

Manuja Gunawardana

PH.D. IN ELECTRICAL AND COMPUTER ENGINEERING

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Education

University of Manitoba

Canada

PH.D. IN ELECTRICAL AND COMPUTER ENGINEERING

Jan 2019 - Oct 2022

- Thesis: "Scattering-Theory-Based Methodology for Electromagnetic Transient Analysis of Nonuniform Frequency-Dependent Transmission Line Structures"
- Advisor: Prof. Behzad Kordi
- Courses: Distributed Energy Generation, Power System Transient Simulation, Power System Protection, Electromagnetic Compatibility of Power Systems
- GPA: 4.38/4.5

University of Manitoba

Canada

M.SC. IN ELECTRICAL AND COMPUTER ENGINEERING

Jan 2017 - Dec 2019

- Thesis: "Enhancement of transmission line theory for finite-length non-uniform transmission lines using scattering theory"
- Advisor: Prof. Behzad Kordi
- Courses: HVDC Transmission, Advanced High Voltage Engineering, Advanced Transmission Line Theory, Probabilistic Methods in Signal Analysis and Machine Learning
- GPA: 4.38/4.5

University of Moratuwa

Sri Lanka

B.SC (HONS) IN ELECTRICAL ENGINEERING

Oct 2011 - Apr 2016

- FYP: "A Low Cost Partial Discharge Measuring System for a High Voltage Laboratory"
- Major Courses: Renewable Energy, High Voltage Engineering, Electrical Machines and Drives, Power Systems, Installations, Control Systems, Analog and Digital Electronics
- GPA: 3.76/4.2 (First Class)

Research Experience

University of Moratuwa

Sri Lanka

PRINCIPAL INVESTIGATOR

Jan. 2022 - Present

- Adaptive switching based control mechanism for mitigating frequency oscillations due to large load drops in renewable rich, low inertia systems:
 - A methodology to provide inertia support during sudden frequency variations due to disturbances using grid connected solar PV farms.
- Artificial intelligence assisted traveling wave based fault location and classification technique for distribution networks with high renewable penetration:
 - A methodology to overcome difficulties in setting protection for renewable rich systems due to intermittency
 - An artificial intelligent model utilizing features of phase currents and zero sequence current component has been implemented for fault classification.
- Estimating the resistance of outdoor distribution substation grounding in homogeneous soil using finite element method and neural network:
 - A potential solution for the absence of analytical formulae for complex grounding electrode structures.
 - An artificial intelligent model trained using finite element simulations and verified using real measurements is presented.
- Detection and localization of partial discharge in a transformer winding using machine learning:
 - A potential solution for early fault localization in power transformers and avoiding catastrophic failures.
 - An artificial intelligent model trained using electromagnetic transient (EMT) simulations is utilized as the classifier.

- Time-domain electromagnetic transient (EMT) model for frequency-dependent nonuniform overhead and buried structures:
 - A theoretical approach to model crosstalk/interference in power transmission lines in the presence of nonuniformities such as cross-ings and sharp bends that are common in modern power networks, especially in the vicinity of grid substations.
 - Implementation of the proposed theoretical model as a circuit component in PSCAD/EMTDC using a finite-difference time-domain (FDTD) technique and verification of accuracy by comparison with full-wave simulations and measurement data.
- Parallel computing algorithms for finite-difference time-domain (FDTD) techniques:
 - FDTD based transmission line models involve more computations per time-step compared to conventional models and thus require longer execution times.
 - Development and performance analysis of parallel computing algorithms based on CPU and GPU architectures to distribute the computational load of FDTD problems among multiple processors, thus allowing faster execution.
- Time-domain coupling model of external fields to nonuniform overhead wire structures:
 - A field-to-line coupling model for nonuniform transmission lines to incorporate the effect of external electromagnetic fields such as those from nearby lightning strikes.
 - Investigation of the transient behaviour of overhead wire structures due to nearby lightning strikes in the presence of frequency-dependent ground and the contribution of nonuniformities in intensifying/lessening transients created by lightning fields to facilitate optimization of protection schemes.
- Time-domain circuit model for the analysis of internal transients in power transformers:
 - An axial multi-conductor transmission line model suitable for cylindrical windings with the capability of creating internal short circuit faults at arbitrary locations inside the winding.
 - An ongoing research in collaboration with University of Trieste, Italy to develop a computer model to determine the location of internal faults when measurement data at the terminals of a winding is available.
- Time-domain circuit model for the analysis of internal transients in power transformers:
 - An axial multi-conductor transmission line model suitable for cylindrical windings with the capability of creating internal short circuit faults at arbitrary locations inside the winding.
 - An ongoing research in collaboration with University of Trieste, Italy to develop a computer model to determine the location of internal faults when measurement data at the terminals of a winding is available.

Consultancies

- 2025 **Renewable Energy Integration, Sri Lanka**
 - Dynamic Response Testing - Dolahena (10 MW), Matale(10MW), Trincomalee(10 MW), Ethimale (108MW)
- 2025 **Public Utilities Commission, Sri Lanka**
 - Study on Energy Poverty among Households and SMEs in Sri Lanka
- 2024 **Asian Development Bank, Sri Lanka Mission**
 - Development of a micro-grid for the yala hotel cluster
- 2024 **Asian Development Bank, Sri Lanka Mission**
 - Artificial Intelligence-Powered Microgrids to Enable a Futuristic and Reliable Distributed Renewable Energy System. In collaboration with Lanka Electricity Company, and universities of Peradeniya, Ruhuna and Jaffna
- 2023 **Ceylon Petroleum Corporation, Head Quarters, Colombo**
 - Safety evaluation of the lightning protection system
- 2023 **LTL Transformers, Transformer Manufacturing Plant, Angulana**
 - Safety Verification of the low voltage and high voltage installation of the HV testing facility

Internships

LTL Transformers (PVT) LTD

Sri Lanka

UNDERGRADUATE INDUSTRIAL TRAINING PROGRAMME

Jan 2015 - Apr 2015

- Gained knowledge and experience about the designing, manufacturing and testing procedure of transformers for distribution networks.

Ceylon Electricity Board

Sri Lanka

UNDERGRADUATE INDUSTRIAL TRAINING PROGRAMME

Oct 2014 - Jan 2015

- Has been trained as a trainee engineer at Generation, Transmission, System Controlling and Planning sections of Ceylon Electricity Board and in the distribution network belonging to Lanka Electricity Company.

Teaching Experience

2022 -
Present

Senior Lecturer, University of Moratuwa,

- Lecturer and examiner of undergraduate modules Power Systems I and II, Circuits and Fields, High Voltage Engineering I and II.
- Lecturer and examiner of M.Sc. modules Lightning Protection and Earthing, Advanced Engineering Mathematics.
- Coordinator of Micro-grid Research Laboratory.
- Industrial Training Coordinator.

2019 - 2022

Teaching Assistant, University of Manitoba, Foundations of Electromagnetics (Fall)

- Assessment of student submissions and supervision of lab sessions.
- Have designed 3 new simulation lab sessions based on COMSOL-Multiphysics (Full-wave electromagnetic solver based on finite- element method).

2021

Teaching Assistant, University of Manitoba, High Voltage Engineering (Winter)

- Assessment of student submissions and supervision of lab sessions.
- Have designed a new simulation lab sessions based on COMSOL-Multiphysics.

2016

Temporary Lecturer, University of Moratuwa,

- Have assisted and conducted tutorials for undergraduate students.
- Have designed a lab session for final year undergraduate students using a PD detection system developed during my final year project.

Project Supervision

2025

An automated software tool for optimized design of external lightning protection systems,

- Final Year Undergraduate Research Project, University of Moratuwa.

2024

Online partial discharge detection and localization of a transformer winding using machine learning,

- Final Year Undergraduate Research Project, University of Moratuwa.

2023

Travelling wave-based fault locator for distribution networks with high renewable penetration,

- Final Year Undergraduate Research Project, University of Moratuwa.

2023

An automated tool to determine the optimum settings for Marx impulse generator,

- Final Year Undergraduate Research Project, University of Moratuwa.

2022

Effect of contact angle of water droplets on the e-field distribution of polymer insulators,

- Final Year Undergraduate Research Project, University of Moratuwa.

Research Student Supervision

2023, 2024

Binula Gunawardana, Research Scholar, University of Moratuwa

- Adaptive switching based control mechanism for mitigating frequency oscillations due to large load drops in low inertia system

2022

N. W. N. J. Nanayakkara, M.Sc. Research Student, University of Moratuwa

- Detection of Distribution Transformer Ratings Using Sweep Frequency Analysis and Artificial Neural Network

2022

D. S. P. Kumara, M.Sc. Research Student, University of Moratuwa

- Analysis of the partial discharge over the moisture content and investigation of optimum moisture removal method for small power transformer.

2021

Brooklynn Taylor-Clark, Undergraduate Research Student (3rd year), University of Manitoba

- Full-wave electromagnetic simulation and transient analysis of nonuniform overhead and buried wire structures in the presence of frequency-dependent lossy ground

2021

Shijie Fu, Undergraduate Research Student (4th year), University of Manitoba

- Transient analysis of transmission lines due to nearby lightning strikes in the presence of frequency-dependent lossy ground using full-wave electromagnetic simulations.

- 2019, 2020 **Ashley Ng**, Undergraduate Research Student (2nd and 3rd years), University of Manitoba
- Full-wave electromagnetic simulation of lossless nonuniform transmission lines.
 - Integration of finite-difference time-domain models for nonuniform frequency-dependent transmission lines into PSCAD/EMTDC.

Publications

JOURNALS

- M. Gunawardana** and B. Kordi, "Coupling Model for Time-Domain Analysis of Nonparallel Overhead Wires and Buried Conductors in the Presence of Lossy Ground," under review in *Electric Power Systems Research*, 2022.
- M. Gunawardana** S. Fu and B. Kordi, "Transient Response of Nonparallel Frequency-Dependent Transmission Lines Due to Nearby Lightning Strikes in the Presence of Finitely-Conducting Ground," *Electric Power Systems Research*, 2022.
- M. Gunawardana** and B. Kordi, "GPU and CPU Based Parallel FDTD Methods for Frequency-Dependent Transmission Line Model," *IEEE Transactions on Power Delivery*, 2022.
- M. Gunawardana**, A. Ng and B. Kordi, "Time-Domain Coupling Model for Nonparallel Frequency-Dependent Overhead Multiconductor Transmission Lines Above Lossy Ground," *IEEE Transactions on Power Delivery*, 2022.
- M. Gunawardana** and B. Kordi, "Time-Domain Modeling of Transmission Line Crossing Using Electromagnetic Scattering Theory," in *IEEE Transactions on Power Delivery*, vol. 35, no. 2, pp. 1020-1027, April 2020.
- M. Gunawardana**, F. Fattal and B. Kordi, "Very Fast Transient Analysis of Transformer Winding Using Axial Multiconductor Transmission Line Theory and Finite Element Method," in *IEEE Transactions on Power Delivery*, vol. 34, no. 5, pp. 1948-1956, Oct. 2019.

REFEREED CONFERENCES

- B. R. Gunawardana, P. S. N. De Silva, K. T. M. U. Hemapala, and **M. Gunawardana**, "Adaptive switching based control mechanism for mitigating frequency oscillations due to large load drops in low inertia systems," *IEEE PES Australasian Universities Power Engineering Conference*, Sydney, Australia, 2024.
- D. Bamunusinghe, P. Peiris, K. Nagarajah, V. Logeeshan, and **M. Gunawardana**, "Traveling Wave Based Fault Location and Fault Classification Technique for Distribution Networks with High Renewable Penetration," *2023 3rd International Conference on Emerging Frontiers in Electrical and Electronic Technologies (ICEFEET)*, Patna, India, 2023.
- R. S. De Silva, U. Vinusan, S. K. Aldeniya, R. Samarasinghe, and **M. Gunawardana**, "Optimizing Marx Impulse Generator Settings for Lightning Impulse Testing of Transformers: An Automated Approach for Enhanced Efficiency and Accuracy," *2023 Moratuwa Engineering Research Conference (MERCon)*, Moratuwa, Sri Lanka, 2023.
- N. Arachchi, A. Antony, B. Gunasinghe **M. Gunawardana** and R. Samarasinghe, "Effect of Contact Angle of Water Droplets on the Electric Field Distribution of Polymer Insulators," *2022 IEEE Conference on Electrical Insulation and Dielectric Phenomena (CEIDP)*, Denver, CO, USA, 2022.
- A. Antony, N. Arachchi, B. Gunasinghe **M. Gunawardana** and R. Samarasinghe, "Analyzing the Optimum Contact Angles of Water Droplets to Mitigate the E-Field Stress on Polymer Insulator," *2022 Moratuwa Engineering Research Conference (MERCon)*, Moratuwa, Sri Lanka, 2022.
- M. Gunawardana** and B. Kordi, "Modelling Transient Response of Nonuniform Transmission Lines Due to Nearby Lightning Strikes," *35th International Conference on Lightning Protection*, Hambanthota, Sri Lanka, 2021.
- A. Ng, **M. Gunawardana** and B. Kordi, "Simulation of Transmission Line Bend Using a Non-Uniform Transmission Line Model Based on Scattering Theory," *IEEE Power & Energy Society General Meeting (PESGM)*, Montreal, Canada, 2020.
- M. Gunawardana** and B. Kordi, "An Enhanced Model for the Analysis of Non-Uniform Multiconductor Transmission Lines Based on Scattering Theory," *2018 Progress in Electromagnetics Research Symposium (PIERS-Toyama)*, Japan, 2018.
- M. Gunawardana**, A. A. T. Kanchana, H. A. P. B. Perera, P. M. Wijesinghe, J. R. Lucas and R. Samarasinghe, "A low cost partial discharge measuring system for a high voltage laboratory," *2016 IEEE International Conference on Power System Technology (POWERCON)*, Wollongong, Australia, 2016.
- M. Gunawardana**, A. A. T. Kanchana, H. A. P. B. Perera, P. M. Wijesinghe, J. R. Lucas and R. Samarasinghe, "A MATLAB Simulink model for a partial discharge measuring system," *Electrical Engineering Conference (EECon)*, Colombo, Sri Lanka, 2016.

Outreach & Professional Development

SERVICE TO TECHNICAL COMMUNITY

- 2023 **Forum on Reforms for a Sustainable Power Sector for the Next Generation**, General Chair
- 2023 **National Symposium on Power Sector Reforms, University of Moratuwa**, General Chair
- 2023 **Electrical Engineering Society, University of Moratuwa**, President
- 2023 **IEEE IAS Student Branch chapter, University of Moratuwa**, Advisor
- 2022 **Journal of Control, Automation and Electrical Systems**, Reviewer
- 2021 **Moratuwa Engineering Research Conference (MERCon), Colombo**, Paper Reviewer
- 2020 **IEEE Electric Power and Energy Conference (EPEC), Edmonton**, Paper Reviewer
- 2020 **Moratuwa Engineering Research Conference (MERCon), Colombo**, Paper Reviewer
- 2018 **IEEE Region 10 Humanitarian Technology Conference, Colombo**, Paper Reviewer
- 2016 **Electrical Engineering Conference (EECon), Colombo**, Conference Secretary

PROFESSIONAL MEMBERSHIPS

- IEEE Power and Energy Society, Member
- Institute of Engineers Sri Lanka (IESL), Associate Member

Awards & Scholarships

2022	Best Paper Award , 2022 Moratuwa Engineering Research Conference (MERCon), Sri Lanka	-
2022	Edward R. Toporeck Graduate Fellowship in Engineering , University of Manitoba	\$4675 CAD
2022	Faculty of Graduate Studies Research Completion Scholarship , University of Manitoba	\$5000 CAD
2021	Young Scientist Award , International Conference in Lightning Protection, Sri Lanka	€ 500 EUR
2020	Gordon P. Osler Graduate Scholarship , University of Manitoba	\$7,000 CAD
2019 - 2021	University of Manitoba Graduate Fellowship , University of Manitoba	\$56,000 CAD
2019	International Graduate Student Scholarship , University of Manitoba	\$5,400 CAD
2018	Young Scientist Award , Progress in Electromagnetic Research Symposium, Japan	-
2018	Best Student Paper Award , Progress in Electromagnetic Research Symposium, Japan	\$550 USD
2017-2018	Manitoba Graduate Scholarship , Province of Manitoba	\$30,000 CAD
2017	International Graduate Student Entrance Scholarship , University of Manitoba	\$5,400 CAD
2011-2015	Mahapola Higher Education Scholarship (Merit) , Government of Sri Lanka	Rs 127,000 LKR

Volunteering Activities & Sports

- 2012-2015 **University Colors Holder 2012, 13, 14 & 15, in Swimming (Captain: 2015)**, University of Moratuwa
- 2011 **Participant at International Mathematics Olympiad, Netherlands**, Team Sri Lanka
- 2015 **Participant at International Mathematics Competition for University Students, Bulgaria**, Team University of Moratuwa
- 2012, 2013 **Voluntary trainer of National team for International Mathematics Olympiad**, Sri Lanka Olympiad Mathematics Foundation
- 2012, 2013 **Organizing Committee Member of the Sri Lankan Mathematics Olympiad**, Sri Lanka Olympiad Mathematics Foundation

References

Available upon request