SUBHASHISH BHATTACHARYA

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A. RESUME

1. Education background:

- **Ph.D** – Electrical & Computer Engineering, August 2003, University of Wisconsin–Madison
  "High Power Active Filter Systems" – Advisor: Prof. Deepak Divan
- **M.E.** – Electrical Engineering, March 1988, Indian Institute of Science, Bangalore, India
  "Modeling and Simulation of HVDC systems for Dynamic Stability Analysis"
  – Advisors: Prof. K. Parthasarathy and Prof. K. R. Padiyar
  – Valedictorian: Awarded the N.R. Khambhati Memorial Medal for best Electrical Engineering student (1987-1988) [attended from 8/1986 – 3/1988]
- **B.E. (Hons)** – Electrical Engineering, June 1986, Indian Institute of Technology (IIT)–Roorkee, (formerly, University of Roorkee), Roorkee, India [attended from 7/1982 – 6/1986]

Senior Design Project: **"**Microprocessor based Current Source Inverter fed Induction Motor Drive" [Best senior design project award in the EE dept.]

2. Professional experience:

- *Duke Energy Distinguished Professor, Department of ECE, NC State University, July, 2018-*
- *Professor, Department of ECE, NC State University, Aug. 16, 2016 – June 30, 2018*
- *ABB Term Professor, Department of ECE, NC State University, Aug. 16, 2014 – Aug 15, 2016*
- *PowerAmerica NNMII [DOE funded WBG (Wide-Band Gap Institute] co-PI, from Jan 2014*
- *ABB Term Associate Professor, Department of ECE, Aug. 16, 2011 – Aug, 15, 2014*
- *FREEDM Systems Center, NSF–ERC co-PI and founding sub-thrust leader on "Solid State Transformer"; was involved from the beginning (2/2007) in developing NSF FREEDM proposal*
- *Assistant Professor, Department of Electrical & Computer Engineering, Aug 2005–Aug 2011*
- *Technical Advisor–Engineer (FACTS & HVS Division),* SIEMENS Power Transmission & Distribution, FACTS & HVS Division; *8/2003 - 8/2005*
- *Senior Engineer (FACTS & HVS Division),* SIEMENS Power Transmission & Distribution, FACTS & HVS Division; *12/1998 - 7/2003*
- *Consultant and Part-time Employee,* Soft Switching Technologies, Middleton,WI; *9/1996 – 11/1998*
- *Consultant and Engineering Intern,* York International Corp., York, PA; *5/1994 – 8/1996*

[**Part of my PhD thesis research on "High Power Active Filter Systems" was commercialized by York International Corporation (now part of Johnson Controls) as "IEEE 519 Filter" for York's air-conditioner chillers and has been in production since 1996;**
S Bhattacharya, TM Frank, DM Divan, B Banerjee, "Active filter system implementation," Industry Applications Magazine, IEEE 4 (5), 47-63, 1998**]**

- *Engineering Intern,* GE Corporate R & D Center, Niskiyuna, NY; *7/1993 – 10/1993*
- *Graduate Research Assistant and Graduate Teaching Assistant,* Dept. of ECE - WEMPEC, University of Wisconsin – Madison; *1/1990 – 8/1996*
- *Graduate Research Assistant,* Dept. of ECE, University of Tennessee – Knoxville; *8/1988 – 12/1989*
- *Engineer, Tata Consultancy Services (TCS), New Delhi, India; 4/1988 – 7/1988*
- *St. Joseph's High School, Allahabad, India; 1/1970 – 6/1982 [elementary, middle and high school]*

3. Research Areas: Power Electronics; Utility Applications of Power Electronics

- Power Conversion Applications of HV SiC devices; High Power Converter Systems and Control
- Solid State Transformer and High Frequency Magnetics for Power Conversion Applications
- Reliability Assessment of HV SiC Devices for MV Power Converter Applications
- FACTS and Utility Applications of Power Electronics to Power Systems
- Voltage Source Convertor Based HVDC Systems and Multi-Terminal DC Applications
- Active Power Filters for Harmonic Mitigation
- Grid Interconnection of renewable energy sources with energy storage systems

4. Scholarly and professional honors and awards:

- *Duke Energy Distinguished Professor, Department of ECE, NC State University, July, 2018*
- Selected as NCSU University Chancellor's Faculty Scholar, Jan 2015 – Dec 2019 [18 total chosen from across all colleges at NCSU]
- ABB Term Professor, Department of ECE, Aug 16, 2014 – Aug 15, 2016
- ABB Term Associate Professor, Aug 16, 2011 – Aug 15, 2014
- Nominated by ECE dept for Alcoa Foundation Award 2018
- Nominated by the ECE dept for RJ Reynolds Award 2017
- Best Paper Award IEEE PELS TC6 2018:
  S. Hazra, S. Bhattacharya, K. Hatua; "Gate Driver Design Considerations for Silicon Carbide MOSFETs Including Series Connected Devices" has been selected for the IEEE PELS TC6 Emerging Technology Best Paper Award. The paper was accepted for the ECCE 2017 High-Performance and Emerging Technologies Track-K.

* Second Place Prize Paper Award in 2016 for all papers published in the IEEE Transactions on Power Electronics in 2016 (award presented at IEEE ECCE 2017 conference); S. Hazra, S. Bhattacharya, et al., "High Switching Performance of 1700-V, 50-A SiC Power MOSFET Over Si IGBT/BiMOSFET for Advanced Power Conversion Applications," in IEEE Transactions on Power Electronics, vol. 31, no. 7, pp. 4742-4754, July 2016
* Nominated by ECE dept for Alcoa Foundation Award 2016
* Best Paper at IEEE 6th International Symposium on Power Electronics for Distributed Generation Systems (PEDG), Aachen, Germany, June 2015 for: Madhusoodhanan, S.; Mainali, K.; Tripathi, A.; Kadavelugu, A.; Patel, D.; Bhattacharya, S., "Thermal design considerations for medium voltage power converters with 15 kV SiC IGBTs".
* Nominated by ECE dept for Alcoa Foundation Award 2014
* Ankan De (PhD student) received the IEEE Suozzi INTELEC(R) Fellowship of $15K for the proposal "Three Phase Three Switch Soft Switching High Frequency Link Rectifier for Telecommunication Power Supply Application" in 2013 – this is based on his PhD research
* IEEE Power Engineering Society Transmission & Distribution Technical Committee Working Group Recognition Award, 2005
* Awarded the best prize paper at the IEEE International Symposium on Industrial Electronics (ISIE), Athens, Greece, July 1995 for the paper titled "Active Filter Solutions for Utility Interface" by Subhashish Bhattacharya, Deepak Divan and Ben Banerjee.

* Awarded the N.R. Khambhati Memorial Medal for best Electrical Engineering student (1987-1988), Indian Institute of Science (IISc), Bangalore, India for Valedictorian in M.E. Electrical Engg.
* Best senior design project award, B.S. (EE, Hons), Indian Institute of Technology, Roorkee, India, 1986

4. Professional service on campus:

- Teaching courses, Capstone project mentor and advisor for MS-EPSE, Aug 2012 - present
- Teaching courses, Capstone project mentor and advisor for MS-WBG, starting Spring 2016
- Mentored (Advisor) and recruited NCSU ECE dept UG **valedictorians** for MS and PhD for the past several years [Daniel Fregosi (2009; for PhD, graduated), Priyadarshini Asokan (2010; for MST, graduated), Heather Vaughn (2011; for MS-EPSE, graduated), Akash Gujarati (2012; for MS, graduated)]; other NCSU ECE dept UG students - Richard Byron Beddingfield (2011 as UG REU; MS-EPSE, now graduated PhD student in June 2018); Eric Green (2010 as UG REU; MS-EPSE, current PhD student); Nicholas Parks (2008 as ECE UG REU, Senior design, joined MS and graduated in 2012); Justin Smith (2008 as ECE UG REU, Senior design, joined MS with Prof Baran and graduated in 2013)]

- Awarded "FREEDM Systems Center Industry Champion" in 2010 for recruiting industry members for FREEDM and ATEC center
- Faculty member (co-PI) of DOE NNMII PowerAmerica since Jan 2014 - present
- Faculty member of FREEDM and ATEC outreach, REU, RET, and HS student mentoring
- Faculty member of NSF ERC FREEDM Center–subthrust leader "Solid State Transformer(SST)"
- Faculty member of ATEC center –Advanced Transportation Energy Center– for PHEV research
- Faculty member of NSF I/UCRC ASTREC – Adv. Space Tech. Research & Engineering Center
- ECE faculty advisor for "EcoCAR" project – Development of Hybrid & PHEV (Plug-in Hybrid Vehicle) - advised ECE senior design project for EcoCAR (3 ECE UG students) for 2years
- Mentor of many ECE UG research students and FREEDM REU students, from 2006 – present [*Recruited 12+ NCSU ECE UGs for MS & PhD through ECE UG research and FREEDM REU*]
- Member of ECE Department Graduate Admissions Committee, Sept. 2008 – Aug. 2011
- Member of the NCSU – TERI cooperation on "Lighting a Billion Lives" (LaBl) campaign, 2008
- Member of Faculty Search Committee, PES area, 2006 – present
- Member of PES area PhD qualifying exam, 2006 - present
- Member of ECE Department Outreach and Open House Committee, Aug. 2005 – Aug. 2011
- Member of ECE Department Assessment Committee, from Feb 2007 – Aug. 2011
- Member of ECE Department UG Research Committee, 2006– 5/2008; Aug 2014 - present

5. Professional service off campus:

- Associate Editor, IEEE Transactions on Power Electronics; from 2008 - present
- Reviewer IEEE Transactions on Power Electronics, IEEE Transactions on Industry Applications, IEEE Transactions on Power Delivery, IEEE Transactions on Industrial Electronics; from 2000 - present
- Reviewer for IEEE Conferences – ECCE, IECON, APEC conferences every year; earlier reviewer for IEEE IAS, IEEE PESC conferences; from 1999 - present
- Reviewer of ARPA-E, DOE proposals since 2011
- Reviewer of DOE SBIR – STTR proposals in 2011, 2012, 2013, 2014, 2015
- Reviewer of National University of Singapore (NUS), Singapore proposals in 2013
- Reviewer of Chilean National Science & Technology Foundation proposals 2011, 2012
- Reviewer of Qatar National Science Foundation proposals in 2013
- Reviewer of Swiss National Science Foundation proposals in 2015/2016
- Reviewer of Polan National Science Foundation proposals in 2016/2017
- Reviewer of Kentucky Science Foundation proposals in 2011 – present
- PhD thesis external reviewer for several foreign universities – such as NTNU (Norway), Chalmers (Sweden), IITs (India), NITs (India)
- Invited to DOE Solar workshop – Aug 2010 - present, NSF/NIST Power Electronics workshop – May 2008
- IEEE ECCE 2009, 2010, 2011, 2013 Annual Meeting: Technical Program committee member
- **IEEE ECCE 2012 Meeting: Technical Program Co-Chair (team of 5 co-chairs – conference in Raleigh)**
- **IEEE IAS 2008, 2007, 2006, PESC 2006 conference: Tutorial Organizer and tutorial presenter on "High Power Converters"**
- IEEE IAS, PESC Conferences (1998 – 2008): Served in numerous Technical program committees
- IEEE ECCE, IAS, PESC Conferences (1998 – 2012): Served as session chairs, session organizer every year
- **IEEE 2007 PESC Program Committee Member**
- **Member of Power Electronics Technical Committee (PETC) in IEEE Industrial Electronics Society (IES) since 2008 - present**
- **IEEE 2006 ICIT (India) Program Committee Member and Publicity Chair**
- NSF SBIR/STTR Review Panel – September 2005, April, 2004
- NSF Review Panel – Feb 2009, November 2010
- Member of several IEEE Power and Energy Society Working Groups, member of CIGRE working group (B4-40) 2004-2008; **co-author of two CIGRE B4-40 reports published**

II. TEACHING AND MENTORING OF UNDERGRADUATE AND GRADUATE STUDENTS

1. Courses Taught

- ECE 534 - Power Electronics, [offered as both on-campus and Distance Education (online) course every Fall; only Distance Education (online) course every Spring; also offered EOL in Summer 2018]
- ECE 792E (Advanced Power Electronics), offered every Spring since Spring 2006
- ECE 792U (Utility Applications of Power Electronics, FACTS and Custom Power), [offered irregularly]
- ECE 305 (Taught 1/3 course with Profs. Baran & Lukic, Fall 2010)
- ECE 534 and ECE 434 combined class – offered only in two semesters

2. Instructional Development highlights:

- First place in ECE Senior Design 2019 – "Automatic 3D Flux Mapper"; ECE UGs Jason Katsaros, Kyle Northrop, Gabrielle Johnson, Geoffrey Balshaw, Christopher Webb; mentored with Richard Byron Beddingfield
- Regular teaching ECE 534-001 (on-campus) and ECE 534-601 (EOL section) every Fall and ECE 534-651 (EOL section) in summer 2018 – this course has 40% grade on a practical DC power converter supply design based project, and 20% on HWs
- – this course has been upgraded with WBG power electronics materials and reported to DOE as part of PowerAmerica educational activities and as a deliverable to DOE.
- Continued developing the ECE 534 companion laboratory with WBG (SiC and GaN) devices power converters through ECE senior design projects and from reference design of PowerAmerica education projects – this is to train UGs and Graduate students in WBG based power electronics as part of PowerAmerica deliverable to DOE.
- Updated ECE 792E course material on "Advanced Power Electronics – Modeling and Control of Three Phase Power Converters" and included WBG based power conversion materials – this updated material was used for course taught in Spring 2019 semester
- Developed PowerAmerica short course modules on "SiC Power Device Characterization and Converter Applications" delivered in Nov 2018 and reported as a deliverable to DOE
- Developed and awarded a PowerAmerica educational proposal in BP5 on "SiC based MV Power Converter Design" – this will be reported as an educational deliverable to DOE in 2019
- IEEE ECCE 2018 tutorial proposal for "High power/voltage power converters and applications – Opportunities and Challenges offered by HV SiC power devices" selected - Developed and delivered ECCE 2018 tutorial (with Dr. Richard Byron Beddingfield) in Sept 2018, and reported to DOE as part of PowerAmerica deliverable to DOE. This tutorial was attended by over 120 people and "highly successful" according to ECCE.
- Contributed to magnetics tutorial materials developed for TMS and MMM 2018 conferences – this has been done as part of our collaboration with CMU

- Teaching courses, Capstone project mentor and advisor for MS-EPSE (Electrical Power Systems Engineering), Dept. of ECE since Aug 2012; 5. Capstone project for MS EPSE Spring 2013, EPSE Fall 2014, EPSE Spring 2014, EPSE Fall 2014, EPSE Spring 2015
- Teaching courses, Capstone project mentor and advisor for one MS-WBG (Wide Band-Gap) based Power Electronics, Dept. of ECE, since Spring 2017
- Developed Power Electronics laboratory experiments and setups for ECE 434 PE course in Fall 2012 – this is being used as a supplement to ECE 434 lecture course
- Created New Course: ECE 792E (*Advanced Power Electronics*) for new PES curriculum (in Spring 2006 and offered every year Spring semester).
- Created New Course: ECE 792U *(Utility Applications of Power Electronics, FACTS and Custom Power)* for new PES curriculum (in Fall 2006).
- Revised ECE 534 course syllabus in Fall 2010 for DOE MS-EPSE program
- Revised ECE 434 course through combined ECE 534 / ECE 434 class
- Developed new graduate "HVDC and MTDC (Multi-Terminal DC)" course at 700 level [ECE 7xx] – at the request of ABB to educate graduate students in HVDC and FACTS area; course to be offered in the near future
- Developing a ECE 534 companion laboratory experiments with WBG (SiC and GaN) devices power converters by 4 senior design projects in Fall 2015 – this is being driven by the MS – WBG program to be offered by PowerAmerica (DOE NNMII)
- ECE 600: Presented one lecture on "Power Electronics and Power Systems and FREEDM Systems Center" in ECE 600 in Spring 2007, Fall 2007, Spring 2008, Fall 2008, Spring 2009, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Fall 2011, Fall 2014
- ECE 109 [Introduction to Engineering]: Presented one lecture on "Power Electronics and Power Systems" in ECE 109 in Fall 2005, Fall 2006 to freshman class
- ECE 561[Embedded Systems] by Prof. Alex Dean: Presented one guest lecture on "Switching Power Supplies and DC-DC power converters" in ECE 561 in Spring 2012, Spring 2013, Spring 2014 – this is part of the guest lecture for the NSF funded project on "CSR: Small: Cost-Effective Energy Efficiency through DVFS (Dynamic Voltage Frequency Scaling) with Real-Time Switching Power Supplies" with Prof. Alex Dean.
- ECE 403 [Electronics Engineering – Analog CMOS course] by Prof. Griff Bilbro: Presented one guest lecture on "Switching Power Supplies and Digital control of DC-DC power converters" in ECE 403 in Spring 2012, Spring 2011, Fall 2009, Fall 2008, Spring 2008, Fall 2007.

3. Independent Study:

1. Kasunaidu Vechalapu, Fall 2013 – PhD student (Independent Study, ECE 833 – 3 credits) – "Study on VSC topologies for MVDC and HVDC systems with HV SiC devices".
2. Roger Brewer [Off Campus Distance Education Student – employee of Lockheed Martin Company, Spring 2013 – MS student (Independent Study, ECE 634 – 3 credits) – "Energy Storage Technologies and Ultracapacitors as a Power Boost".
3. Vishal Khawarey, Spring 2008 – MS student (Independent Study, ECE 634 – 3 credits) – "Design and implementation of a digital flickermeter on DSP based controller platform".
4. Lenoard White, Fall 2007 – PhD student (Independent Study, ECE 834 – 3 credits) – "Design and algorithm development for a digital flickermeter based on IEC standard".

5. Anand Ramamurthy, Fall 2007 – MS student (Independent Study, ECE 634 – 3 credits) – "Design of a reliable, high performance Power Control Module for autonomous Space Robots/Satellites".
6. Maaz Aziz, Fall 2006 (Independent Study, ECE 634 – 3 credits) - "Effects of Parasitics in Boost Converter at High Frequency".
7. Robert Dawley, Fall 2006 (Independent Research, ECE 693 – 1 credit) – "Dual Current Source Inverter Switching Control Strategies"

4. **ECE Senior Design, Undergraduate Research (NCSU UG students) and REU Students: On average 4-5 UG students every semester for UG research, REU and ECE Senior Design**

- First place in ECE Senior Design – "Automatic 3D Flux Mapper"; ECE UGs Jason Katsaros, Kyle Northrop, Gabrielle Johnson, Geoffrey Balshaw, Christopher Webb; mentored with Richard Byron Beddingfield
- Advisor to senior design projects – typically 2 every semester each with 4 students
- - Every semester 4-5 ECE REU UG students working with PhD students on sponsored projects
- - S'18 and F'18 semesters had 5 ECE UG students working with PhD students on sponsored projects (including my two PA projects)
- - Mentoring ECE MS thesis students (typically 4-5); around 15+ paid MS hourly students working with PhD students on sponsored projects
- - Mentoring ECE PhD, MS students – currently 20 PhD students, 5 MST students

- 2009-10: Joseph Elliott (NCSU MAE) – UG research on thermal management of SST
- 2010: Eric Green (ECE) – UG research, then continued on for MS and currently PhD student
- 2010-2011: Heather Vaughn* [*Heather Vaughn was the NCSU ECE dept valedictorian in 2011; also did senior design project with me and graduated with MS-EPSE as ABM]
- 2013: Matthew Boyce (ECE) – UG research
- Fall 2013 – ECE Senior design: Lloyd Adams, Michael Irwin, Ling Jiang; "Typhoon HIL DSP Interface System and implemented power converter controller"
- Summer 2014 – UGRS: Pamela Dupree; "FEA of Series Coupled DC side Transformer Flux - Multiple FEA models for DC flux cancellation", prepared and part of PES-GM 2014 poster
- Fall 2014: REU – Andrew Choi: "Typhoon HIL model of Eaton UPS system"
- Fall 2014: REU – Erin Fenton: "Beagle Bone based communications for SST mini-grids"
- Fall 2014: REU – Stephen Kerr: "ARM DGI for SST mini-grid system"
- Fall 2015: REU – Michael Irwin: "DC active filter controller assessment and development"; did comprehensive assesment with PE capability based guidelines.
- Spring 2015: BS/MS Exchange student from RWTH-Aachen – Martin Gerlach: "Digital Thyristor control for MVDC system"
- Spring 2015: REU – Alex Davis: "Characterization of Parallel Active Filter System"; Implemented multiple active filter models, rebuild MVDC test bed and ESTS 2015 publication, construction of LV SST.
- 2015-2016: ECE Senior design: Khalifa Al Ali, Reuben Valeriano, Mark Hwang, Karin Eriksson; "Dispatchable Solar Energy Source"; Developed controls for novel switch converter to actively control power flow.

- Fall 2016: Exchange student – Natasha Wiechers; "Power Electronics converter batch testing in Opal-RT"
- Fall 2016: REU – Allan Odour; "Power Electronics converter batch testing in Opal-RT"
- Fall 2016: REU –Kyle Daughenbaugh; "Power Electronics converter batch testing in Opal-RT"
- Fall 2016 and Spring 2017: REU – David Storelli; "Characterization of Magnetic Materials" [co-authored several papers and one IP disclosure which is provisional patent now]
- 2016-2017: ECE Senior design: Abdalla Jasim Alzaabi, Daniel James Masters, Hector Suarez, Ryan Patrick Vary; "High Power Programmable Load"; Constructed a 50kW DC-DC programmable load for laboratory testing.
- Fall 2018: REU – David D'Amico; "Python automated magnetic core testing system"
- Fall 2018: REU – T.J. Adams; "Python automated magnetic core testing system"
- Fall 2018: REU – Jacob Maryak; "Python automated magnetic core testing system"
- Fall 2018: REU – Akshay Paruchuri; "Python automated magnetic core testing system"
- Fall 2018: REU – Paul Galeazzi; "Python automated magnetic core testing system"
- Summer 2018: UGRS – Jason Arias; "FEA Validation of Transformer with Strain Anealed Integreated Lekage Inducance"; Verfied transformer operation.
- Summer 2018: UGRS – Abir Muhuri; "Development of Typhoon HIL MVDC Model"; Several crucial steps forward on model, ultimately unable to verify HIL capability due to coupling / fundamental issues.
- Summer 2018: UGRS – Stephen Paul; "Design of High Power, Low Capacitance Inductor for Grid Tied SST"; Provided several improved inductor designs with reduced mass, volume and capacitance.
- Summer 2018 and Fall 2018: REU / UGRS – Mark Nations; "Advanced Magnetic Core Characterization / Genetic Algorithm Based Optimization of Axial Transformers with Strain Annealed Leakage Cores"; 3D Flux Field Mapping of for Leakage Loss Characterization / Working algorithm showing designs with >99% effieciency and >50W/in^3 (DOE SunLamp project metrics)
- Summer REU 2009: Matthew Crumpler, Victor Lopez, Ines M. Radovanovic-Rivas, Daniel Fergosi [Daniel Fergosi was the NCSU ECE dept valedictorian in 2009; also did senior design project with me and graduated with PhD]
- Summer REU 2010: Michele Bustamante and Chris Adkins and Adam Smith
- Summer REU 2011: Adam Nickels
- Summer REU 2012: Matthew Wiesner, Elisabeth Foster
- Summer REU 2013: Chad Auginash
- Three ECE UG students supported by ECE dept for UG research since Jan 2010 until Fall 2013.
- Consistently have 3 FREEDM REUs and one ECE REU (UG – both NCSU and outside) since Summer of 2009 continuously. These students have been able to contribute towards FREEDM conference papers and also one IEEE ECCE 2010 conference paper.
- Two student groups for ECE senior design in S' 2011, Fall 2011, S' 2012, Fall 2012, S' 2013, Fall 2013 – 4 students each
- One student groups for ECE senior design in Spring 2014 – 4 students
- Two student groups for ECE senior design in Fall 2010 – 4 students
- One student group for ECE senior design in Spring 2010 – 4 students
- One student group for ECE senior design in Fall 2009 – 4 students
- One student group for ECE senior design in Fall 2008 – 4 students–"Design and development of a solar charging station and large-scale parking deck for charging PHEVs (Plug-in Hybrid Cars).

- One group of students for ECE senior design in Spring 2009 – 3 students with EcoCAR project.
- REU student Ricardo Calderon - UG ECE student from Mississippi State University, Summer 2008 - working on a research project "Battery modeling and battery control for Hybrid Electric Vehicle".
- NCSU UG ECE student Nick Parks – funded through NCSU UG Energy research fund for Summer 2008 - working on a research project "Inverter modeling and control for Hybrid Electric Vehicle – for Toyota Prius Car". Continuing to advise in Fall 2008 and Spring 2009 for ECE Senior Design project.
- NCSU UG ECE student Justin Smith – funded through NCSU UG Energy research fund for Summer 2008 - working on a research project "Power semiconductor device level modeling and Inverter control for Hybrid Electric Vehicle – for Toyota Prius Car". Continuing to advise in Fall 2008 and Spring 2009 for ECE Senior Design project.
- **EcoCar Project** – faculty advisor from ECE dept since Feb 2008 - NCSU UG ECE students Nick Parks and Justin Smith – working on the EcoCar research project "Inverter modeling and control for Hybrid Electric Vehicle and Plug-in Hybrid Electric Vehicles".
- Marcus Wagnborg, Fall 2005, Spring 2006 – Sophomore UG student working in the SPEC lab. under my guidance on a project "Design and development of a flexible multipurpose DSP controller system with control redundancy for power electronics applications" with my MS graduate student Rahul Godbole.
- Stevan Dupor, Fall 2006, Spring 2007 - Junior UG student working in the SPEC lab. under my guidance on a project "Design and development of a flexible multipurpose DSP controller system with control redundancy for power electronics applications" with my MS graduate student Rahul Godbole. **Recipient of COE UG research award.**

- **D. MASTER'S AND DOCTORAL THESES DIRECTED AND BEING DIRECTED**

1. Mentored PhD Thesis as chair [26] and co-chaired PhD Thesis [3]:

1. Babak Parkhideh, PhD (graduated May 2012), (my role: chair).
   Thesis: "**Control Methods and Architectures for Voltage-Sourced Converter Based Systems for Utility Applications**".
   [Joined EPIC center and Dept of ECE, UNC-Charlotte as Assistant Professor; now Associate Professor (with tenure)]
2. Leonard White, PhD (graduated August 2012), (my role: chair).
   Thesis: "**Compensation of Electric Arc Furnaces Based on LaGrange Minimization**".
   [Joined FREEDM Systems Center, Dept of ECE, NC State University, as Assistant Research Professor; now Research Professor]
3. Zhengping Xi, PhD (graduated May 2013), (my role: chair).
   Thesis: "**Control Strategy of STATCOM during System Faults**".
4. Arun Kadavelugu, PhD (graduated Dec 2014), (my role: chair)
   Thesis: "**Medium Voltage Power Conversion Enabled by 15 kV SiC IGBTs**"
   [Joined ABB Corporate Research Center, Raleigh].
5. Seunghun Baek, PhD (graduated Dec 2013), (my role: chair).
   Thesis: "**High-Frequency AC-link Transformers for Medium-Voltage DC/DC Converters and Solid State Transformer Applications**".
   [Joined Enphase Inc., CA; now Assistant Professor, Kyungnam University, South Korea]
6. Daniel Fregosi, PhD (graduated May 2014), (my role: chair).
   Thesis: "**Ripple Droop Control: Control of Distributed Storage Devices with Droop Control using AC Voltage Injection**".
   [Joined Robert Bosch Inc.; DC Microgrids Division, Charlotte, NC; Post-Doc at NCSU with me; Research Associate at EPIC, UNC-Charlotte; now at Electric Power Research Institute (EPRI), Charlotte, NC]
7. Saman Babaei, PhD (graduated May 2014), (my role: chair).
   Thesis: "**Control Structures for VSC-based FACTS Devices under Normal and Faulted AC-systems**".
   [Joined New York Power Authority (NYPA), White Plains, NY, now at Arrivo Corporation]
8. Nima Yousefpoor, PhD (graduated May 2014), (my role: chair).
   Thesis: "**Control of Advanced Power Converter Topologies for Transmission Grid Management**".
   [Joined Quanta Technologies, Raleigh, NC; now at Eaton Corporation, Raleigh, NC]
9. Sumit Dutta, PhD (graduated Aug 2014), (my role: chair);
   Thesis: "**Solid State Transformer Applications and Control of Dual Active Bridge DC to DC converter**"
   [Joined John Deere Electronics Division, Fargo, ND]

10. Hesam Mirzaee, PhD (graduated Aug 2014), (my role: chair).
    Thesis: "**Medium-Voltage DC Power Conversion and Distribution for Efficient Electric Power Delivery in Shipboard and Mobile Mining Application**".
    [Joined Quanta Technologies, Raleigh, NC]
11. Ankan De, PhD (graduated Dec 2015), (my role: chair).
    Thesis: "**Device Characterization, Hardware Implementation and System Analysis of Soft Switched AC/AC Converters**"
    [Joined Texas Instruments, PA; now at Apple Inc.]
12. Sachin Madhusoodhanan PhD (graduated Feb 2016), (my role: chair).
    Thesis: "**Control Technique for Medium Voltage SiC Devices based Active Front End Converter for Grid Tied Solid State Transformer Applications**".
    [Joined GE Corporate Research Center, NY; now at ON Semiconductor].
13. Awneesh Tripathi, PhD (graduated March 2016), (my role: chair).
    Thesis: "**Control Design and Characterization of Medium-Voltage Three-phase Dual Active Bridge Converters with HV SiC Devices**".
    [Joined ABB, Pittsburgh].
14. Samir Hazra, PhD (graduated Nov 2016), (my role: chair).
    Thesis: "**Power Converter Architectures and Control for Wave Energy Generation and Integration**".
    [Joined NCSU with me as Post-Doctoral Scholar; now at Electronic Power Conversion (EPC), San Diego, CA].
15. Ali Azidehak, PhD (graduated April 2017), (my role: chair).
    Thesis: "**Design of Fault Tolerant Controller for Modular Multi-Level Converter**"
    [Joined Gotion Inc.; San Jose, CA].
16. Yonghwan Cho, PhD (graduated Aug 2017), (my role: chair).
    Thesis: "**Distributed Control of Multiple Solid State Transformer and Current Source Converter based Solid State Transformer**"
    [Joined Analog Devices; San Jose, CA].
17. Govind Chavan, PhD (graduated August 2017), (my role: chair).
    Thesis: "**Dynamic Control of FACTS devices to enable large scale penetration of Renewable Energy Resources**"
    [Joined SmartWires Inc.; CA].
18. Kasunaidu Vechalapu, PhD (graduated Aug 2017), (my role: chair),
    Thesis: "**Enabling High Efficiency Medium Voltage Converter for High Speed Drives and Other Grid applications using Low Voltage (LV) and High Voltage (HV) Silicon Carbide (SiC) Devices**"
    [Joined Eaton Corporation].
19. Mahsa Ghapandar Kashani, PhD (graduated Nov 2017), (my role: chair).
    Thesis: "**System Study for High PV Penetration in Distribution Systems**"
    [Joined SmartWires Inc.; CA].
20. Maziar Mobarrez, PhD (graduated Jan 2018), (my role: chair).

Thesis: "**DC Microgrids: Architectures, Control and Economic Analysis**".
[Joined ABB Corporate Research Center, Raleigh].

21. Richard Byron Beddingfield, PhD (graduated June 2018), (my role: chair).
Thesis: "**High Power Medium Frequency Magnetics for Power Electronics Applications**".
[joined NETL, DOE Lab]
22. Ritwik Chattopadhyay, PhD (graduated Nov 2018),
Thesis: "Three Port Transformer Isolated Phase Shifted DC-DC Converter Design & Control for Renewable Energy Source and Energy Storage Integration"
[Joined Eaton Corporation, Raleigh, NC].
23. Sayan Acharya, PhD (graduated May 2019),
Thesis: "**Control and Operation of Multi-Terminal HVDC system and MV power converters with SiC devices**".
[Joined ABB CRC, Raleigh, NC].
24. Faris Alfaris, PhD (graduated Nov 2019), (my role: chair)
Thesis: "**Modular Static Transmission and Distribution Controller for Distributed Renewable Energy Resources**".
[Joined as faculty in ECE dept at King Saud University, Saudi Arabia]
25. Vishnu Iyer, PhD (graduated Nov 2019, passed prelim), (my role: chair);
Thesis: **"Extreme Fast Charging Station Power Delivery Scheme for Electric Vehicles with Partial Power Processing".**
[Joined GE-GRC, NY]
26. Srinivas Gulur, PhD (graduated Jan 17, 2020), (my role: chair);
Thesis: **"Advanced Control of Voltage Source Converters for Grid-Tied Applications with Integrated Filtering Solutions".**

27. Giti Karimi, PhD (graduated May 2014), (my role: co-chair; with co-chair Prof. Richard Gould, MAE).
Thesis: "**Applications of Thermomagnetic Convection in Thermal Management of Electronic Systems**"
[Joined ABB Corporate Research Center, Raleigh; now at Zunum Aero].
28. Jun Li, (graduated Sept 2010), (my role: Co-chair; with Co-Chair: Alex Huang).
Thesis: "**Design, Control and Characteristics of Multilevel Active NPC Converters for High Power Applications**".
[Joined industry ABB Corporate Research Center, Raleigh; now at Eaton Corporation, Raleigh, NC].
29. Sercan Teleke, PhD (graduated Jan 2010), (my role: co-chair; with Chair: Mesut Baran).
Thesis: "**Control Methods for Energy Storage for Dispatching Intermittent Renewable Energy Sources**".
[Joined industry Quanta Technologies Inc. as first job].

2. Currently mentoring 28 PhD Students and Thesis (as chair):

30. Eric Green, PhD (will graduate Dec 2020), (my role: chair).
    Thesis: "**Power Converter Control and Reliability for Battery Energy Storage Systems for Frequency and Voltage Regulation in Microgrids**".
    [Joined Pike Corporation, Raleigh, NC].
31. Mohammed Alharbi, PhD (will graduate May 2020, passed prelim), (my role: chair)
    Thesis: "**HVDC system with Modular Multi-Level Converters – Operation under system faults and reliability**".
32. Suyash Shah, PhD (will graduate Feb 28, 2020, passed prelim), (my role: chair);
    Thesis: **"Modeling and Analyses of DC-DC Converter Systems for Auxiliary Power Supply in Heavy Vehicles".**
33. Ashish Kumar, PhD (will graduate Dec 2020), (my role: chair; co-chair: Prof. Jay Baliga);
    Thesis: TBD
34. Heonyoung Kim, PhD (will graduate Dec 2020), (my role: chair); Thesis: TBD
35. Anup Anurag, PhD (will graduate August 2020), (my role: chair); Thesis: TBD
36. Sanket Parasher, PhD (will graduate August 2021), (my role: chair); Thesis: TBD
37. Yos Prabowo, PhD (will graduate August 2021), (my role: chair); Thesis: TBD
38. Harish Pulakhandam, PhD (will graduate August 2022), (my role: chair); Thesis: TBD
39. Semih Isik, PhD (will graduate August 2022), (my role: chair); Thesis: TBD
40. Harshit Nath, PhD (will graduate August 2022), (my role: chair); Thesis: TBD
41. Niloofar Ghanbari, PhD (will graduate August 2022), (my role: chair); Thesis: TBD
42. Ajit Kanale, PhD (will graduate August 2021), (my role: chair, co-chair: Prof. Jay Baliga);
43. Mehrnaz Madadi, PhD (will graduate August 2022), (my role: chair)
44. Sneha Narasimhan, PhD (will graduate August 2022), (my role: chair)
45. Isaac Wong, PhD (will graduate August 2022), (my role: chair)
46. Sagar Rastogi, PhD (will graduate August 2022), (my role: chair)
47. Nithin Kolli, PhD (will graduate August 2023), (my role: chair)
48. Apoorv Agarwal, PhD (will graduate August 2023), (my role: chair)
49. Shrivastal Sharma, PhD (will graduate August 2023), (my role: chair)
50. Partha Das, PhD (will graduate August 2023), (my role: chair)
51. Subhranshu Satpathy, PhD (will graduate August 2023), (my role: chair)
52. Raj Kumar, PhD (will graduate August 2024), (my role: chair)
53. Osamah, PhD (will graduate August 2024), (my role: chair)
54. Sulaiman, PhD (will graduate August 2024), (my role: chair)
55. Hadhlul, PhD (will graduate August 2024), (my role: chair)
56. Mark Nations, PhD (will graduate August 2024), (my role: chair)
57. Zackery Miller, PhD (will graduate August 2024), (my role: chair)

Note: PhD and MS committee member of numerous (> 100) students

3. Chaired MS Thesis [33] and Co-Chaired MS Thesis [6]:

1. Apoorv Agarwal, MST Spring 2019, NCSU (my role: **chair**).
2. Ajit Kanale, MST Fall 2018, NCSU (my role: **co-chair with Prof. Baliga**).
3. Rushikesh Agashe, MST Spring 2018, NCSU (my role: **chair**).
4. Shrishti Singh, MST Spring 2018, NCSU (my role: **chair**).
5. Satish Rengarajan, MST, May 2018, NCSU (my role: **chair**).
6. Utkarsh Raheja, MST Dec 2017, NCSU (my role: **chair**).
7. Shashank Mathur, MST Dec 2017, NCSU (my role: **chair**).
8. Adrian Weimer, MS student RWTH – Aachen, Germany; May-Dec 2017 (**MS thesis co-chair**)
9. Abhay Negi, MST Dec 2016, NCSU (my role: **chair**).
10. Prathamesh Kamat, MST Aug 2016, NCSU (my role: **chair**).
11. Shivam Gupta, MST Aug 2016, NCSU (my role: **chair**).
12. Ashish Sanjay Shrivastav, MST Jan 2016, NCSU (my role: **chair**).
13. Anirudha Mahajan, MST Jan 2016, NCSU (my role: **chair**).
14. Sandesh Chitnis, MST Jan 2015, NCSU (my role: **chair**).
15. Abhijit Kuvar, MST Jan 2015, NCSU (my role: **chair**).
16. Akash Gujarati, MST August 2014, NCSU (my role: **chair**).
17. Vivek Ramachandran, MST May 2014, NCSU (my role: **chair**).
18. Ajit Narwal, MST May 2014, NCSU (my role: **chair**).
19. Shikhar Singh, MST May 2014, NCSU (my role: **chair**).
20. Ali Azidehak, MST May 2014, NCSU (my role: **chair**).
21. Roger Brewer, MST Aug 2014, LMCO employee, NCSU (my role: **chair**).
22. Ajit Narwal, MST, May 2014, NCSU (my role: **chair**).
23. Martin Gerlach, MS student RWTH – Aachen, Germany; May-Dec 2013 (**MS thesis co-chair**)
24. Karan Tewari, MST, May 2006, NCSU (my role: **co- chair**).
    Thesis: "Investigation of High Temperature Operation Emitter Turn Off Thyristor (ETO) and Electro Thermal Design of Heatpipe Based High Power Voltage Source Converter Using ETO". [First employment: IBM, RPT]
25. Rahul Godbole, MST (graduated May 2008), NCSU (my role: **chair**).
    Thesis: "Design of a Flexible DSP Based Controller Hardware System for Power Electronics Applications". [First employment: Mentor Graphics, RPT]
26. Anand Ramamurthy, MST (graduated Jan 2010), NCSU (my role: **chair**).
    Thesis: "Flexible Digital Electrical Power System Design and Modeling for Small Satellites". [First employment: Linear Technology, Austin, TX]
27. Seunghun Baek, MST (graduated Jan 2010), NCSU (my role: **chair**).
    Thesis: "Design Considerations of High Voltage and High Frequency Transformer for Solid State Transformer Application".
28. Chun-Kit Leung, MST (graduated May 2010), NCSU (my role: **chair**).
    Thesis: "Design Considerations of High Voltage and High Frequency 3 Phase Transformer for Solid State Transformer Application".
29. Craig Rende, MST in MAE dept. (graduated Jan 2010), NCSU – my role **co- chair**, advisor Prof. Richard Gould.

Thesis: "Heat Transfer Analysis on Various Thermal Dissipation Device - Thermal management and design considerations for Si and SiC power semiconductor devices based Solid State Transformer (SST)".

30. James McBryde, MST (graduated May 2010), NCSU (my role: **chair**).
    Thesis: "Inverter Efficiency Simulation and Measurement for Various Modern Switching Devices".
31. David Bolliat, MS student at ETH, Zurich (graduated Sept 2010 and continuing for PhD at ETH), NCSU (my role: **co-chair at NCSU**).
    Thesis: "Novel Design Considerations for a Three-Phase Dual-Active-Bridge DC-DC Converter"
    Project and paper: Reactive power minimization for DC-DC Dual Active Bridge (DAB) and design of three-phase high-frequency co-axial transformer. This work has resulted in a FREEDM conference paper and a paper at APEC 2011.
32. Misha Kumar, MST (graduated Dec 2011), NCSU (my role: **chair**).
    Thesis: "Control Implementations for High Bandwidth Shunt Active Filter".
33. Svanand Juvekar, MST (graduated May 2012), NCSU (my role: **chair**).
    Thesis: "A Fast Acting DC Solid State Circuit Breaker".
34. Nicholas Park, MST (graduated May 2012), NCSU (my role: **chair**).
    Thesis: "Black Start Control of a Solid State Transformer for Emergency Distribution Power Restoration".
35. Shailesh Notani, MST (graduated Dec 2011), NCSU (my role: **chair**).
    Thesis: "Development of Distributed, Scalable and Flexible Electrical Power System Module for CubeSat and Small Satellites".
36. Priyadarshini Asokan (ABM), MST (graduated May 2011), NCSU (my role: **chair**).
    Thesis: "Field Programmable Array Implementation of Active Filter Controller".
37. Mihir Shah, MST (graduated Dec 2012), NCSU (my role: **chair**).
    Thesis: "Enabling Aggressive Voltage Scaling for Real-Time and Embedded System with Inexpensive and Efficient Power Conversion".
38. Audrey Stanley, MST in MAE dept. (Discontinued – MS at NCSU, in Dec 2008), NCSU – **my role co-advisor**, advisor Prof. Richard Gould. Thesis: "Thermal management and design considerations for Si and SiC power semiconductor devices based Solid State Transformer (SST)".
39. Jason Watterson, MS August 2012; recipient of FREEDM graduate fellowship; discontinued from PhD

4. Mentored Project Assistant:

Rohit Rajashekhran, MST (graduated Dec 2009), NCSU (my role: **advisor working as project assistant**). Project: DSP and FPGA controller board design and testing with communication and FREEDM Digital Testbed communication implementation and demonstration.

5. Currently mentoring 4 MS Thesis Students (as chair):

1. Ramandeep Narwal, MST will graduate Dec 2020, NCSU (my role: **chair**) – will continue for PhD.
2. Vashista Burugula, MST will graduate Dec 2020, NCSU (my role: **chair**).
3. Shrishti Pal, MST will graduate Dec 2020, NCSU (my role: **chair**).
4. Varun Nand Rajpal, MST will graduate Dec 2020, NCSU (my role: **chair**).

5. Mentored 13 Post-Doctoral Scholars:

1. Dr. Kamalesh Hatua; for 2 years from Dec 2010 – Nov 2012; joined IIT-Madras as Asst. Prof.

2. Dr. Sudhin Roy; for 2 years from Dec 2011 – Nov 2013; joined NUS, Singapore
3. Dr. Dhaval Patel; for 2 years from Nov 2012 – Oct 2014; joined IIT-Jodhpur as Asst. Prof.
4. Dr. Debmalya Banerjee; for 3 months from Nov 2015 – Feb 2016
5. Dr. Krishna Mainali; for 2.5 years from March 2013 – Nov 2015; joined GE - GRC
6. Dr. Ghanshyamsingh Gohil; for 1 year from July 2016 – July 2017; joined UT-Dallas as Asst. Prof
7. Dr. Tushar Batra; for 1 year from July 2016 – June 2017; joined ABB, Sweden
8. Dr. Babak Parkhideh; for 3 months May – Aug 2012; joined UNC-Charlotte as Asst. Prof
9. Dr. Daniel Fregosi; for 3 months Jan-March 2017; joined UNC-Charlotte as Research Associate, now at EPRI
10. Dr. Samir Hazra; for 4 months from Dec 2106 – March 2017; joined Electronic Power Conversion (EPC), San Diego
11. Dr. Viju Nair – 2 years
12. Dr. Venkat Jakka – 2 years
13. Dr. Byeonyoung Kim – 1.5 years

6. Currently Mentoring 2 Post-Doctoral Scholars:

1. Richard Byron Beddingfield
2. Dr. Suvendu Samanta

7. Visting Scholars [9]:

1. Venu Sonti – PhD scholar funded by BASE (India) fellowship for 1 year
2. Dr. Mohammadamin Bahmani – funded by Chalmers University, Sweden for 4 months
3. Prof. Braz Cardoso – funded by UFMG, Brazil for 1 month
4. Gustovo Pinares – PhD student from Chalmers University, Sweden for 6 months
5. Prof. Po-Tai Cheng – funded by Taiwan Govt and NTU for 3 months
6. Prof. Saravana Ilango – Asst Professor at NIT-Trichy funded by BASE (India) fellowship for 3 months
7. Sungmin Kim - PhD student, Seoul National University, Korea for 15 months (Jan 2012 – April 2013) funded by me
8. Yongshu Han - PhD student, Seoul National University, Korea for 12 months (Aug 2013 – July 2014) funded by SNU and Korean government fellowship
9. Prof. Mukul Chandorkar – Professor, Indian Institute of Technology (IIT), Bombay, India for 6 months (Jan 2012 – July 2012) funded by me

Highlights of past students:

Note 1: Daniel Fregosi was NCSU ECE dept valedictorian in May 2009; started direct PhD in Fall 2009; recipient of MIT Lincoln Lab. fellowship FREEDM fellowship and RA support in 2009-2010; recipient of DOD NDSEG 3 years fellowship from Sept 2010 – Aug 2013; currently RA; PhD graduated Aug 2014; did ECE UG research with EcoCar project and was also FREEDM REU for two semesters with Subhashish Bhattacharya; and ECE senior design project with Subhashish Bhattacharya

Note 2: Seunghun Baek joined MST in Fall 2007; received MST in Aug. 2009 and graduated PhD; selected FREEDM exchange student to ETH – Zurich from 09/2011-03/2012

Note 3: Ankan De joined direct PhD Fall 2010; selected FREEDM exchange student to ETH – Zurich, Fall 2013; recipient of IEEE INTELEC Society Fellowship 2013 -2014 for the best proposal [IEEE INTELEC Society Fellowship is given to only one PhD student worldwide]

Note 4: Saman Babaei recipient of NCSU PhD Graduate Fellowship for 2010-2011 academic year

Note 5: Eric Green (NCSU ECE UG) started direct PhD Spring 2011; recipient of FREEDM fellowship in 2010-2011 and 2011-2012; currently PhD student; did ECE UG research and was also FREEDM REU for two semesters with Subhashish Bhattacharya; and ECE senior design project with Subhashish Bhattacharya

Note 6: Akash Gujarati was NCSU ECE dept valedictorian in May 2012; recipient of ECE dept. Outstanding Senior Scholarly Achievement Award 2012; started MS/PhD in Fall 2012; recipient of University graduate fellowship 2012-2013; post graduate scholarship from the ACC conference in 2012, and Jerry J. Collier award for being a student athlete 2012-2013; did ECE UG research for one semester with Subhashish Bhattacharya; and ECE senior design project with Subhashish Bhattacharya

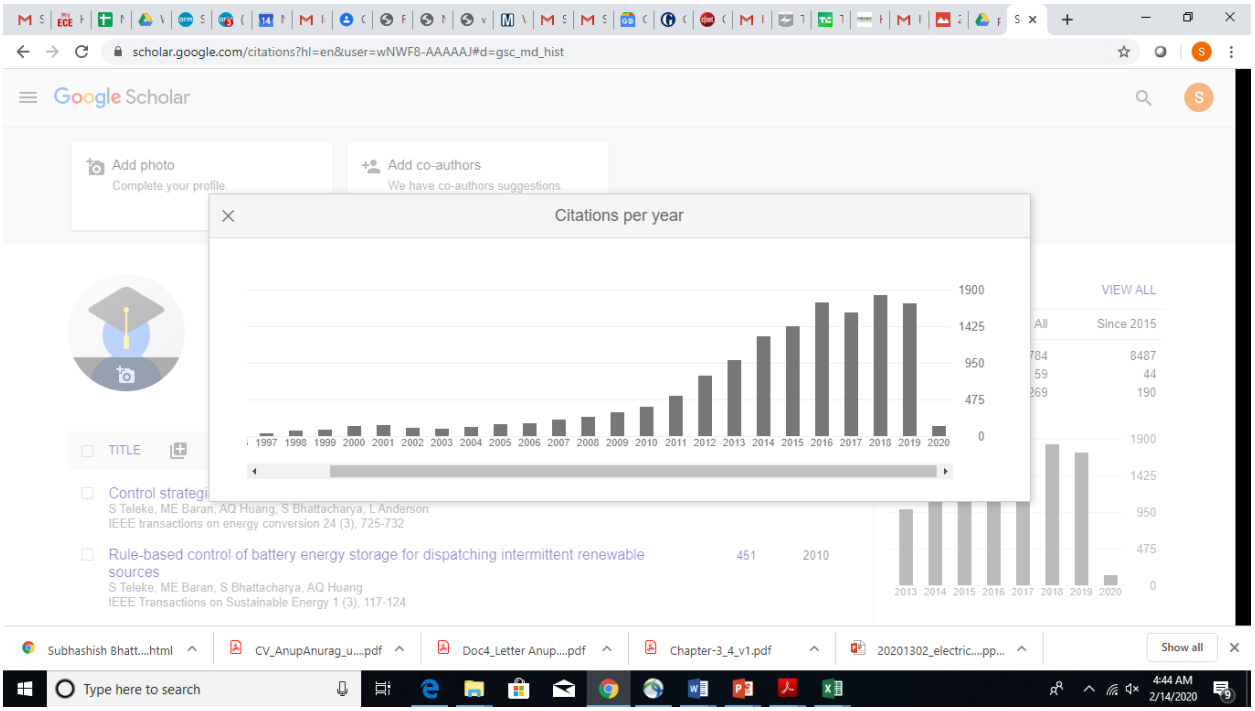
Note 7: Richard Beddingfield (NCSU ECE UG) joined PhD in Fall 2013; completed PhD June 2018, completed MS-EPSE program; advisor for MS-EPSE Capstone project; did ECE UG research and was also FREEDM REU for 4 semesters with Subhashish Bhattacharya; and ECE senior design project with Subhashish Bhattacharya

Note 8: Jason Watterson (NCSU ECE UG) started direct PhD Fall 2010; recipient of FREEDM fellowship in 2010-2011; RA and TA in 2011-2012; did ECE UG research and was also FREEDM REU for two semesters with Subhashish Bhattacharya; and ECE senior design project with Subhashish Bhattacharya; received MS in Dec 2012; discontinued from Ph.D. and joined ABB Corporate Research, Raleigh.

III. PUBLICATIONS (PEER-REVIEWED):

Google Scholar h-index

	All	Since 2015
Citations	14784	8487
h-index	59	44
i10-index	269	190



1. JOURNAL PUBLICATIONS (PEER-REVIEWED):

BOOK CHAPTERS: [4]

1. Subhashish Bhattacharya; Book chapter 7 “Gate Drives for WBG devices” submitted for WIDE BANDGAP SEMICONDUCTOR POWER DEVICES, edited by B.J. Baliga; 2018.
2. Arun Kadavelugu, Samir Hazra, Sachin Madhusoodhanan, Awneesh Tripathi, Kasunaidu Vechalapu, Ankan De, Krishna Mainali, Dhaval Patel, Kamalesh Hatua, Subhashish Bhattacharya; “Semiconductor power devices”, Chapter 1 of “Power Electronic Converters and Systems: Frontiers and Applications”, The Institution of Engineering and Technology (IET) Press, Published in 2016.
3. Bayram, I. S., Michailidis, G., Devetsikiotis, M., Granelli, F., & **Bhattacharya, S**. (2012). "Smart Vehicles in the Smart Grid: Challenges, Trends, and Application to the Design of Charging Stations". In *Control and Optimization Methods for Electric Smart Grids* (pp. 133-145). Springer New York.
4. S Bhattacharya, "High power active filter systems", PhD Thesis, University of Wisconsin--Madison, 2003.

Journal Papers Published: **[79]**

1. **Subhashish Bhattacharya; “Transforming the Transformer”; in IEEE Spectrum, Vol: 54, Issue: 7, PP: 38-43, July 2017**
2. S. Acharya, A. Anurag, S. Bhattacharya and D. Pellicone, "Performance Evaluation of a Loop Thermosyphon-Based Heatsink for High-Power SiC-Based Converter Applications," in *IEEE Transactions on Components, Packaging and Manufacturing Technology*, vol. 10, no. 1, pp. 99-110, Jan. 2020. doi: 10.1109/TCPMT.2019.2923332
3. S. Gulur, V. Mahadeva Iyer and S. Bhattacharya, "A CM Filter Configuration for Grid-Tied Voltage Source Converters," in *IEEE Transactions on Industrial Electronics*. doi: 10.1109/TIE.2019.2949530
4. A. Anurag, S. Acharya, S. Bhattacharya and T. Weatherford, "Thermal Performance and Reliability Analysis of a Medium Voltage Three-Phase Inverter Considering the Influence of High dv/dt on Parasitic Filter Elements," in *IEEE Journal of Emerging and Selected Topics in Power Electronics*. doi: 10.1109/JESTPE.2019.2952570
5. M. Alharbi and S. Bhattacharya, "Scale-Up Methodology of a Modular Multilevel Converter for HVdc Applications," in *IEEE Transactions on Industry Applications*, vol. 55, no. 5, pp. 4974-4983, Sept.-Oct. 2019.doi: 10.1109/TIA.2019.2925055
6. S. S. Shah, V. M. Iyer and S. Bhattacharya, "Exact Solution of ZVS Boundaries and AC-Port Currents in Dual Active Bridge Type DC–DC Converters," in *IEEE Transactions on Power Electronics*, vol. 34, no. 6, pp. 5043-5047, June 2019. doi: 10.1109/TPEL.2018.2884294
7. M. G. Kashani, M. Mobarrez and S. Bhattacharya, "Smart Inverter Volt-Watt Control Design in High PV-Penetrated Distribution Systems," in *IEEE Transactions on*

Industry Applications, vol. 55, no. 2, pp. 1147-1156, March-April 2019. doi: 10.1109/TIA.2018.2878844

8. A. K. Yadav, K. Gopakumar, K. R. R, L. Umanand, S. Bhattacharya and W. Jarzyna, "A Hybrid 7-Level Inverter Using Low-Voltage Devices and Operation With Single DC-Link," in *IEEE Transactions on Power Electronics*, vol. 34, no. 10, pp. 9844-9853, Oct. 2019. doi: 10.1109/TPEL.2018.2890371

9. S. Gulur, V. M. Iyer and S. Bhattacharya, "A Dual-Loop Current Control Structure With Improved Disturbance Rejection for Grid-Connected Converters," in *IEEE Transactions on Power Electronics*, vol. 34, no. 10, pp. 10233-10244, Oct. 2019. doi: 10.1109/TPEL.2019.2891686

10. S. S. Shah and S. Bhattacharya, "A Simple Unified Model for Generic Operation of Dual Active Bridge Converter," in *IEEE Transactions on Industrial Electronics*, vol. 66, no. 5, pp. 3486-3495, May 2019. doi: 10.1109/TIE.2018.2850012

11. A. Anurag, S. Acharya, Y. Prabowo, G. Gohil and S. Bhattacharya, "Design Considerations and Development of an Innovative Gate Driver for Medium-Voltage Power Devices With High dv/dt," in *IEEE Transactions on Power Electronics*, vol. 34, no. 6, pp. 5256-5267, June 2019.doi: 10.1109/TPEL.2018.2870084

12. F. E. Alfaris and S. Bhattacharya, "Control and Real-Time Validation for Convertible Static Transmission Controller Enabled Dual Active Power Filters and PV Integration," in *IEEE Transactions on Industry Applications*, vol. 55, no. 4, pp. 4309-4320, July-Aug. 2019. doi: 10.1109/TIA.2019.2910782

13. V. M. Iyer, S. Gulur and S. Bhattacharya, "Small-Signal Stability Assessment and Active Stabilization of a Bidirectional Battery Charger," in *IEEE Transactions on Industry Applications*, vol. 55, no. 1, pp. 563-574, Jan.-Feb. 2019.doi: 10.1109/TIA.2018.2871101

14. S. Baek and S. Bhattacharya, "Isolation Transformer for 3-Port 3-Phase Dual-Active Bridge Converters in Medium Voltage Level," in IEEE Access, vol. 7, pp. 19678-19687, 2019.doi: 10.1109/ACCESS.2019.2895818

15. S. S. Shah, V. Mahadeva Iyer and S. Bhattacharya, "Exact Solution of ZVS Boundaries and AC Currents in Dual Active Bridge Type DC-DC Converters," in *IEEE Transactions on Power Electronics*. doi: 10.1109/TPEL.2018.2884294

16. A. Anurag, S. Acharya, Y. Prabowo, G. Gohil and S. Bhattacharya, "Design Considerations and Development of an Innovative Gate Driver for Medium Voltage Power Devices with High dv/dt," in IEEE Transactions on Power Electronics. doi: 10.1109/TPEL.2018.2870084

17. A. De, Adam Morgan, Vishnu M Iyer, Haotao Ke, Xin Zhao, Kasunaidu Vechalapu, Subhashish Bhattacharya, Dogulas Hopkins; "Design, Package, and Hardware Verification of a High-Voltage Current Switch," in *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 6, no. 1, pp. 441-450, March 2018

18. R. Beddingfield, K. Byerly, S. Simizu, A. Leary, S. Bhattacharya, P. Ohodnicki, M. McHenry, “Thermal Profile Shaping and Loss Impacts of Strain Annealing on Magnetic Ribbon Cores,” Journal of Materials Research, accepted to be published in 2018.

19. K. Byerly, R. Ohodnicki, S. R. Moon, A. M. Leary, V. Keylin, M. E. McHenry, S. Simizu, R. Beddingfield, Y. Yu, G. Feichter, R. Noebe, R. Bowman, S. Bhattacharya

"Metal Amorphous Nanocomposite (MANC) Alloy Cores with Spatially Tuned Permeability for Advanced Power Magnetics Applications," Journal of Materials, 2018

20. K. Byerly,. R. Ohodnicki, S. R. Moon, A. M. Leary, V. Keylin, M. E. McHenry, S. Simizu, R. Beddingfield, Y. Yu, G. Feichter, R. Noebe, R. Bowman, S. Bhattacharya "Metal Amorphous Nanocomposite (MANC) Alloy Cores with Spatially Tuned Permeability for Advanced Power Magnetics Applications," Journal of Materials, 2018
21. S. S. Shah and S. Bhattacharya, "A Simple Unified Model for Generic Operation of Dual Active Bridge Converter," in IEEE Transactions on Industrial Electronics, accepted to be published in 2018.
22. Seunghun Babek, Subhashish Bhattacharya; 'Analytical Modeling and Implementation of a Coaxially Wound Transformer with Integrated Filter Inductance for Isolated Soft-Switching DC–DC Converters' in IEEE Transactions on Industrial Electronics, Vol: 65, Issue: 2, PP: 2245-2255, March 2018.
23. M. G. Kashani, S. Bhattacharya, J. Matamoros, D. Kaiser and M. Cespedes, "Autonomous Inverter Voltage Regulation in a Low Voltage Distribution Network," in *IEEE Transactions on Smart Grid, 2018.*
24. S. Hazra and S. Bhattacharya, "Modeling and Emulation of a Rotating Paddle Type Wave Energy Converter," in *IEEE Transactions on Energy Conversion*, vol. 33, no. 2, pp. 594-604, June 2018.
25. M. Boby, A. R. S, K. Gopakumar, L. Umanand, F. Blaabjerg and S. Bhattacharya, "A Low-Order Harmonic Elimination Scheme for Induction Motor Drives Using a Multilevel Octadecagonal Space Vector Structure with a Single DC Source," in *IEEE Transactions on Power Electronics*, vol. 33, no. 3, pp. 2430-2437, March 2018.
26. S. Madhusoodhanan, S. Bhattacharya, et al., "Harmonic Analysis and Controller Design of 15 kV SiC IGBT-Based Medium-Voltage Grid-Connected Three-Phase Three-Level NPC Converter," in IEEE Transactions on Power Electronics, vol. 32, no. 5, pp. 3355-3369, May 2017.
27. S. Hazra and S. Bhattacharya, "An Active Filter-Enabled Power Architecture for Oscillating Wave Energy Generation," in IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 5, no. 2, pp. 723-734, June 2017.
28. V. Sonti, S. Jain and S. Bhattacharya, "Analysis of the Modulation Strategy for the Minimization of the Leakage Current in the PV Grid-Connected Cascaded Multilevel Inverter," in IEEE Transactions on Power Electronics, vol. 32, no. 2, pp. 1156-1169, Feb. 2017.
29. A. K. Tripathi, Krishna Mainali, Sachin Madhusoodhanan, Arun Kadavelugu, Kasunaidu Vechalapu, Dhaval C Patel, Samir Hazra, Subhashish Bhattacharya, Kamalesh Hatua; "A Novel ZVS Range Enhancement Technique of a High-Voltage Dual Active Bridge Converter Using Series Injection," in IEEE Transactions on Power Electronics, vol. 32, no. 6, pp. 4231-4245, June 2017, doi: 10.1109/TPEL.2016.2602285.
30. M. T. A. Khan, G. Norris, R. Chattopadhyay, I. Husain and S. Bhattacharya, "Autoinspection and Permitting with a PV Utility Interface (PUI) for Residential Plug-and-Play Solar Photovoltaic Unit," in IEEE Transactions on Industry Applications, vol. 53, no. 2, pp. 1337-1346, March-April 2017.
31. G. Chavan, M. Weiss, A. Chakrabortty, S. Bhattacharya, A. Salazar and F. Ashrafi, "Identification and Predictive Analysis of a Multi-Area WECC Power System Model

Using Synchrophasors," in *IEEE Transactions on Smart Grid*, vol. 8, no. 4, pp. 1977-1986, July 2017.

32. A. V. Rocha, S. Bhattacharya, G. K. Moghaddam, R. D. Gould, H. de Paula and B. de Jesus Cardoso Filho, "Thermal Stress and High Temperature Effects on Power Devices in a Fault-Resilient NPC IGCT-Based Converter," in IEEE Transactions on Power Electronics, vol. 31, no. 4, pp. 2800-2807, April 2016.
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10. Po-Tai Cheng, **Subhashish Bhattacharya**, Deepakraj M. Divan; ""Power Line Harmonic Reduction by Hybrid Parallel Active / Passive Filter System Using Square-Wave Inverters and DC Bus Control", US patent no. 5,731,965; issued Mar. 24, 1998, filed June 21, 1996. [citations: 35] [**Assignee: Wisconsin Alumni Research Foundation (Madison, WI)]**

Docket # Application #	Date Filed Country	Title	Patent Status
221404-1300 16/363,485	3/25/2019 United States	Fault-tolerant Controller for Modular Multi-level Converter	Filed
221404-2240	12/24/2018	Semiconductor Topologies and Devices for Soft	Filed

US/PCT2018/068069	International	Starting and Active Fault Protection of Power Converters	
098192/1113684 PCT/US2018/059817	11/8/2018 International	Circuit for Providing Variable Waveform Excitation	Filed
221404-2230 PCT/US2018/059503	11/6/2018 International	Mixed Material Magnetic Core for Shielding of Eddy Current Induced Excess Losses	Expired
221404-8520 62/647,284	3/23/2018 United States	Fault-tolerant Controller for Modular Multi-level Converter	Expired

Disclosures Filed:

Multi-terminal Axial Power Transformer	Bradley Aycock	Inactive -> Waived University Interest	10/16/2018	Download

NCSU OTT Technology Transfer

1. Rahul Godbole, **Subhashish Bhattacharya**; "Flexible DSP based Controller Hardware System"; submitted as "Technology Transfer or Trade Secret" 12/15/2010. **This has been successfully "Non-exclusively Licensed" to a small company in June 2011 for $40K.**

PATENT DISCLOSURES SUBMITTED:

1. Leonard White, **Subhashish Bhattacharya**, "Minimization of Electric Arc Furnace Input Current Harmonics", filed 4/12/2011; currently unprotected due to old bylaws [NCSU OTT].
2. Babak Parkhideh, **Subhashish Bhattacharya**, "Unified Modular Transformer Converter System", filed 4/12/2011; currently unprotected due to old FREEDM bylaws [NCSU OTT].
3. Seunghun Baek, **Subhashish Bhattacharya**, "Coaxial-type Resonant Power Transformer", filed 9/15/2011; currently unprotected due to old FREEDM bylaws [NCSU OTT].
4. Tie Wu, Leda Lunardi, **Subhashish Bhattacharya**, "Optical Access System for Smart Grid Communications", filed 12/03/2012, provisional patent filed March 15, 2013.
5. Sachin Madhusoodhanan, **Subhashish Bhattacharya**, "Control Technique for Medium Voltage Active Front End Converter for Grid Interface Applications", patent disclosure filed 9/17/2013.
6. Awneesh K. Tripathi, **Subhashish Bhattacharya**, Dhaval Patel, Krishna Mainali, "Control Method for the Three-Phase Dual Active Bridge in Presence of Transformer Parasitics", patent disclosure filed 9/18/2013.
7. Arun Kadavelugu, **Subhashish Bhattacharya**, "Gate Driver Design with High dv/dt Immunity for Ultrahigh Voltage SiC Power Semiconductor Devices", patent disclosure filed 9/24/2013.
8. Arun Kadavelugu, **Subhashish Bhattacharya**, "Ultrahigh Voltage (>=10 kV) Complementary Inverter using SiC P-IGBT and N-IGBT", patent disclosure filed 9/24/2013.
9. Saman Babaei, **Subhashish Bhattacharya**, "Dual Angle Controller for Line-Frequency-Switched Static Synchronous Compensators under System Faults", patent disclosure filed 9/24/2013.
10. Saman Babaei, **Subhashish Bhattacharya**, "DC-side Series Active Power Filter for STATCOM Performance under System Faults", patent disclosure filed 10/07/2013.

11. Sungmin Kim, Nima Yousefpoor, **Subhashish Bhattacharya**; "Method and apparatus for Y-connected three-phase modular converter", patent disclosure filed 10/10/2013.
12. David Bolliat, **Subhashish Bhattacharya**; "Multi-Phase Coaxial Transformer with One Core" – submitted to NCSU OTT
13. Sumit Dutta, **Subhashish Bhattacharya**; "A Novel Control Principle for a Transformer-Based-Multiport Converter for Renewable Energy Sources Integration", – submitted to OTT
14. Alex Dean, **Subhashish Bhattacharya**; "Optimizing switching power converters by adjusting control loop frequency", – submitted to NCSU OTT.
15. Ankan De, **Subhashish Bhattacharya**; "Three Phase - Three Switch - Soft Switching High Frequency Link Rectifier with Galvanic Isolation", – submitted to NCSU OTT.

D. Technical Reports:

1. Steven Englebretson, Wen Ouyang, Colin Tschida, Joseph Carr, VR Ramanan, Matthew Johnson, Matthew Gardner, Hamid Toliyat, Bill Staby, Allan Chertok, Samir Hazra, Subhashish Bhattacharya; 'Advanced Direct Drive Generator for Improved Availability of Oscillating Wave Surge Converter Power Generation Systems Final Technical Report' Published by ABB Inc., Zürich (Switzerland), 2017; Citations=2
2. Stanley Atcitty, Ranbir Singh, Subhashish Bhattacharya; "All-SiC Power Module for Grid-tied Energy Storage", Published by Sandia National Lab.(SNL-NM), Albuquerque, NM, 2016;
3. Ranbir Singh, Subhashish Bhattacharya; 'All-Silicon Carbide power module based boost converter platform for grid-tied energy storage' Published by Sandia National Lab.(SNL-NM), Albuquerque, NM (United States), 2016
4. E Green, V Ramachandran, S Bhattacharya, "Impact Study of Value-Added Functionality on Inverter Reliability in Stationary Energy Storage Systems.," Sandia National Laboratories (SNL-NM), SAND2013-9296C, Albuquerque, NM (United States), 2013.
5. Atcitty, S., Green, E., Ramachandran, V., & Bhattacharya, S.; "Impact Study of Value-Added Functionality on Inverters in Energy Storage Systems" (No. SAND2012-7705C). Sandia National Laboratories, Albuquerque, NM (United States), 2012.
6. S Atcitty, D Fregosi, S Bhattacharya, "Empirical Battery Model Characterizing a Utility-scale Carbon-enhanced VRLA Battery.," Sandia National Laboratories (SNL-NM), SAND2011-6669C, Albuquerque, NM (United States), 2011
7. "New York Power Authority (NYPA) 2 x 100 MVA UPFC, Statcom, SSSC and IPFC (Integrated Power Flow Controller) commissioning and project report, EPRI final project report Feb. 2004.
8. "Voltage Source Converter (VSC) topologies and controls for next generation FACTS applications", Siemens internal research report.
9. "Static Synchronous Series Compensator (SSSC) – Operation and Commissioning" CIGRE Working Gr. B4-40.
10. S. Bhattacharya; "High power three-level Neutral Point Clamped (NPC) inverter with series connected Integrated Gate Commutated Thyristors (IGCTs) for FACTS applications", EPRI report, Feb. 2003.
11. "Korea 2 x 40 MVA UPFC (Unified Power Flow Controller), Statcom and SSSC (Static Synchronous Series Compensator) commissioning and project report, Siemens Power T&D, Dec. 2002.
12. "Central & Southwest (CSW) – Military Highway 150 MVA Statcom Transient Network Analyser (TNA) report, Siemens Power T&D, Aug. 2000.
13. "Central & Southwest (CSW) – Military Highway 150 MVA Statcom commissioning and project report, Siemens Power T&D, Dec. 2000.
14. "Central & Southwest (CSW) – Laredo 150 MVA Statcom Transient Network Analyser (TNA) report, Siemens Power T&D, May. 2001.
15. "Central & Southwest (CSW) – Laredo 150 MVA Statcom commissioning and project report, Siemens Power T&D, Dec. 2001.

E. Conference Tutorials and Presentations:

1. Subhashish Bhattacharya, Richard Byron Beddingfield; "High power/voltage power converters and applications – Opportunities and Challenges offered by HV SiC power device" at IEEE Energy Conversion Congress and Exposition (ECCE), 2018; and reported to DOE as part of PowerAmerica **deliverable to DOE.** This tutorial was attended by over 120 people and "highly successful" according to ECCE.

2. Subhashish Bhattacharya, "SiC Power Device Characterization and Converter Applications", PowerAmerica WIDE BANDGAP DEVICES & APPLICATIONS SHORT COURSE, Nov, 2018; and reported as a **deliverable to DOE**

3. Developed and awarded a PowerAmerica educational proposal in BP5 on "SiC based MV Power Converter Design" – will report as an educational **deliverable to DOE** in 2019

4. Subhashish Bhattacharya, "State of SiC based Power Electronics", invited presentation at Sandia National Lab organized workshop on "Enabling Advanced Power Electronics Technologies for the Next Generation Electric Utility Grid", July 2018
5. Contributed to magnetics tutorial materials developed for TMS and MMM 2018 conferences – this has been done as part of our collaboration with CMU – presented by Dr. Richard Byron Beddingfield, Dr. Paul Ohodnicki, Prof. Mike McHenry

1. Subhashish Bhattacharya, Richard Beddingfield; "High power/voltage power converters and applications – Opportunities and Challenges offered by HV SiC power devices" at IEEE ECCE, 2017
2. Subhashish Bhattacharya, Victor Veliadis; "SiC Power Device, and HV SiC Devices Enabled MV Power Converters Applications and Circuit Topologies – Opportunities and Challenges" at IEEE APEC, March 2017, Tampa, FL.
3. Subhashish Bhattacharya, Victor Veliadis; "SiC Power Device Design and Fabrication, and Insertion in Novel MV Power Converters" at IEEE ECCE, Cincinnati, OH.
4. Subhashish Bhattacharya, "HV SiC Devices Enabled MV Power Converters Applications and Circuit Topologies – Opportunities and Challenges"; at 5th IEEE Workshop on Wide Bandgap Power Devices and Applications (WiPDA), Oct 30, 2017
5. Subhashish Bhattacharya, "15 kV SiC IGBT Converters and High Voltage Circuit Topologies"; at 2017 International Conference on Silicon Carbide and Related Materials (ICSCRM), Sept 2017, DC
6. Subhashish Bhattacharya, "SiC Power Device Characterization and Converter Applications", PowerAmerica WIDE BANDGAP DEVICES & APPLICATIONS SHORT COURSE, Nov 7-9, 2017
7. S. Bhattacharya, Prof. Rik DeDoncker; "HV SiC Devices Enabled MV Power Converters Applications – Opportunities and Challenges", tutorial presented at IEEE Power Electronics for Distributed Generation Systems (PEDG), 2015 IEEE 6th International Symposium, June 2015.
8. S. Bhattacharya, "HV SiC Devices Enabled MV Power Converters Applications – Opportunities and Challenges", tutorial presented at IEEE in Power Electronics and ECCE Asia (ICPE-ECCE Asia), 2015 9th International Conference on, 1-5 June 2015.
9. Bhattacharya, S., and R. Adapa; "Wide-band Gap (WBG) WBG devices enabled MV power converters for utility applications — Opportunities and challenges," in Wide Bandgap Power Devices and Applications (WiPDA), 2014 IEEE Workshop on, pp.1-125, 13-15 Oct. 2014
10. Joseph Carr, Zhenyuan Wang, Subhashish Bhattacharya, Kamalesh Hatua, Sachin Madhusoodhanan; "Evaluation of a Transformerless Intelligent Power Substation as an Energy Control Center for Electronic Power Distribution Systems", Presentation at IEEE Fourth Conference on Innovative Smart Grid Technologies (ISGT 2013), Feb 2013

11. **Tutorial Organizer and Presenter for 3 tutorials (with Prof. Rik DeDoncker and Prof. Hirofumi Akagi). "High Power Converters for Motor Drives and Utility Applications"; "Power Converters for Utility Applications" IEEE Industry Applications Society (IAS) Conference, Oct. 2008; New Orleans, Sept 2007; Tampa, Oct 2006**.
12. Tutorial Organizer and Presenter. "Power Converters" Tutorial presented at the IEEE Power Electronics Specialists' Conference (PESC), Korea, June 2006.
13. S. Bhattacharya, "Series Connected IGCT based High Power Voltage Source Converter (VSC) Pole for FACTS Applications", presented at the IPCC "Products and Services" session at IEEE Industry Applications Society (IAS) Annual Meeting 2005, Hong Kong, Oct. 2005.
14. S. Bhattacharya, "Experimental comparison of GTO Thyristor and IGCT for series connection in high power voltage source inverter applications", presented at the Power Devices and Components Committee "Products and Services" session at IEEE Industry Applications Society (IAS) Annual Meeting 2005, Hong Kong, Oct. 2005.
15. **IEEE Tutorial** presenter at IEEE Industry Applications Society (IAS) Annual Meeting 1995, on "**Utility Interface Issues of Power Electronic Loads - Case Studies of Active Filter Applications**", sponsored by IAS - Industrial Power Converter Committee (IPCC), at IEEE - IAS Annual Meeting at Orlando, Oct 1995.

F. Invited Talks:

- S. Bhattacharya; "DC Microgrids Architecture and Control", IEEE DC Microgrids Conference (ICDCM), Matsue, Japan, May 2019
- Two Invited Papers at IEEE Intl Power Electronics Conference (IPEC), Hiroshima, May 2014
- One Invited Paper at IEEE APEC, Dallas, March 2014
- Invited presentation on "FACTS Technology" at EU Twenties Conference, Brussels, April 2011
- Invited presentation on "High Power Converters and SiC based Power Conversion" at Ingeteam Company, Bilbao, Spain, April 2011
- Invited presentation on "SiC Power Conversion and High Frequency Magnetics" at EoN Center and RWTH, Aachen, April 2011
- Two invited presentations at MIT, Laboratory of Power Electronics-Feb11, 2011, May16, 2012
- Invited Plenary Session Paper IPEC 2005, Niigata, Japan – FACTS paper, 3 plenary speakers
- Invited Plenary Session Paper NAPS 2004, U. Idaho, USA – FACTS paper, 2 plenary speakers
- Power Converters Applications with HV SiC Devices; GE-GRC, Feb 13, 2014

1. **Invited plenary session presentation on "Voltage Source Converter based FACTS Solutions: NYPA Convertible Static Compensator (CSC)" at the 5th International Power Electronics Conference (IPEC), Niigata, April 2005**.
2. Presentations on (a) "NYPA Convertible Static Compensator (CSC) operation and performance" and (b) "Operation and performance of TVA 100 MVA Statcom", at the 8th FACTS User's Group Meeting, Stamford, CT, Aug. 2005.
3. Presentations on (a) "IGCT VSC development for next generation FACTS applications"; (b) "NYPA Convertible Static Compensator (CSC) - SSSC and Statcom operating experience"; and (c) "Series Compensation Modes of the NYPA Convertible Static Compensator (CSC)", at 7th FACTS User's Group Meeting, Austin, TX, Nov 2004.
4. Presentations on "NYPA Convertible Static Compensator (CSC) commissioning test results" at the 6th FACTS User's Group Meeting, Utica, NY, Oct 2003.
5. Invited presentation on "De-icer Application and convertibility of NYPA Convertible Static Compensator (CSC) as a De-icer", at IIT-Kharagpur, August, 2005.
6. Invited presentation on 'Statcom solution for arc-furnace flicker mitigation", at Semiconductor Power Electronics Center (SPEC) meeting, Department of ECE, North Carolina State University, Dec. 2004.
7. Invited presentation on 'Voltage Source Converter based FACTS technology" at Department of ECE, North Carolina State University, Nov. 2004.
8. Invited presentation on 'Voltage Source Converter based FACTS technology and NYPA Convertible Static Compensator (CSC) project" at IIT-Kharagpur, Sept. 2004.
9. **Invited plenary session presentation on "NYPA Convertible Static Compensator (CSC) Project" at the North American Power Symposium, (NAPS), University of Idaho, Moscow, ID, Aug 2004**.
10. Invited presentation on 'Voltage Source Converter based FACTS technology – NYPA Convertible Static Compensator (CSC) project" at Indian Institute of Science (IISc) -Bangalore, May 2004.
11. Invited presentation on 'Voltage Source Converter based FACTS technology and Siemens (FPQD) FACTS installations" at IIT-Bombay, April 2004.
12. WEMPEC seminar on "FACTS applications at NYPA Convertible Static Compensator (CSC) performance" at WEMPEC, University of Wisconsin – Madison, Feb. 2004.
13. WEMPEC seminar on "FACTS technology" at University of Wisconsin–Madison, Nov. 2001.
14. Invited presentation on 'FACTS technology and Siemens (FPQD) FACTS installations" at RWTH - Aachen Institute for Power Electronics and Electrical Drives (ISEA), Aachen, Germany in July 2001.
15. Invited presentation on "Active Power Filters" at Eindhoven Institute of Technology, Eindhoven, The Netherlands in Feb. 1996.
16. Invited presentation on "Hybrid Active Power Filters" at Siemens Automation, Atlanta in May 1995.
17. Presentation on "Hybrid Active Power Filters" at EPRI - Schneider Electric Co. meeting in Jan. 1992.

18. Several presentations on "High Power Active Filters" at Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC) annual meetings in 1991, 1992, 1994, 1995, 1996, 1997, 1998

G. Research Impacts:

Technology Commercialization:

- **Commercialization of Active Power Filter for York's Air-Conditioner Chiller Systems which was developed as part of my PhD research work.**

H. Highlights of Technical Experience

1. Siemens Power Transmission & Distribution, FACTS Division

As part of the research and engineering team at Siemens FACTS Division, I have been involved in:

- Control development, implementation and system level validation of FACTS controllers such as Statcom, SSSC, UPFC, IPFC and Back-to-Back system on hardware based Transient Network Analyser (TNA) for commercial and R&D projects.
- Design and analysis of high power voltage source inverter topologies, and magnetics design and specifications for FACTS applications.
- Experimental evaluation of power semiconductor devices for next generation FACTS voltage source inverters – GTOs, IGCTs; device characterization, series connection issues, snubber circuit design, valve design for three-level converters and device failure analysis.
- Completed an EPRI project on "Investigation, development and high power testing of IGCT based inverter poles for FACTS applications". Significant cost reduction, increased MVA rating and performance benefits compared to existing GTO based three-level FACTS inverter platform, were the objectives to merit EPRI funding for next generation FACTS inverter platform. This project developed and tested series connection of three 4.5kV, 4kA IGCT 3-level inverter pole each rated at 12 MVA.
- List of completed FACTS projects:
    - $\pm$ 80 MVA Statcom for arc-furnace flicker mitigation at Structural Metals Incorporated (SMI)
    - Korea 2 x 40 MVA UPFC, Statcom and SSSC project
    - **New York Power Authority (NYPA) 2 x 100 MVA Convertible Static Compensator (CSC) UPFC, Statcom, SSSC, IPFC project – completed Jan. 2004**
    - American Electric Power (AEP) – Military Highway $\pm$ 150 MVA Statcom project
    - American Electric Power (AEP) – Laredo $\pm$ 150 MVA Statcom project

2. Soft Switching Technologies (SST) Corporation

As consultant and part-time employee, my tasks included:

- Design, control development and prototype testing of 150 kVA shunt active filter implemented with soft switching Resonant DC Link (RDCL) inverter for 500 kW motor drive systems for Baldor Electric.
- Control design for 150 kVA "hybrid parallel active filter" for harmonic compensation of 1MW thyristor rectifier fed DC motor drive.
- Developed "Active Filter Application Guide" funded by EPRI for matching active filter solutions to harmonic producing loads.

3. York International Corporation

EPRI and York jointly funded part of my Ph.D thesis research on active filter, with the objective of commercializing active filter technology.

- Research, control and inverter design implementation and production unit development of shunt active filter system for York's air-conditioner chiller product from 200 kW to 1 MW load.
- Technology transfer and development of York's commercial "IEEE 519 Filter" – in production 1996.

4. GE Corporate Research & Development Center (GE – CRD)

- Developed and implemented a new PWM scheme for inverter fed AC locomotive drive for GE locomotive division, Erie, PA.
- Developed a simple excel based finite element program for thermal design of magnetics. This was applied for design of high power and high frequency transformer for auxiliary power supply for traction applications.

5. **University of Wisconsin – Madison,** Dept. of Electrical and Computer Engg., PhD research assistant in **Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC)**

- Research, design, laboratory experimental verification and **first site installation of Hybrid Series Active Filter (HSAF) system**. Supported by EPRI and in cooperation of New England Electric Power Company (NEEPC), a HSAF system developed in the laboratory was installed at Beverly Pump Station (Beverly, MA) for 765 kVA ASD pump load to meet IEEE 519 standards. Developed and patented a new Synchronous Reference Frame (SRF) controller for active filter applications.
- Proposed, developed and experimental validation of a new Dominant Harmonic Active Filter (DHAF) for harmonic compensation of high power loads and for ac-side filtering in HVDC applications. Two patents have been issued as part of this UW-Madison funded project.
- Research and design of Hybrid Parallel Active Filter system
- Proposed and implemented SRF controller for DVR (Dynamic Voltage Restorer) application.
- Explanation and experimental verification of motor bearing currents caused by hard- and soft-switching inverters (WEMPEC sponsored).
- Research projects on Resonant DC Link inverter design improvements for drives and utility interface.
- Development and experimental validation of DSP based real-time power electronics simulator – part of team (WEMPEC sponsored).

6. **University of Wisconsin – Madison,** Dept. of Electrical and Computer Engg., Course Project for ECE 714: Utility Applications of Power Electronics

"Unified Power Flow Controller (UPFC) for FACTS applications"

Developed UPFC controllers for series voltage injection, power flow control and impedance control modes. The goal was to implement UPFC functions with fundamental frequency switching or without PWM control of shunt and series inverters. UPFC operation was verified by simulation.

Proposed new hybrid UPFC configurations (with passive filters) for voltage regulation, harmonic filtering and flicker mitigation for distribution systems.

7. **M.E. Thesis:** Department of Electrical Engineering, Indian Institute of Science, Bangalore, India
   "Modeling and Simulation of HVDC systems for Dynamic Stability Analysis"
   Thesis Advisors: Prof. K.R. Padiyar and Prof. K. Parthasarathy

Developed a linearized system model for HVDC system with digital controls to investigate dynamic stability of a compound AC/DC system. Averaging techniques were used to model pure time delays of rectifier and inverter side controllers to derive discrete-time state equations. Stability regions were determined for controller parameter gains for different operating conditions. Small signal eigen-value analysis was used to refine controller gains. Simulation results for a benchmark HVDC system were used to validate the mode.

GRANTS AND CONTRACTS:

Note 1: RADAR summary attached separately – unable to integrate as a word document

Note 2: PINS report summary attached separately – NOTE: Yellow highlighted are 28 proposals applied in 2018 only

In 2018 (Highlights) – not captured in RADAR report:

- **PowerAmerica funding continuously for all BPs [BP1 – BP5]**
- **RADAR report does not include PA funding in 2018 – which was $600K (Project 4.11) and $450K (Project 4.30 + OIF)**
- Awarded ABB research funding for $55K (w/o F&A)
- Awarded Ford research funding for $45K (w/o F&A)
- Eaton Corporation research funding for $45K (w/o F&A)
- Continuation of funding from NYPA (New York Power Authority) - in RADAR
- Continuation of CSI funding of $65K – continuously funded since 2009
- Projects awarded in earlier years and which are continuing in 2018 are marked in "dark yellow" in the RADAR report
- Projects with were proposed and awarded in 2018 are marked in "yellow" in the RADAR report
- Submitted 1 SBIR with a small companies [NCSU PI]

Highlights – not captured in RADAR report:

- Awarded ABB research funding for $50K (w/o F&A) every year since 2009
- Awarded Enphase Inc. research funding for $45K (w/o F&A) each year in 2015, 2016

Total RADAR reported funded projects (as PI and co-PI): $90 M

Total PINS reported 219 proposals submitted.

Total my share of funding: ~$20 M