Valliappan MUTHUKARUPPAN

Electrical Engineer | Ph.D. Candidate

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Raleigh, NC

I am a self-motivated and highly organized research assistant with over 4 years of experience with expertise in power system modelling and control. I have completed multiple academic and industry researh projects developing tools and applications to enhance the power system monitoring, operation and resilience. I am a innovator with advanced skills in power system modelling, optimization and data analytics.

Professional Experience

Present – Jan 2019 | **Ph.D. in Electrical Engineering, North Carolina State University, Raleigh, NC**
Research : DER Management in a Smart Distribution System under Normal and Abnormal Conditions.
Major : Power System Engineering (GPA : **4.0/4.0**).
Minor : Statistics (GPA : **4.0/4.0**).
Advisor : Dr. Mesut E. Baran (NCSU).
Co-Advisors : Dr. Ning Lu (NCSU), Dr. Wenyuan Tang (NCSU) and Dr. David Lubkeman (NCSU).

Dec 2018 – Aug 2016 | **M.S. in Electrical Engineering, North Carolina State University, Raleigh, NC**
Research : Practical Aspects of Implementing a Decentralized Volt-VAR Optimization Scheme.
Major : Power System Engineering (GPA : **4.0/4.0**).
Advisor : Dr. Mesut E. Baran (NCSU).

May 2014 – Aug 2010 | **B.Tech in Electrical and Electronics Engineering, NIT Trichy, India**
Research : Robust Control Scheme for Operating a Nonholonomic Semi-Autonomous Robot.
Advisor : Dr. V. Sankaranarayanan.

Professional Experience

Present – Aug 2017 | **Graduate Research Assistant, FREEDM System Center, NCSU, Raleigh**

- Developed a decentralized volt/var optimization scheme and implemented using Distributed Grid Intelligence software architecture on three different platforms - Hardware, Hardware-in-loop and Software testbed. (*Linux, PSCAD, Modbus, C/C++, Matlab, Wireshark, Computer Networking*)
- Developed AMI based communication scheme for implementing decentralized and distributed volt/var optimization schemes in smart distribution system. (*Matlab*)
- Implemented the decentralized volt/var scheme on embedded system using beagle bone boards and resilient information architecture platform for the Smart Grid (RIAPs). (*Linux, C/C++, Computer Networking*)
- Investigated the impact of a new Dynamic-VAR (DVAR) device on the islanding protection of utility owned PV power plants using Hardware-in-loop simulations and SEL relays for Duke Energy. (*OpalRT, Matlab/Simulink*)
- Developed a stochastic optimization based restoration strategy for residential distribution feeders with high penetration of PV under extreme outages using utility owned mobile energy devices. (*Yalmip, Pyomo, Matlab, Python*)
- Developed a data-driven solution for distribution transformer overloading assessment and a replacement tool for under loaded transformers using smart meter data from a local utility. *(*Python, Pandas)

Matlab | Python | C/C++ | Simulink | Wireshark | Linux | Pyomo | Yalmip | PSCAD | OpalRT

Aug 2019 – May 2019 | **Synchrophasor Distribution Intern, ABB US Corporate Research Center (USCRC), Raleigh**

- Developed a robust re-synchronization strategy for an existing IEEE 9-bus microgrid black start case that was successfully implemented with an ABB relay using Hardware-in-loop simulation. (*Matlab, Simulink, OpalRT*)
- Developed a microgrid model using IEEE 123 system with multiple DERs and micro-PMU's in OpalRT. (*Matlab, Simulink*)
- Investigated the ambiguous requirement of smart inverters to implement both low voltage ride through and islanding detection subject to same disturbance conditions as per IEEE 1547-2018 standard using IEEE 123-node microgrid model. (*Matlab, Simulink*)

Matlab | Simulink | OpalRT

Aug 2017 – Jan 2017 | **Graduate Student Researcher, FREEDM System Center, NCSU, Raleigh**

- Investigated the effect of Negative Impedance Loads (Constant Power Loads) on the stability of microgirds.
- Investigated the effect of the constant power loads on numerical stability of Hardware-in-loop simulations for microgrid.
- Developed different constant power load models in matlab/simulink to stabilize hardware-in-loop simulations of microgrid.

Matlab | Simulink

Jul 2018 – Jan 2017 | **Battery sub-thrust leader, Solarpack, NCSU, Raleigh**

Solarpack - the official Solar Car team of NCSU.

- Served as design lead for Batteries, Battery Protection and Battery Management System for the first version of the solar car.
- Built a custom battery pack at 450V using Toshiba's LTO Cells.
- Developed the Battery Protection System for the vehicle in compliance with the specifications from the American Solar Car Challenge (ASC).

Jun 2016 – Jun 2014 | **Senior Electrical Engineer, Larsen & Toubro Ltd., PT&D IC, Doha, Qatar**

- Lead Erection Engineer responsible for installation and commissioning of power equipments at 132/11kV Doha Festival City Substation (*Net Worth : $23 million*)
- Lead Cable Engineer responsible for installation & testing of 132kV and 11kV power cables inside the substation.
- Successfully commissioned the 132/11kV Doha Festival City Substation on *June 30, 2016*.

Publications

Confeerences

[C5] V. Muthukaruppan, M. E. Baran, N. Lu, et. al., "**Overloading Analysis of Distribution Transformers using Smart Meter Data**," *IEEE Innovative Smart Grid Technologies (ISGT),* 2022, Washington D.C., pp. 1-5.

[C4] R. Hu, Y. Li, S. Zhang, A. Shirsat, V. Muthukaruppan, et. al., "**A Load Switching Group based Feeder-level Microgrid Energy Management Algorithm for Service Restoration in Power Distribution System,**" *IEEE Power & Energy Society General Meeting (PESGM),* 2021, pp. 1-5.

[C3] A. Shirsat, V. Muthukaruppan, et. al., "**Hierarchical Multi-timescale Framework for Operation of Dynamic Community Microgrid,**" *IEEE Power & Energy Society General Meeting (PESGM),* 2021, pp. 1-5.

[C2] V. Muthukaruppan, and M. E. Baran, "**AMI Based Communication Scheme for Decentralzied Volt/VAR Control**," *IEEE Power & Energy Society General Meeting (PESGM),* 2020, pp. 1-5.

[C1] V. Muthukaruppan, and M. E. Baran, "**Implementing a Decentralized Communication Scheme on a Smart Distribution System**," *IEEE PES Innovative Smart Grid Technologies (ISGT) Conference*, Washington D.C., 2020, pp. 1-5.

Programming Languages

Matlab	●●●●●
Python	●●●●●
C/C++	●●●●●
R	●●●●○
Julia	●●●○○
SAS	●●●○○
Unix Shell	●●○○○

Simulation Tools

- OpenDSS
- Yalmip/Pyomo
- Tensorflow/keras
- PyTorch
- OpalRT/PSCAD
- Simulink
- JMP
- RIAPs/DGI

Office Skills

- LaTeX
- MS Office Suite
- MS Visio
- InkScape
- Markdown

Honors and Awards

2022	**Awardee**	NCSU Travel Grant to Attend IEEE ISGT 2022, Washington D.C.
2021	**Awardee**	Graduate level winner at NC State Datathon conducted by NCSU Statistics Department and John Deere
2020	**Second Place**	NCSU ECE Student Poster competition conducted Graduate Student association of NCSU.
2020	**Awardee**	NCSU Travel Grant to Attend IEEE PESGM 2020 (Virtual) Conference.
2014	**Second Place**	Quiz competition at Quality Week Celebration conducted by Larsen & Toubro Ltd.
2013	**Awardee**	Inspire and Innovate Award at 2013 First Tech Challenge conducted by M/s. Caterpillar Pvt. Ltd., India.

Professional Activities

Proessional Society Membership

2018-Present	Student Member, IEEE
2018-Present	Student Member, IEEE Power and Energy Society (PES)

Peer Review Service

Reviewer	IEEE Transactions on Smart Grid
Reviewer	IEEE Transactions on Power Systems
Reviewer	IEEE Power and Energy Society General Meeting (PESGM)

Club Activities

2017-2018	Education and Outreach Officer at Student Leadership Council (SLC) of FREEDM Systems Center
2020-Present	Advisor - SKY club at NC State University.

Teaching and Mentoring

Fall 2021 | **Mentor, North Carolina State University, Raleigh, NC**
Provided mentoring for Aniruddh Ravi, a Master Student during the course of his Thesis.

Fall2018 | **Teaching and Lab Assistant, North Carolina State University, Raleigh, NC**
Course : ECE 586 - Communiactions and SCADA Systems for Smart Grid.
Instructors : Dr. David Lubkeman and Dr. Wenye Wang.
Responsibilities :

- Setup and test laboratory experiments using SEL relays and communication devices for implementing different protection and communication schemes.
- Assist instructors in setting up and evaluating difficulty of homeworks.
- Help students with homework, coursework and lab sessions.
- Evaluate students lab sessions, project and final exams.

Certifications

2018	NCEES FE Electrical and Computer Exam - Verifiable link.
2016	Qatar KAHRAMAA LOA Holder - Authorized access & restricted permit to work in energized substations.

Talks/Presentations

Webinar — November 2019
FREEDM Technical Webinar Series — Raleigh, NC
The Effectiveness of Anti-Islanding Schemes on a Distribution System with DER

Paper Presentation — August 2020
IEEE Power & Energy Society General Meeting (PESGM) — Virtual
AMI Based Communication Scheme for Decentralized Volt/VAR Control

Poster Presentation — Feburary 2020
IEEE Innovative Smart Grid Technologies (ISGT) — Washington D.C.
Implementing a Decentralized Communication Scheme on a Distribution System.

References

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Dr. David Lubkeman
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