Amarsagar Reddy Ramapuram Matavalam — Resume (September 12, 2018)

Contact Information

Iowa State University
Electrical and Computer Engineering
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Research Interests

Power Grid Stability - Analysis, Monitoring & Mitigation; Transmission & Distribution PMU Applications; Static & Dynamic Simulation including Transmission - Distribution Interaction; Integration of DERs; Machine Learning Applications in Power System; Cyber-Physical Security of Power Systems by Merging Models & Measurements; Cyber-Physical Real-Time Test-Beds.

Education

Iowa State University, Ames, Iowa, USA

Ph.D. Student, Electrical Engineering (Aug 2013 - Dec 2018) - *GPA: 3.97/4.00*

- Advisor: Dr. Venkataramana Ajjarapu (*Fellow, IEEE*)
- Thesis : Online Monitoring & Mitigation of Short Term and Long Term Voltage Instability using Synchrophasors

Indian Institute of Technology-Madras (IIT-M), Chennai, India

B.Tech. & M.Tech. in Electrical Engineering with specialization in Power Systems and Power Electronics; Minor in Operations Research, (Aug 2006-May 2011) - *GPA: 9.11/10.00*

- Thesis : Design and Implementation of a Synchronous DC-DC Converter with Soft Switching - Received the Bhagyalakshmi and Krishna Ayengar Award for the **best Institute wide masters project in energy efficiency**

Journal Publications

Amarsagar Reddy R.M.; Ajjarapu, V., "Sensitivity based Thevenin Index with Systematic Inclusion of Reactive Power Limits," *in IEEE Transactions on Power Systems, vol. 33, no. 1, pp. 932-942, Jan. 2018.*

Journal Publications - Submitted & in Preparation

Amarsagar Reddy R.M.; Ajjarapu, V., "PMU based Monitoring and Mitigation of Delayed Voltage Recovery using Admittances," *Under review in IEEE Transactions on Power Systems.*

Amarsagar Reddy R.M.; A. Singhal and V. Ajjarapu, "Differentiating Long Term Voltage Instability Due to Distribution & Transmission Networks Using μPMUs & PMUs," *to be submitted in IEEE Transactions on Smart Grid Special Edition on μPMUs.*

Amarsagar Reddy R.M.; R. Venkatraman and V. Ajjarapu, "Monitoring & Mitigation of Delayed Voltage Recovery using μPMU based Reduced Distribution System Model," *to be submitted in IEEE Transactions on Smart Grid Special Edition on μPMUs.*

Selected Conference Publications

Amarsagar Reddy R.M.; A. Singhal and V. Ajjarapu, "Identifying Long Term Voltage Stability Caused by Distribution Systems vs Transmission Systems", *PESGM 2018*, Aug 2018.

Amarsagar Reddy R.M.; et. al., "PMU based real-time short term voltage stability monitoring - Analysis and Implementation on a real-time test bed," in *NAPS 2014*, Sep. 2014.

Research Experience

Graduate Research Assistant, Iowa State University, Aug 2013 - Present

Long-term Voltage Stability Assessment by Merging Synchrophasor Data & System Models.

- Analytically proved connection between Jacobian and Thevenin index; Proposed Sensitivity based Thevenin Index (STI) that validates the local index and detects noisy/malicious data.
- Incorporated generator reactive limits in the STI extending Thevenin methods to predict both saddle-node & limit-induced bifurcations in real-time - tested on matpower-3120 system.
- Extended the Thevenin methodology into distribution systems including the unbalance in topology and loads - enables the estimation of critical regions in distribution systems.

Short-term Voltage Stability Monitoring & Control using Synchrophasors.

- Analyzed and simplified the WECC Composite Load (CMLD) model utilizing the physics of the load behavior during Fault Induced Delayed Voltage Recovery (FIDVR).
- Derived FIDVR recovery time from the simplified model and estimated load control using offline learning to ensure recovery within a specified time. The method, based on load admittance, can reliably detect, quantify and mitigate FIDVR, even in presence of oscillations.
- Extended the methodology using μPMU measurements and distribution topology to localize motor stalling and utilize Q-support from the DERs to mitigate distribution FIDVR.

Development of the Real-Time Cyber-Physical Test-Bed.

- Implemented the WECC CMLD model in Modelica and imported it into Opal-RT for real-time simulation and control of the FIDVR phenomenon using OpenPDC.

Power Flow based on Polar Holomorphic Embedding.

- Developed and efficiently implemented holomorphic power flow using voltage magnitude and phase angle as the embedding variables with execution time similar to runpf() in matpower.

Ongoing Collaborations.

- Prof. Umesh Vaidya, Iowa State University - Koopman linear operator framework for analysis of the power system DAE and control strategies to mitigate voltage stability.
- Prof. Decebal Mocanu, Eindhoven University of Technology - Sparse Neural Networks to represent and learn power flow solutions under changing topology.

NSF, DOE & Power System Engineering Research Center (PSERC) Proposal Writing.

- Led successful proposals by coordinating with several faculty in different research disciplines (total $500k); Further supported successful proposals (total $ 2M).

Masters Graduate Project, IIT-M, Chennai, India (Aug 2010 - July 2011)

Design and Implementation of a Synchronous Soft Switched DC-DC Converter

- Improving efficiency of a Buck converter for low power applications by utilizing Synchronous Soft Switching to reduce losses - hardware implementation improved efficiency upto 6%

Select Honors and Awards

- Awarded **3rd Prize** for the Best Graduate Poster at the 2016 IEEE PES General Meeting
- Awarded **2nd Prize** for the Best Paper at the 2015 North American Power Symposium
- Awarded **Institute Merit Prize** at IIT-M for the best Academic Achievement in Power Systems & Power Electronics during 7^{th} and 8^{th} Semester

Relevant Skills

Languages:	MATLAB, Python, C, C++, C#, Mathematica, R, Embedded C, Modelica
Software:	PSSE, PSLF, OpenPDC, RTDS, Opal-RT, Simulink, OpenDSS, GridLab-D
ML Libraries:	Tensorflow, Keras, PyTorch

Relevant Graduate Coursework

- Power System Dynamics
- Steady State Analysis
- Wind Energy Technologies
- Power System Planning
- Power System Reliability
- Cyber Security in Power Systems
- Statistical Methods I
- Non-Linear Systems
- Harmonic Analysis
- Applied Linear Algebra
- Convex Optimization
- Exploratory Data Analysis
- Data Analytics (audit)

Professional Work Experience

Summer Intern, GE Grid Solutions, Redmond,WA (June 2015 - Aug 2015)

Implemented signal processing and data analytics methods (Non-linear PCA, Dynamic Mode Decomposition & Koopman Analysis) on real PMU data for generator model validation.

- Filed patent application for the methodology and it is now part of commercial WAMS.

Edison Engineer, General Electric, India (July 2011 - July 2013)

Developed and tested GE's Global Trip Unit (GTU) and Ground Fault Circuit Interrupter (GFCI) with Self-Test.

- Developed firmware fix to solve electromagnetic interference caused by hardware issues.

Devised and validated a voltage stability index based on local PMU measurements.

- Setup Hardware-in-Loop test-bed with OPAL-RT & GE PMU for studying dynamic stability.

Other Activities and Interests

- Member of the IEEE PES Student Chapter at Iowa State University
- Active Member of Sankalp - a volunteering student organization at Iowa State University

References

Venkataramana Ajjarapu:
- Professor, Department of Electrical Engineering
- Iowa State University
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James D. McCalley:
- Professor, Department of Electrical Engineering
- Iowa State University
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Jay Giri:
- Director, Power Systems Technology Initiatives
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