Ragini V. Meshram, Ph.D.

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Education

2015–19 **Ph.D., Electrical Engineering** VJTI, Mumbai, India
Thesis title: *Phasor Modeling and Control of Power Convertors in Complex Network*
Presented research in FREEDM's National Science Foundation Year-8 Annual Site Visit Meeting at Florida State University, Florida, USA

2013–15 **M.Tech. Electrical Engineering (Control Systems)** VJTI, Mumbai, India
Thesis title: *Various Field Oriented Control Techniques for Three Phase Induction Motor Drives*

Supplementary Education/ Training

2016 **DSP Training Program** CoE-CNDS, VJTI, Mumbai
L&T, Power Electronics & Automation Technology Centre, Mahape, Navi Mumbai
Software used: CCS 6 controlSUITE v3.3.7
Topics: Digital Input/Output, ADC module, Generating SPWM, SVPWM, Communication McBSP, SPI, SCI Modules

OPAL-RT Online Training Sessions
Ilamparithi T., Opal-RT Technologies, Bangalore, India
Software/Hardware used: Opal-RT OP 4500, RT-Lab
Topics: converting a MATLAB model to RT-LAB compatible format, data logging and configuring I/O, I/O configuration – Analog type and PWM type

Experience

Research Experience

2016 – 19 **Research Scholar** VJTI, Mumbai, India
Development of a multidisciplinary model for the integration of renewable sources and storage device in the hybrid microgrid using graphical tool Bond graphs to minimizing complexity in numerical computations
The systematic procedure is developed for port-Controlled Phasor Hamiltonian (PCPH) formation using dynamic phasors to analyze nonlinear behavior
The interconnection and damping assignment passivity-based controller is designed to address the voltage regulation issues because of intermittent nature of renewable sources
Verified designed controller on SiC MOSFET based SST interfaced to 3.6kV distribution grid test bed developed at FREEDM System Center, North Carolina State University, NC, USA
Validated of the effectiveness of the proposed approach with Hardware in Loop (HIL) simulation using Opal-RT and dSPACE simulators

2014–16 **Research Assistant** VJTI, Mumbai, India
Development of vector control for induction motor using indirect method for the independent control of speed and torque.
Development of sensorless model reference adaptive control for speed sensorless vector control and estimation of resistance
Design of robust adaptive sensorless technique for speed estimation using high gain observers which accounts modelling uncertainty and measurement noise
Implementation of v/f control on Induction motor (3.7 kW, 50 Hz, 415 V, 4 pole, 1500 rpm SQ Cage) using 5 Level IGBT Power Stack (2x3 H Bridges, 120V/25A, with built in DC Capacitors, Driver Cards, Heat Sink, Fuses & 3 Phase Diode Bridge)

Experience (continued)

2016–18 **M Tech projects assisted** VJTI, Mumbai, India
Modelling and analysis of dual active bridge dc-dc converter in different mathematical domains
LMI based H-infinity control for rectifier
Design of IMC and LMI based H-infinity controller for rectifier
Energy based modeling and control of solid state transformer
Design of explicit model predictive controller for the Dual Active Bridge converter

Teaching Experience

2018-19 **Ad-hoc faculty** VJTI, Mumbai, India
Courses taught: Control systems, Electric Traction
Conducted laboratory experiments: PLC & SCADA Lab, Power Electronics and Drives Lab

2016-18 **Teaching Assistant** VJTI, Mumbai, India
Courses taught: Computational Methods, High performance industrial drives, Linear Control Design, Nonlinear Control Design, Nonlinear System Analysis
Assisted tutorials and laboratory experiments: Controller Design Lab, MATLAB Lab, Nonlinear Control Design, Nonlinear System Analysis, Research Methodologies

Projects

2020 **IEEE VTS Motor Vehicles Challenge 2020**
Development of Energy Management Strategy (EMS) for a Fuel Cell/Ultracapacitor/Lead-Acid Battery Hybrid Electric Vehicle
Technical Specifications: ECCE of 30kW PEM fuel cell, 540 V 16 F ultracapacitors and a 540V battery pack (owned by Univ. Bourgogne Franche-Comte and operated by FEMTO-ST and FCLAB research labs)
EMS to reduce the hydrogen consumption and to increase the lifetime of energy sources of ECCE.

2019 **Disturbance Rejection and Harmonic mitigation for SST through Passivity Based Control**
PBC design for the 2-stage SST (comprising of DAB and inverter)
Asymptotic convergence of the tracking error to zero and the robustness against input voltage sag/swell and for the load disturbances
the design facilitates the mitigation of voltage harmonics for inverter and performance is demonstrated through simulations using MATLAB/Simulink
The future scope includes the design of passivity based PI controller for 3-stage SST to achieve improvements in transient performance

Robust Control of SST using Dynamic Phasor model with dq transformation
Modular control of each stage of SST through dynamic phasor based robust control
Control is formulated in frequency domain by representing the system states with time varying Fourier coefficients or dynamic phasors (DP)
dq transformation is applied on DP, which facilitates the design of PI controller to smooth-en out the ripples in the output voltage waveform
loop shaping and pole assignment technique for tuning the controller gains to reject input and load disturbances and attenuate measurement noise
The robustness of the controller is against parametric uncertainties using small gain theorem.
Effectiveness of design is analized with the HIL simulations using Opal-RT and dSPACE simulators

2018 **Brayton-Moser Modeling of SST**
Models are constructed using the power flowing through the system and stabilization of power converters is achieved by shaping a power function instead of the energy function
Alternative paradigm to overcome disturbance due to extensive dissipation
The formalism is based on Brayton-Moser mixed-potential function

Projects (continued)

2017 **Internal Model Control of SST for Microgrid Stability Enhancement**
Voltage regulation issue of SST by adopting dynamic phasor-based modeling and internal model control based nested loop PI control
Internal model control (systematic model based) design technique for tuning of PI controller

2015 **High gain observer design for the induction motor sensorless vector control**
The on-line estimation of the rotor fluxes, the motor speed and the load torque of the induction motor from the current and voltage measurements
Design of nonlinear observer using $\alpha - \beta$ Park's model
Design of adaptive observer techniques using high gain extended Kalman filter

Research Publications

Journal Articles

1. **R. V. Meshram**, Bhagwat, M., Khade, S., Wagh, S. R., Stanković, A. M. & Singh, N. M. (2019). Port-controlled phasor hamiltonian modeling and ida-pbc control of solid-state transformer. *IEEE Transactions on Control Systems Technology*, *27*(1), 161–174. https://doi.org/10.1109/TCST.2017.2761866

2. **R.V. Meshram**, Khade, S., Wagh, S., Singh, N. & StankoviÄ□, A. (2018). Bond graph approach for port-controlled hamiltonian modeling for sst. *Electric Power Systems Research*, *158*, 105–114. https://doi.org/https://doi.org/10.1016/j.epsr.2017.12.035

3. Pande, N., Pagrut, V., **Ragini Meshram**, Kazi, F., Singh, N. & Wagh, S. (2015). Real time distributed control of variable speed drive system in cyber physical framework [9th IFAC Symposium on Control of Power and Energy Systems CPES 2015]. *IFAC-PapersOnLine*, *48*(30), 357–362. https://doi.org/https://doi.org/10.1016/j.ifacol.2015.12.404

Conference Proceedings

1. Monika, M., **R. Meshram** & Wagh, S. (2019a). Disturbance rejection and harmonic mitigation for solid state transformer through passivity based control, In *Australian new zealand control conference (anzcc)*.

2. Monika, M., **R. Meshram** & Wagh, S. (2019b). Robust control of solid state transformer using dynamic phasor based model with dq transformation, In *North american power symposium (naps)*.

3. Gedam, S., Pal, V. & **R. Meshram**. (2018). Brayton-moser modeling of solid state transformer, In *2018 condition monitoring and diagnosis (cmd)*. https://doi.org/10.1109/CMD.2018.8535957

4. Monika, M., **R. Meshram**, Wagh, S. & Stankovic, A. M. (2017). Internal model control of solid state transformer for microgrid stability enhancement, In *2017 north american power symposium (naps)*. https://doi.org/10.1109/NAPS.2017.8107221

5. Khade, S., Gaonkar, A., Weakey, S., Chavan, R. & **R. Meshram**. (2016). Stability enhancement of rectifier and dab stages of sst model using dynamic phasor based pi controller, In *2016 ieee 6th international conference on power systems (icps)*. https://doi.org/10.1109/ICPES.2016.7584146

6. **Meshram, R**, Bahadure, S., Matani, S., Datkhile, G., Kumar, T. & Wagh, S. (2015). Sensorless field orientation control of induction motor using reduced order observer, In *National power electronics conference (npec)*.

Book Chapter

1. **Ragini Meshram**, Madhusoodan, M. & Wagh, S. (2018). Harmonic mitigation for vsi using dp-based pi controller (M. T. Lamchich, Ed.). In M. T. Lamchich (Ed.), *Compendium of new techniques in harmonic analysis*. Rijeka, IntechOpen. https://doi.org/10.5772/intechopen.74587

https://scholar.google.co.in/citations?user=moK56XoAAAAJ&hl=en

Conference Presentations

Sept 2017 — **North American Power Symposium (NAPS)** West Virginia University, Morgantown, USA
"Internal Model Control of Solid State Transformer for Microgrid Stability Enhancement"
"Implementation of Single-phase Modified SRF-PLL using Model Based Development Approach"

June 2016 — **FREEDM's Y-8 NSF-SV Meeting** Florida State University, Tallahassee, USA
"IDA-PBC Control for Port-controlled Phasor Hamiltonian Model of Solid State Transformer"
"Dynamic Phasor-based Robust PI Control of Solid State Transformer"
"Hamiltonian formulation and control design using bond graph approach for 3-stage SST"

Dec 2015 — **National Power Electronics Conference (NPEC)** IIT Bombay, India
"Sensorless Field Orientation Control of Induction Motor Using Reduced Order Observer"

IFAC symposium on Control of Power and Energy Systems IIT, Delhi, India
"Real time distributed control of variable speed drive system in cyber physical framework"

Industry/Academic Contributions

Jan 2020 — **"Faculty development program on Perspective of control systems"** VJTI, Mumbai
Role: *Organizer and speaker*
Delivered lecture on state space controller/observer design and internal model control strategies to design linear controller
Delivered lecture on Hardware in loop implementation/simulations using Opal-RT, dSPACE and Typhoon HIL

2014–17 — **"Development of Control Algorithm for Power Electronics (CAPE)"** VJTI, Mumbai
Consultancy project in collaboration with Larsen & Toubro Electrical & Automation, Mahape, Mumbai, India
Role: *Research Scholar*
Design and develop an indirect vector control algorithm for the speed and torque control independently
Designed/computed the tuning parameters for the cascaded PI controllers (flux, speed, current controllers) in vector control algorithm using loop shaping method
Tested designed algorithm on L& T machine parameters and 5 different machines in MATLAB/Simulink
Developed the sensorless model reference adaptive vector control for the L& T machine and implemented successfully

Jan 2017 — **"Special course on 3-phase Power Electronics for the Central Railways' employees"** CRTI, Thakurli, Mumbai
Role: *Speaker*
Delivered 5 lectures on the control scheme for AC traction motor and demonstrated MATLAB demo models

Mar 2017 — **"Control System: Theory to Practice"** Jalgaon, Maharashtra, India
Cybermotion Technologies Pvt. Ltd., Hyderabad, India
Developed course material on the classical control theory and controller design in time domain, frequency domain and state space analysis

Scholarships Received

2017 — **Travel grant of Rs. 1 Lac** received from VJTI, Mumbai for paper presentation in USA

2015–18 — **Scholarship during PhD** from the Centre of Excellence in Complex and nonlinear dynamical systems (CoE-CNDS) Under TEQIP-II, sub-component 1.2.1 for 3 years.

2013 -15 — **AICTE GATE scholarship** received during M Tech at VJTI, Mumbai

Skills

Programming — MATLAB, Simulink, SCILAB, NI Multisim, LOGOSoft, C, Python, TensorFlow, LaTeX

Software — RT-Lab, dSPACE Control Desk, Code Composer Studio, MS Windows, MS Officev and Visio, Typhoon HIL

Hardware — Opal-RT OP4500, dSPACE DS1104, DSP TI320F28335, Typhoon HIL 602+

Professional Memberships

Since 2016 — **IEEE Student Member** – Membership number: 92816885
IEEE Vehicular Society Membership
IEEE Women in Engineering

Peer Review Activities

Jan 2020 — **IEEE Journal of Emerging and Selected Topics in Industrial Electronics**(1)

Jan 2016–19 — **IEEE Transactions on Circuits and Systems I: Regular Papers**(5)

Jan 2019 — **IEEE Power & Energy Society General Meeting**(1)

Jan 2018 — **Mathematical and Computer Modelling of Dynamical Systems, Taylor & Francis**(1)

IEEE Power Engineering Letters(1)

References

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