

[1] Vusani Nemudzivhadi, "Design Thinking Course", 2021
[2] Namhla F. Mtukushe, "The analytical and experimental study on the establishment of a tidal power plant in South Africa", Master of Engineering, Durban University of Technology, 2021.
[3] Abayomi Adebiyi, "Optimization of distribution static compensator for mitigation of power quality issues in grid-tied photovoltaic systems", Doctor of Engineering (DEng), Durban University of Technology, 2021.
[4] Timothy Akindeji, "Training on LV/MV Electrical Reticulation & Systems Protection" (2 Day CPD Course), 2021.

Industry Secondment and Skills Training

[1] Vusani Nemudzivhadi "Royal Academy of Engineering (RAEng)", Industry Secondment, 3 Months Industrial Experience
[2] Ntombi Mazibuko "Royal Academy of Engineering (RAEng)", Industry Secondment, 3 Months Industrial Experience
[3] Dr Elutunji Buraimoh "Royal Academy of Engineering (RAEng)", Industry Secondment, 3 Months Industrial Experience

Community Service Activities

Keynote Address, Tutorial and Invited Presentations

[1] Rodney Stops, "Unfurling Post School Education and Training (UPSET)", Co-constructing Articulation Implementation Plans Conference. 25th August 2021.
[2] Innocent E. Davidson, "Activities at the Durban University of Technology: Design and Implementation of a 10kW Solar-PV Grid-tie Inverter System and Battery Energy Storage", In, HEPSSA Project: Enhancing the Role of Engineers in Translational Research and Entrepreneurship", Final Knowledge Sharing Workshop, Jose Eduardo Dos Santos Campus, Ongwediva, Namibia. 2 – 3rd December 2021.
[3] Vusani Nemudzivhadi, "Operation and Monitoring of a 10kW Solar-PV Hybrid Systems for EPE at DUT", In, HEPSSA Project: Enhancing the Role of Engineers in Translational Research and Entrepreneurship", Final Knowledge Sharing Workshop, Jose Eduardo Dos Santos Campus, Ongwediva, Namibia. 2 – 3rd December 2021.
[4] Elutunji Buraimoh, "Design and Testing of Inverter and Battery Storage 10kW Solar-Hybrid System", In, HEPSSA Project: Enhancing the Role of Engineers in Translational Research and Entrepreneurship", Final Knowledge Sharing Workshop, Jose Eduardo Dos Santos Campus, Ongwediva, Namibia. 2 – 3rd December 2021.

[5] Ntombenhle Mazibuko, "Design and Installation of a Solar-PV System for a 10kW Solar-Hybrid System at EPE Department, DUT", In, HEPSSA Project: Enhancing the Role of Engineers in Translational Research and Entrepreneurship", Final Knowledge Sharing Workshop, Jose Eduardo Dos Santos Campus, Ongwediva, Namibia. 2 – 3rd December 2021.

[6] Innocent E. Davidson, "Durban University of Technology Space Research Program - Global Network of Satellite Systems Research and Applications", Workshop on "BDS/GNSS Applications in China and South Africa", Science Forum South Africa 2021, 1-3 December 2021.

[7] Innocent E. Davidson, "Smart Infrastructures for Sustainable Cities", Invited Guest Lecture at the "International Conference on Sustainable Development", Zimbali Capital, Ballito, KZN, South Africa, 7 – 9 December 2021.

Conferences / Symposium / Workshop - Host/Organiser, Reviewer and Attended

[1] Conference/Workshop/Symposium Host/Organizer: **Professor IE Davidson**

- 30th Southern African Universities Power Engineering Conference (SAUPEC2022), Durban, 25-27 January 2022
- 1st Space Science and CNS Symposium, Hotel School, Durban, 25 Oct 2021.
- Research and Collaboration – Eskom Distribution and Smart Grid Research Centre, DUT, 13 September 2022.
- 1st RAEng Industry Guest Lecture, "Drivers, Opportunities and Challenges of Solar PV Projects within Municipalities in South Africa", Presenter: Dr Sanjeeth Sewchurran, Virtual Presentation, 2nd Nov 2021.
- 2nd RAEng Industry Guest Lecture, "CHP and an oversight into SA's Energy transition", Presenter: Mr Denzil Moodley, Virtual Presentation, 9th Nov 2021.
- DUT EPE Postgraduate Seminars.

[2] Conference Technical Chair: **Dr M Kabeya**

- 30th Southern African Universities Power Engineering Conference (SAUPEC2022), Durban, 25-27 January 2022

[3] Conference Publications Chair: **Dr E. Buraimoh**

- 30th Southern African Universities Power Engineering Conference (SAUPEC2022), Durban, 25-27 January 2022

[4] Conference Reviewer: **Professor IE Davidson**

- 2021 IEEE PES/IAS Power Africa Virtual Conference, 23 – 27 August 2021.
- 2021 IEEE PES/IAS Power Africa Virtual Conference, 23 – 27 August 2021.

[5] Conference Reviewer: **Dr AA. Adebiyi**

- 30th Southern African Universities Power Engineering Conference (SAUPEC2022), Durban, 25-27 January 2022
- 2021 IEEE PES/IAS Power Africa Virtual Conference, 23 – 27 August 2021.

[6] Conference Reviewer: **Dr E.E. Ojo**

- 30th Southern African Universities Power Engineering Conference (SAUPEC2022), Durban, 25-27 January 2022

[7] Conference Reviewer: **Mr. K T Akindeji**

- Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa, Potchefstroom, South Africa, 27-29 Jan. 2021.
- 2021 IEEE PES/IAS Power Africa Virtual Conference, 23 – 27 August 2021.

[8] Conference Reviewer: **Dr M. Kabeya**

- 30th Southern African Universities Power Engineering Conference (SAUPEC2022), Durban, 25-27 January 2022
- Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa, Potchefstroom, South Africa, 27-29 Jan. 2021.
- IEEE PES/IAS Power Africa Virtual Conference, 23 – 27 August 2021.

[9] Conferences, Symposium and Workshops Attended: **Mr V. Nemudzivhadi**

- 30th Southern African Universities Power Engineering Conference (SAUPEC2022), Durban, 25-27 January 2022
- 1st Space Science and CNS Symposium, 25 Oct 2021
- Inaugural Lecture of Professor Oluwatosin Ademola Ijabadeniyi, 2021/11/17- 2021/12/03
- Wellness Training for Managers, 2021/11/30
- SURE Colloquium - DUT 2021, 2021/11/16
- RAEng Presentation Meeting, 2021/11/09
- Transforming our Heritage Webinar, 2021/10/22
- Innobiz DUT Centre for Entrepreneurship Launch, 2021/11/05
- Relax, Release and Rejuvenate with Yoga Session, 2021/10/13
- DUT Research Outputs Submissions. Unpacking The DHET Research Outputs Policy, 2021/10/05
- Decolonisation of Writing Centre Spaces Webinar, 2021/10/04
- SARMS PILOT STUDY-Testing Team, 2021/09/15
- Eskom visit to DUT (EPE), 2021/09/13
- GAP Competition 2021 Business Basics Training, 2021/09/02
- Enhancing You Coping Strategies in a Time of Crisis, 2021/08/17
- THE IMPORTANCE & EFFECTIVENESS OF THE COVID-19 VACCINES
- Research Integrity and Responsible Conduct of Research Workshop, 9 July 2021
- SURE WEBINAR_V
- Youth Day Commemoration
- 1st RAEng Industry Guest Lecture, "Drivers, Opportunities and Challenges of Solar PV Projects within Municipalities in South Africa", Presenter: Dr Sanjeeth Sewchurran, Virtual Presentation, 2nd Nov 2021.
- 2nd RAEng Industry Guest Lecture, "CHP and an oversight into SA's Energy transition", Presenter: Mr Denzil Moodley, Virtual Presentation, 9th Nov 2021.
- Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa, Potchefstroom, South Africa, 27-29 Jan. 2021
- DUT EPE Postgraduate Seminars

[10] Conferences, Symposium and Workshops Attended: **Prof IE Davidson**

- Rethinking Employee Wellness, 30 November 2021

[11] Conferences, Symposium and Workshops Attended: **Mr Sipho Lafleni**

- 1st RAEng Industry Guest Lecture, "Drivers, Opportunities and Challenges of Solar PV Projects within Municipalities in South Africa", Presenter: Dr Sanjeeth Sewchurran, Virtual Presentation, 2nd Nov 2021.
- 1st Space Science and CNS Symposium, Hotel School, Durban, 25 Oct 2021.
- Research and Collaboration – Eskom Distribution and Smart Grid Research Centre, DUT, 13 September 2022.
- DUT "Entrepreneurship and innovation day 2021" invited by Professor Bhekisipho Twala, Executive Dean, FEBE.
- DUT EPE Postgraduate Seminars

[12] Conferences, Symposium and Workshops Attended: **Ms Ntombenhle Mazibuko**

- 1st RAEng Industry Guest Lecture, "Drivers, Opportunities and Challenges of Solar PV Projects within Municipalities in South Africa", Presenter: Dr Sanjeeth Sewchurran, Virtual Presentation, 2nd Nov 2021.
- 2nd RAEng Industry Guest Lecture, "CHP and an oversight into SA's Energy transition", Presenter: Mr Denzil Moodley, Virtual Presentation, 9th Nov 2021.
- 1st Space Science and CNS Symposium, Hotel School, Durban, 25 Oct 2021.
- Research and Collaboration – Eskom Distribution and Smart Grid Research Centre, DUT, 13 September 2022.
- DUT EPE Postgraduate Seminars

[13] Conferences, Symposium and Workshops Attended: **Ms Ntombenhle Mazibuko**

- Southern African Universities Power Engineering Conference/Robotics and Mechatronics/Pattern Recognition Association of South Africa, Potchefstroom, South Africa, 27-29 Jan. 2021

Community Outreach

[14] DUT Research Day (2021): **Mr Dwayne Reddy**
[15] South African Technology (2021): **Mr Dwayne Reddy**

Community Service (Journal Article Reviewer)

[16] Journal Reviewer: **Professor IE Davidson**

- Electric Power Systems Research Journal
- International Journal of Electrical Power and Energy Systems
- International Journal of Engineering Research in Africa (JERA)
- Frontiers in Energy
- International Journal of Renewable Energy Research (IJRER)

[17] Journal Reviewer: **Dr M. Kabeya**

- International Journal of Electrical Power and Energy Systems.
- IEEE Transactions on Neural Networks and Learning Systems
- International Transactions on Electrical Energy Systems
- Iranian Journal of Science and Technology, Transactions of Electrical Engineering (ISTE)

- Journal of Energy Storage
- Renewable Energy Journal
- Electric Power Systems Research (EPSR)

[18] Journal Reviewer: **Dr G. Sharma**
- Journal of Energy Research (Wiley), Int. journal of Engineering Research in Africa, Int.

[19] Journal Reviewer: **Mr. Timothy Akindeji**
- International Journal of Renewable Energy Research (IJRER)
- Journal of Emerging and Selected Topics in Power Electronics (JESTPE)
- Sustainable Energy Technologies and Assessments (SETA)

Community Service (External Programs / Thesis Examiner / Moderator)

[20] External Examiner: **Professor IE Davidson**.
- MSc Dissertation: University of Cape Town.
- PhD, Dissertation: University of Pretoria.

[21] External Examiner: **Dr M Kabeya**.
- MEng Dissertation: University of Johannesburg.
- MEng Dissertation: Central University of Technology.

[22] External Moderator: **Dr M Kabeya**.
- National Diploma, Mangosuthu University of Technology (MUT)

Community Project Executed

[23] Design and Installation of a 10kW Solar-PV Grid-tie Inverter System with Battery Energy Storage Unit.
Prof IE Davidson
Dr Elutunji Buraimoh
Ms Ntombenhle Mazibuko
Mr Vusani Nemudzivhadi

Curriculum Development

[24] BEng Tech (Honours) Program Development: **Mr Dwayne Reddy**
- ECSA Endorsement, SAQA, POQM, HEQC Online
- Program Overview Documents for Approval.

Capacity Enhancement

[1] Dr Elutunji Buraimoh was appointed as a Post-Doctoral Researcher at the DUT Smart Grid Research Centre, under the supervision of Prof IE Davidson. He conducted his doctoral research with Smart Grids Laboratory, Durban University of Technology, and DEEPER Research Group, University of Valladolid, Spain. He was an International PhD Exchange Researcher at the University of Valladolid, Spain, from February 2019 to July 2019, under the Erasmus+ KA107 Project. He was a recipient of the Best Paper Award (third place) at the Clemson University Power Systems Conference, Clemson, SC, USA, held on March 10–13, 2020. He holds a Doctor of Engineering [D.Eng.], Electrical Engineering, Durban University of Technology, South Africa, 2021; Master of Science in Engineering in Electronic, and Electrical Engineering, Obafemi Awolowo University, Nigeria, 2016; and a Bachelor of Technology Honours, Second Class Upper, Electronic and Electrical Engineering, Ladoke Akintola University of Technology, Nigeria, 2012. He is a Registered Engineer, Council for the Regulation of Engineering in Nigeria, 2017; Corporate Member, Nigerian Society of Engineers, 2017; Member, Institute of Electrical and Electronics Engineers, 2018; Candidate Engineering Technologist, Engineering Council of South Africa, 2020; and Graduate Member, Project Management Professional Institute, 2013. His research interests are in Renewable Energy: Microgrids and Microgrid Design, Inverter-Based Microgrids, Control of Power Converters in AC Microgrids, Photovoltaic System, Grid Codes and Regulation, Fault Ride-Through and Grid Integration of Renewable Energy Sources; Grid Synchronization: Phase Locked Loop, Delayed Signal Cancellation Algorithm, Sag/Swell Detection, and Symmetrical Components Extraction. Power Systems and Control: Power System Reliability Analysis, Power System Security and Contingency Analysis, Flexible Alternating Current Transmission Systems and Control, Economic Load Dispatch with Artificial Intelligence.

[2] Dr Emmanuel Mukubwa was appointed as a Post-Doctoral Researcher at the DUT Space Science Research Centre, under the supervision of Prof IE Davidson. He has over 10 years of experience in the field of telecommunication, controls, computer and electronics, seeking to contribute to the formulation of new ideas in electronics and telecommunication engineering, research on practical communication engineering problems of the times facing the industrial sector with the view of providing solutions. He holds a Doctor of Engineering in Electronic Engineering, 2021, in the area of massive MIMO systems; Master of Technology in Telecommunications, Tshwane University of Technology, and /Master of Science in Electronic engineering from Ecole Superieure d'Ingenieurs en Electrotechnique et Electronique (ESSIE); and a Bachelor of Technology in Electrical and communication Engineering, 2002, Moi University, Kenya.

Research Grants

[1] UCDG Grant Qualifications Completion Grant: **Mr Rodney Stops**, R55 000.
[2] Principal Investigator/Research Leader: **Prof IE Davidson**: DSI-DUT Space Science Program: (Research Proposal: Communications and Navigation Systems (CNS) – Space Science Research) Department of Science and Innovation, Space Science Research Grant: R3 204 750.00.
[3] Co-Investigator: **Prof IE Davidson**: Royal Academy of Engineering, United Kingdom (Research Proposal: Enhancing the Role of Engineers in Translational Research and Entrepreneurship, 2020-2021): Grant Amount: £200 000.00.
[4] DUT Research Productivity Rewards and Outputs (2019): **Dr M Kabeya**, R16 319.82
[5] DUT Research Productivity Rewards and Outputs (2019): **Mr Timothy Akindeji**, R63 795,69
[6] DUT Research Productivity Rewards and Outputs (2019): **Prof IE Davidson**, R267 298,93
[7] DUT Research Productivity Rewards and Outputs (2019): **Dr Gulshan Sharma**, R162 000
[8] Principal Investigator: **Mr. Dwayne Reddy**: NRF Thuthuka Grant: R115 000 (2021); R95 000 (2022), and R95 000 (2023); for the project: "Effects of Ion Doping on the Electron Transfer Layer of Perovskite Solar Cells".
[9] Principal Investigator: **Dr Musasa Kabeya**: NRF Thuthuka Grant: R300 000 (2021); R300 000 (2022), and R300 000 (2023); for the project: "Modern Power Electronics Technology for Grid Integration of Renewable Energy Sources".
[10] Research Leader: **Prof IE Davidson**: Smart Grid Research Focus Area (RFA) Award for 2021: R300 000.

[11] Project Leader: **Prof IE Davidson**: Space Science Research Focus Area (RFA) Award for 2021: R180 000.
[12] Principal Investigator: **Dr Gulshan Sharma**, "Development of frequency stabilization strategies for integration of renewable technologies such as hydro power, PV & wind power into the modern power system", ESKOM Tertiary Education Support Program. Award for 2021: R50 000.
[13] **Dr Gulshan Sharma**, Incentive funding for rated researcher from National Research Foundation, South Africa. Award: R50 000.
[14] Principal Investigator: **Dr Gulshan Sharma**, "Development of frequency stabilization strategies for integration of renewable technologies such as hydro power, PV & wind power into the modern power system", ESKOM Tertiary Education Support Program. Award for 2021: R50 000.
[15] Principal Investigator: **Mr Timothy Akindeji**, "Application of Microgrid Concept with Renewable Energy Source for Rural Electrification.", ESKOM Tertiary Education Support Program. Award for 2021: R90 000.
[16] Principal Investigator: **Prof IE Davidson**, "HVDC Studies", ESKOM Tertiary Education Support Program. Award for 2021: R70 000.
[17] Principal Investigator: **Prof IE Davidson**, "Smart Grids", ESKOM Tertiary Education Support Program. Award for 2021: R70 000.
[18] Principal Investigator: **Prof IE Davidson**, "Power System Simulation Studies", ESKOM Tertiary Education Support Program. Award for 2021: R70 000.

Honours, Awards and Recognitions

[1] **2021: Durban University of Technology Top Impact Author Award**:
Prof IE Davidson was Recipient of the "*Top Impact Author Award*" at the Durban University of Technology's Annual Research & Innovation Awards, Virtual Meeting, November 2020. Prize Money: R10 000.00

[2] **2021: Durban University of Technology Field Weighted Citation Impact (FWCI) Award**:
Dr Elutunji Buraimoh was Recipient of the "*Field Weighted Citation Impact (FWCI) Award*" at the Durban University of Technology's Annual Research & Innovation Awards, Virtual Meeting, November 2020. Prize Money: R10 000.00

[3] **2021: Published News Articles**:
"DUT is Gearing to Host the Next SAUPEC/ROBMECH/PRASA Conference". This IEEE conference will be hosted by DUT's Department of Electrical Power Engineering, under the General Chair, Prof Innocent E Davidson, in conjunction with the South African Institute of Electrical Engineers (SAIEE) and other industries and partners. https://www.dut.ac.za/dut-is-gearing-up-to-host-the-next-saupecrobmechprasa-conference/

[4] **2021: Department of Electrical Power Engineering – Excellence in Technical Services Award**: Mr Vusani Nemudzivhadi, November 2021.