

ANIRUDH GUHA

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I take this opportunity to thank my Professors, Teachers, Managers, Colleagues, Friends and Family for their invaluable contributions to what I have been able to do so far and for the days ahead.

*I seek to contribute to teaching and R&D endeavours in **Power Electronic Converters and their Control**.*

DATE OF BIRTH 2nd October 1987

ADDRESS A7, Vaishali Apartments, 17 Dr Nair Road,
T.Nagar, Chennai - 600017

EDUCATION

August 2011 – March 2017 Doctor of Philosophy (PhD)
Department: **Electrical Engineering**
Indian Institute of Science, Bangalore, India
Defended on 10 March 2017, Awarded in June 2017
GPA: 7.8 / 8.0

August 2009 - Dec 2010 Master of Science in Engineering (MSE)
Department: **Electrical and Computer Engineering**
The University of Texas at Austin, USA
Academic Track: **Energy Systems.**
GPA: 4.0 / 4.0

August 2005 - May 2009 Bachelor of Engineering (B.E)
Department: **Electrical and Electronics Engineering**
SSN College of Engineering, Anna University, Chennai, India.
GPA: 88 / 100
First class with distinction
University state rank: 14 (among 9962 candidates)

June 1990 – May 2005 School
Padma Seshadri Bala Bhavan (P.S.B.B), Chennai, India

WORK EXPERIENCE

October 2019 onwards **Assistant Professor,**
Department of Electrical Engineering
Indian Institute of Technology (IIT) - Palakkad

March-2018-Sept 2019
August 2017- March 2018

R&D Engineer, ABB GISPL, Chennai
Scientist, ABB GISPL, Chennai
(2 years and 1 month industry experience)

August 2016 – June 2017

Research Associate,
Department of Electrical Engineering
Indian Institute of Science, Bangalore
(4 months academic research experience post PhD thesis defense)

RESEARCH INTERESTS

Power Electronics and Drives, Pulse-Width Modulation, Control of Inverters, Power Electronics for Power System Applications, HVDC and FACTS, Power Quality and Harmonics, Electric Traction Systems, Renewable Integration, Modeling, Analysis and Control of Power Electronic Systems, Stability and Control.

HARDWARE TESTING, DESIGN AND DIGITAL CONTROLLERS

- Experience working with 100-kW inverter-fed induction motor (3-phase, two-level inverter).
- Experience in testing of IGBTs, IGBT based inverters, working knowledge and good exposure to design aspects of such inverters including sandwich bus-bar, gate driver circuitry, switching characteristics of IGBTs, and inverter protection logic.
- Programming of TI DSP TMS320F2812.

SOFTWARE AND SIMULATION PACKAGES

MATLAB® and Simulink, PSIM, PSCAD, C, TI Code composer studio, HiDraw

RESEARCH EXPERIENCE / PROJECTS:

ABB GXT R&D (August 2017 – Sept 2019)

a) Modular Multilevel/Chain-link converters

- Part of control development team working on technology development of a hybrid modular multilevel converter topology. **(March 2018 – Sept 2019)**
 - Control of Modular Multilevel/ Chainlink Converters applicable to HVDC and also for FACTS applications
 - Fault analysis and control during faults (ac and dc faults)
 - Protection of converters
 - Knowledge of thyristors and their commutation.
 - Dynamic performance studies during dc faults
 - Troubleshooting

b) DC Traction System (September 2017- March 2018)

- Modelling and simulation of dc traction power supply system.
- Impact of energy storage and energy recovery systems on DC traction network.
- Working on model of an actual dc railway network

c) Battery energy storage for Utility Applications (September 2017 – December 2017)

- Survey of battery energy storage for Utility applications
- Survey of converter topologies with energy storage

d) Other activities

- Lean Product Development (LDP) practices Work experience in a SPRINT framework including SCRUM methodology
- Root cause analysis (5 Whys)
- Part of team publishing Technical News letter
- Technical documentation and document organization.

INDUSTRIAL CONSULTANCY PROJECT (AUGUST 2014 – AUGUST 2015)

(Supervised by Prof. G. Narayanan, IISc Bangalore, India)

- Worked with and provided training to engineers from L&T technology services, Bangalore.
- Engineers were trained on topics such as pulse-width modulation, control of inverters, induction motors, inverter dead-time effect and its compensation, oscillatory behavior and stability of induction motors.
- Research on oscillatory behaviour and its mitigation in motor drives of different power levels.

PhD THESIS (Defended March 2017, awarded June 2017) (IISc Bangalore, India)

(advisor: Prof. G. Narayanan, IISc Bangalore, India)

Dead-time Induced Oscillations in Voltage Source Inverter-fed Induction Motor Drives -

Detailed analytical, simulation and experimental study of sustained sub-harmonic oscillations in Volts per Hertz (V/Hz) controlled induction motor drives, and mitigation of such instability or oscillatory behavior in the motor drive. Extensive studies and experiments were primarily carried out on a 100-kW motor drive.

a) Dynamic and steady-state modeling of an induction motor drive including the effect of inverter dead-time

- Developed dynamic models of an inverter fed induction motor including the effect of dead-time.
- Proposed a simplified iterative method to evaluate steady-solution of the non-linear drive system.

b) Small-signal stability analysis of an induction motor drive including effect of inverter dead-time

- Proposed a small-signal model of an inverter-fed induction motor including dead-time effect.
- Stability analysis using eigen values carried out to predict occurrences of oscillatory behavior in induction motors and frequencies of such oscillations.

c) Impact of dead-time on inverter-input current and dc-link dynamics

- Modeled the effect of dead-time on inverter input current.
- Proposed an improved dc-link dynamic model of a rectifier-inverter fed motor drive including inverter dead-time effect.

d) Impact of under-compensation and over-compensation of dead-time effect on stability of induction motor drive

- Studied effects of inaccurate dead-time compensation arising due to system non-idealities such as device switching delays and transition times.
- Proposed small-signal models for cases of under- and over-compensation of dead-time effect.
- Identified and demonstrated two types of resonances or oscillatory behaviour in the motor drive with under- and over-compensation of dead-time effect, respectively.

e) Inductance emulation based active damping

- Surveyed impedance emulation concepts typically used for current limiting and power flow applications in grid connected or microgrid systems.
- Proposed and implemented two active damping schemes based on inductance emulation to mitigate sustained oscillatory behavior in a 100-kW motor drive.

TERM RESEARCH PROJECT (JANUARY 2012 – JUNE 2012) (IISc, Bangalore)

Low Switching Frequency Pulse-Width Modulation Schemes

- Simulation and analysis of low switching frequency or low pulse number PWM schemes with reduced current ripple and torque ripple, for high power or high-speed motor drives.

MASTER'S REPORT (DECEMBER 2010) (UT Austin, USA)

(advisor: Prof. Surya Santoso, UT Austin, USA)

Circuit Breaker Transient Recovery Voltage Analysis with Shunt Capacitor Bank Configurations

- Theoretical analysis and time domain simulation of breaker transient recovery voltage (TRV) initiated during fault clearing, in different configurations of single-phase and three-phase capacitor banks with inrush current-limiting reactors.

B.E PROJECT (SENIOR DESIGN PROJECT) (MAY 2009) (SSNCE, Anna University, India)

(advisor: Prof. A.N Arvindan, SSN College of Engineering, India)

Performance Analysis of an Improved Power Quality 48-pulse Bidirectional AC-DC Converter

- Designed and simulated a system for AC to DC conversion of electrical power with reduced ripple and harmonics.
- Prototype developed for a unidirectional AC to DC 48-pulse uncontrolled rectifier.
- ***Project was one of 10 student projects in the state selected for funding by the Tamil Nadu State Council for Science and Technology, India.***

TEACHING ASSISTANTSHIP

- Power Electronics Lab TA (under Prof G. Narayanan, IISc Bangalore): **Aug-Dec 2012 to 2015.**
- Short course on Pulse Width Modulated Converters (under Prof G. Narayanan, IISc Bangalore)
- General Lab TA (under Prof Surya Santoso, UT Austin, USA): **Fall 2009, Spring 2010, Fall 2010.**

KEY COURSES DURING PhD AND MSE

- Power Electronics, Electric Drives, PWM Converters and Applications, Electromagnetic Compatibility, Dynamics of Linear Systems.
- Power Quality, Distributed Generation Technologies, Renewable Energy and Power Systems, Power System Engineering.

HONOURS AND AWARDS

- Best Presentation Award EECS 2016 Symposium, IISc Bangalore
- University State Rank 14
(among 9962 candidates) Bachelor of Engineering, Electrical and Electronics Engineering,
Anna University, Chennai, India.
- Chairman's Gold Medal Instituted by SSN College of Engineering, Chennai, India.
- Academic Merit Scholarship Instituted by SSN College of Engineering, Chennai, India
Recipient for four consecutive years - 2005 to 2009.
- B.E Research Project Selected for funding by the Tamil Nadu State Council for
Science and Technology, India.
- Ranked All India 42 GATE 2009 Examinations (Graduate Entrance Exam), India.
- IIT JEE 2005 Qualified Qualified in IIT JEE 2005 with all India rank 3006
- Ranked in top 0.1% in India
in Physics, Chemistry and
Sanskrit Class 12 - High school graduation examinations 2005,
CBSE, India.
- Merit Scholarship Instituted by CBSE for performance in class 12 exams, 2005.

LIST OF PUBLICATIONS:

JOURNALS (First Author Publications in Chronological Order) :

Published/Accepted:

- 1) A. Guha and G. Narayanan, "Small-signal stability analysis of an open-loop induction motor drive including the effect of inverter dead-time," **published in *IEEE Trans Ind. Appl.*, vol. 52, no.1, pp.242-253, 2016**
Citation Count: 17, Journal Impact factor: 2.937
- 2) A. Guha and G. Narayanan, "Modelling and analysis of an open-loop induction motor drive including the effect of inverter dead-time," **published in *Sadhana*, vol. 41, no.2, pp.125-145, 2016.**
Citation Count: 4, Journal Impact factor: 0.465

- 3) A. Guha, A. Chetty, C. Kumaresan, G. Narayanan and R. Krishnamoorthy, "Theoretical prediction and experimental verification of light-load instability in a 11-kW open-loop induction motor drive," **published in *Sadhana*, vol. 42, no.8, pp.1263-1273, 2017.**
Citation Count: 3, Journal Impact factor: 0.465
- 4) A. Guha and G. Narayanan, "Impact of dead-time on inverter input current, dc-link dynamics and light-load instability in rectifier-inverter-fed induction motor drives," **published in *IEEE Trans Ind. Appl.*, vol. 54, no.2, pp.1414- 1424, March-April 2018**
Citation Count: 9, Journal Impact factor: 2.937
- 5) A. Guha and G. Narayanan, "Impact of under-compensation and over-compensation of dead-time effect on small-signal stability of induction motor drive", **published in *IEEE Trans Ind. Appl.*, vol. 54, no.6, pp.6027- 6041, Nov-Dec 2018**
Citation Count: 5, Journal Impact factor: 2.937

CONFERENCES (First Author Publications in Chronological Order) :

Published/Accepted:

- 1) A. Guha and G. Narayanan, "Average modelling of a voltage source inverter with dead-time in a synchronous reference frame," in Proc. *IEEE Innovative Smart Grid Technologies-Asia (ISGT Asia)*, Bangalore, India, Nov 2013.
Citation Count: 9
- 2) A. Guha, A. Tripathi, and G. Narayanan, "Experimental study on dead-time induced oscillations in a 100-kW open-loop induction motor drive," in Proc. *National Power Electronics Conference NPEC 2013*, Kanpur, India, Dec 2013.
Citation Count: 11
- 3) A. Guha, A. Datta, C. Rangesh, and G. Narayanan, "Experimental investigation on switching characteristics of high-current insulated gate bipolar transistors at low currents," in Proc. *IEEE International Conference on Electrical Energy Systems, ICEES 2014*, Chennai, India, Jan 2014.
Citation Count: 5
- 4) A. Guha and G. Narayanan, "An improved dead-time compensation scheme for voltage source inverters considering the device switching transition times," in Proc. *IEEE India Intl Conf on Power Electron. (IICPE), 2014*, Kurukshetra, India, Dec 2014.
Citation Count: 8
- 5) A. Guha and G. Narayanan, "Small-signal stability analysis of an open-loop induction motor drive including the effect of inverter dead-time," in Proc. *IEEE Power Electron. Drives Conf. (PEDES), 2014*, Mumbai, India, Dec 2014.
Citation Count: NA
- 6) A. Guha and G. Narayanan, "Inductance-emulation-based active damping of dead-time-induced oscillations in a 100-kW induction motor drive" in Proc *IEEE Transportation and Electrification Conf, ITEC-India, 2015*, Chennai, India, Aug 2015.
Citation Count: 2

- 7) A. Guha, A. Chetty, C. Kumaresan, G. Narayanan and R. Krishnamoorthy, "Theoretical prediction and experimental verification of light-load instability in a 11-kW open-loop induction motor drive," in Proc. *National Power Electronics Conference NPEC 2015*, Mumbai, India, Dec 2015.
Citation Count: NA
- 8) A. Guha, A. Chetty, E. Panda, C. Kumaresan, G. Narayanan, and R. Krishnamoorthy, "Experimental case studies on dead-time induced oscillations and its mitigation in 5-hp and 10-hp induction motor drives," in Proc. *IEEE International Conference on Electrical Energy Systems, ICEES 2016*, Chennai, India, March 2016.
Citation Count: nil
- 9) A. Guha and G. Narayanan, "Impact of dead-time on inverter input current, dc-link dynamics and light-load instability in rectifier-inverter-fed induction motor drives," in Proc *IEEE SPEEDAM 2016*, Anacapri, Italy, June 2016.
Citation Count: NA
- 10) A. Guha and G. Narayanan, "Impact of under-compensation and over-compensation of dead-time effect on small-signal stability of induction motor drive", in Proc *IEEE Power Electron. Drives Conf. (PEDES), 2016*, Trivandrum, India, Dec 2016.
Citation count: nil

CONFERENCES (Coauthored Publications in Chronological Order) :

Published/Accepted:

- 1) Arvindan, A. N., and A. Guha. "Novel topologies of 24-pulse rectifier with conventional transformers for phase shifting." in Proc. *IEEE International Conference on Electrical Energy Systems, ICEES 2011*, Chennai, India, 2011.
Citation Count: 14
- 2) A. Datta, A. Guha and G. Narayanan, "An advanced gate driver for insulated gate bipolar transistors to eliminate dead-time induced distortions in inverter output," in Proc. *IEEE Power Electron. Drives Conf. (PEDES) 2014*, Mumbai, India, Dec 2014.
Citation Count: 2