2024 IEEE 25th Workshop on Control and Modeling for Power Electronics

LUMS
A Not-for-Profit University

pels IEEE POWER ELECTRONICS SOCIETY

June 24-27, 2024 | Lahore University of Management Sciences | Lahore, Pakistan

G.F.C. FANS

SKYELECTRIC
Powered by Intelligence

Dawlance

Hitachi Energy

Taraz TECHNOLOGIES

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WELCOME

On behalf of the COMPEL 2024 Organizing Committee, we are delighted to welcome you to the IEEE 25th Workshop on Control and Modeling for Power Electronics, hosted at LUMS in Lahore, Pakistan. We are thrilled to celebrate the Silver Jubilee of this prestigious conference with you.

Sponsored by the IEEE Power Electronics Society, COMPEL serves as the flagship conference for TC1: Technical Committee on Control and Modeling of Power Electronics. Since its inaugural edition held at MIT in 1988, only a year after the establishment of the IEEE Power Electronics Society, COMPEL has grown to become a premier forum for the exchange of groundbreaking research in power electronics. COMPEL's location alternates between the Americas and the rest of the world, reflecting its global reach and influence. LUMS, a premier academic institution with a vibrant power electronics research culture, brings COMPEL for the first time to the heart of Asia.

This year 120 digests were received from authors in 27 countries and 71 of these have been selected for presentation by the Technical Program Committee. The program covers a wide range of topics, spanning modeling, control, design, and optimization of power converters, components, and systems. The program also has a tutorial on the analysis and design of power converters using discrete time modeling. This year's program also features keynotes from three power electronic visionaries in academia and industry. Their reflections on the evolution and direction of the field will undoubtedly inspire us. In honor of the 25th anniversary, we are privileged to also have welcome remarks from the founding president of the IEEE Power Electronics Society and the founding general chair of COMPEL. An attractive feature of COMPEL is its single-track format, which ensures that all participants can engage in every session without missing any of the invaluable insights shared during the conference.

COMPEL 2024 also offers social events designed to enhance your experience and foster connections. The program includes a Women in Engineering event, celebrating the contributions and achievements of underrepresented groups in our field while providing a platform for networking and mentorship. Two specially organized excursions, delving into the rich cultural heritage and vibrant history of Lahore will give you opportunities to explore this historic city and experience a gala dinner at the iconic Lahore Fort. We look forward to these events enhancing your overall conference experience and creating lasting memories.

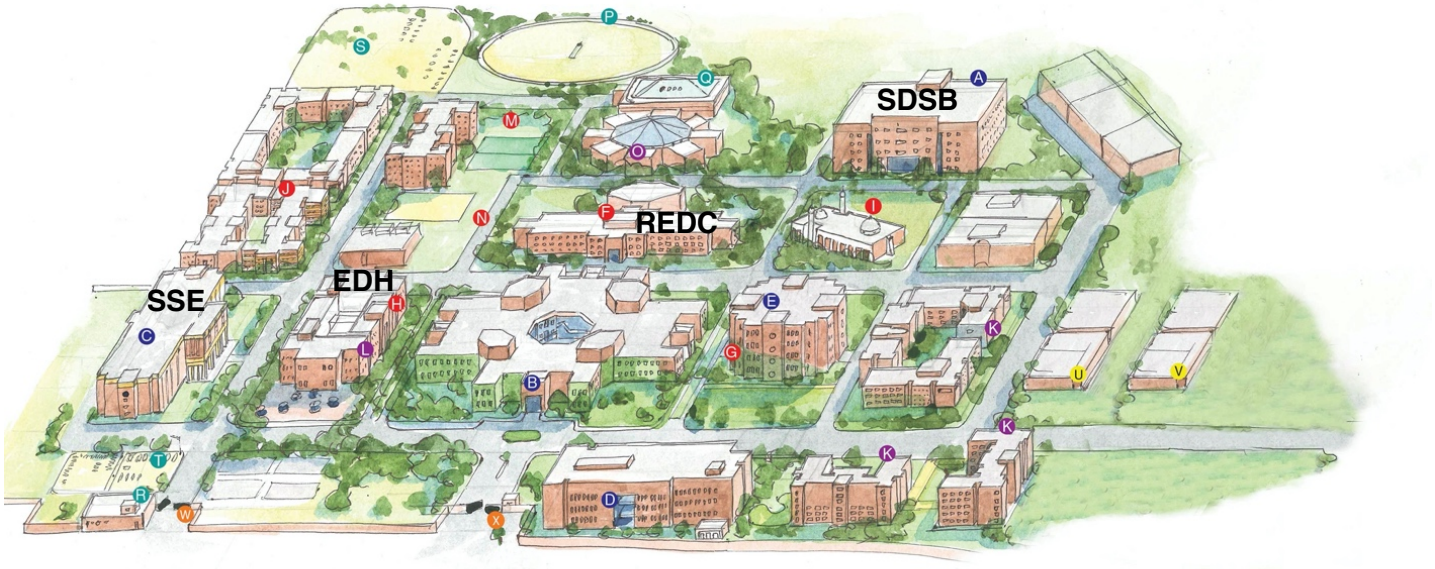
Thank you for your participation and contributions to COMPEL 2024. We look forward to an engaging event and our time together in Lahore, Pakistan!

Khurram Afridi
Nauman Zaffar
General Chairs, IEEE COMPEL 2024

SCHEDULE

Time	June 24 Monday	June 25 Tuesday	June 26 Wednesday	June 27 Thursday
7:00 - 8:30 am	Breakfast	Breakfast	Breakfast	Breakfast
8:30 - 10:00 am	Tour of Campus	Welcome & Keynotes	Oral Session 4	Oral Session 7
10:00 - 10:30 am	Registration Opens	Coffee Break	Coffee Break	Coffee Break
10:30 - 12:00 pm	Tour of SSE, LCE & Power Electronics Lab	Oral Session 1	Oral Session 5	Oral Session 8
12:00 - 1:30 pm	Welcome Lunch	WiE Event & Lunch	Networking Lunch	Alwadai Lunch
1:30 - 3:00 pm	Tutorial Part 1	Oral Session 2	Poster Session 1	Poster Session 2
3:00 - 3:30 pm	Coffee Break	Coffee Break	Coffee Break	Coffee Break
3:30 - 5:00 pm	Tutorial Part 2	Oral Session 3	Oral Session 6	Oral Session 9
5:00 pm -	Remote Oral Session, Remote Keynote, TC1 Meeting & Dinner	Excursion & Dinner	History by Night and Gala Dinner at the Lahore Fort	Awards Dinner

CAMPUS MAP



GENERAL INFORMATION

Registration Desk Hours (Venue: SDSB Basement Lobby)

- Monday, June 24: 10:00 am - 4:00 pm
- Tuesday June 25: 8:00 am - 2:00 pm
- Wednesday June 26: 8:00 am - 2:00 pm
- Thursday June 27: 8:00 am - 2:00 pm

Official Language

English

Internet/WIFI

WIFI is available for all attendees. Connect to the **IEEE2024** network and use the following password **Lum$@2024**. No username is required.

Papers

Papers presented at the conference can be downloaded from ieee-compel.org/papers.php

Badges

Badges must be visibly worn at all times. Admission into workshop sessions and social events will require the display of a badge.

Certificate of Attendance

Certificates will be sent by email upon request to compel2024@lums.edu.pk after the workshop.

Persons with Special Needs

Every effort has been made to ensure that people with special needs are catered to. Please let us know if you require any specific assistance.

Oral Presentation Information

The time allocated to each oral presentation is 20 minutes, including Q&A. Slides should be in widescreen format with aspect ratio of 16:9 to best utilize the projection screen. PowerPoint slides are highly recommended over other formats. All presentations will utilize a conference laptop, which is a Windows machine. Individual laptops will not be accommodated. Presenters should have a copy of their presentation on a flash drive that is compatible with Windows. Please load your presentation onto the conference laptop in the morning before the first talk begins. Technical support will be available.

Poster Presentation Information

The time allocated to each poster session is 1.5 hours to enable thoughtful discussions. Posters should be in landscape format and 4-feet wide by 3-feet high to best utilize the poster boards. Posters should not exceed this size. Each side of the poster board will only have one poster. Each poster board will be numbered with push pins provided. Posters should be hung during coffee break or lunch so they are ready for viewing during the appropriate session. Local poster printing services for conference participants are available.

AWARDS INFORMATION

Best Paper Awards

Three papers will be selected by a committee consisting of the General Chair, Technical Program Committee Chair, and the Chair of TC1. Among the criteria include impact, innovation, technical merit, and presentation. The awardees will be announced shortly after the conclusion of the conference.

Student Travel Grant Awards

The COMPEL Student Travel Grant is sponsored by the IEEE Power Electronics Society's TC1: Technical Committee on Control and Modeling of Power Electronics. The travel grant helps broaden student participation at COMPEL. The Student Travel Grant Committee for COMPEL 2024 will award grants between $100 – $1000 among several students. A total of 8,000 USD will be awarded.

SOCIAL EVENTS

WELCOME LUNCH
Monday June 24, 12:00 – 1:30 pm
Executive Dining Hall (EDH)

IEEE COMPEL 2024 starts off with an opportunity for attendees to get to know each other over lunch.

TC1 MEETING AND DINNER
Monday June 24, 8:00 pm –
Executive Dining Hall (EDH)

Learn about IEEE PELS Technical Committee on Control and Modeling of Power Electronics (TC1) and participate in its activities over dinner.

WOMEN IN ENGINEERING (WiE) EVENT & LUNCH
Tuesday June 25, 12:00 – 1:30 pm
Executive Dining Hall (EDH)

Join IEEE PELS WiE career advice and networking event **EMPOWER ALL: Fostering Inclusivity, Career Growth, and Diverse Representation in Engineering** to help broaden participation of underrepresented groups in engineering. Hosts: Marium Rasheed (Ford) and Katherine Kim (National Taiwan University). Panelists: Regan Zane (Utah State), Johann Kolar (ETH Zurich), Ayesha Chaudhry (10xEngineers), Firehiwot Gurara (Cornell), and Reesha Arshad (LUMS). Event includes a delightful lunch with exquisite Pakistani cuisine.

EXCURSION AND DINNER
Tuesday June 25, 5:00 – 9:00 pm
Departure from Rausing Center (REDC)

Visit Lahore's famous landmarks followed by a traditional dinner.

NETWORKING LUNCH
Wednesday June 26, 12:00 – 1:30 pm
Executive Dining Hall (EDH)

Build your IEEE PELS Network over lunch.

HISTORY BY NIGHT AND GALA DINNER AT THE LAHORE FORT
Wednesday June 26, 5:00 – 10:00 pm
Departure from Rausing Center (REDC)

Experience the magic of Lahore Fort under the stars. An unforgettable night of history, culture, and entertainment, including the Rangeela Rickshaw ride and interaction with Mughal-era characters.

ALWADAI LUNCH
Thursday June 27, 12:00 – 1:30 pm
Executive Dining Hall (EDH)

Exchange notes as you dig into mangoes.

AWARDS DINNER
Thursday June 27, 5:00 – 10:00 pm
Executive Dining Hall (EDH)

Dine in style as COMPEL winds down and awards are distributed to Student Travel Grant Awardees.

EXPLORE LAHORE AND PAKISTAN

LAHORE

Lahore, settled in 2000 BC, is a city steeped in rich history, captivating culture, and vibrant energy. Its bustling bazaars and winding alleys transport one through centuries of various imperial dynasties, each leaving their indelible mark on this enchanting city. The Lahore Fort, a UNESCO World Heritage site, stands as a majestic testament to this storied past, with its intricate architecture and lush gardens. The Badshahi Mosque, an architectural marvel of the Mughal era, showcases grandeur of Islamic artistry. For a taste of local life, the Walled City offers a sensory feast of aromatic street food, artisanal crafts, and the melodious strains of traditional music. Not to be missed are the Shahi Hammam, the Masjid Wazir Khan, the Tomb of Emperor Jahangir, the Tomb of Nur Jahan, and the awe-inspiring Shalimar Gardens, a serene oasis where Mughal emperors once sought respite. Lahore's vivacious spirit is further exemplified by its British era and modern attractions, including the Lahore Museum, the Kim’s Gun, the Government College, and the Lahore Zoo, providing a delightful blend of past and present. With its warm hospitality and a tapestry of historical wonders, Lahore promises an unforgettable journey into the heart of Pakistan's cultural legacy.

PAKISTAN

Pakistan, a land of astonishing diversity and captivating beauty, offers a treasure trove of experiences for travelers seeking adventure, culture, and history. Nestled in South Asia, it boasts a landscape that ranges from the rugged grandeur of the Himalayas in the north to the pristine beaches along the Arabian Sea in the south. History comes alive in the ancient cities of Lahore, Taxila, and Mohenjo-Daro, where millennia-old civilizations have left their mark. For nature enthusiasts, the serene valleys of Swat and Hunza offer breathtaking vistas of lush greenery and towering peaks. The stunning landscapes of the Makran Coast and the Hingol National Park, with their rugged cliffs and pristine beaches, offer an unparalleled experience. The bustling bazaars of Karachi and the colorful markets of Peshawar beckon with a kaleidoscope of textiles, spices, and handicrafts. Pakistan's warm and hospitable people, combined with its mouthwatering cuisine, ensure an unforgettable journey. From the awe-inspiring mountains of the north to the bustling cities and historical sites, Pakistan invites you to explore its wonders and experience its rich tapestry of cultures and traditions.

ORGANIZING COMMITTEE

GENERAL CHAIRS
Khurram Afridi, CORNELL UNIVERSITY
Nauman Zaffar, LUMS

TECHNICAL PROGRAM COMMITTEE
David Perreault, MIT
Ahmed Hembel, GENERAL MOTORS
Al Avestruz, U OF MICHIGAN ANN ARBOR
Ali Khajehoddin, UNIVERSITY OF ALBERTA
Ashish Kumar, TAU MOTORS
Daniel Costinett, U OF TENNESSEE KNOXVILLE
Dragan Maksimovic, U OF COLORADO BOULDER
Hafsa Qamar, LUMS
Hanh-Phuc Le, U OF CALIFORNIA SAN DIEGO
Huai Wang, AALBORG UNIVERSITY
Iftikhar Khan, SARHAD UNIVERSITY
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Juan Rivas, STANFORD UNIVERSITY
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Katherine Kim, NATIONAL TAIWAN UNIVERSITY
Mahshid Amirabadi, NORTHEASTERN U
Marium Rasheed, FORD
Minjie Chen, PRINCETON UNIVERSITY
Robert Pilawa, U OF CALIFORNIA BERKELEY
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Sam Coday, MIT
Sreyam Sinha, IIT DELHI
Tom Jahns, U OF WISCONSIN MADISON
Usama Anwar, TEXAS INSTRUMENTS

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Faisal Khan, NREL
Francisco Azcondo, UNIVERSITY OF CANTABRIA

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Masna Hassan, LUMS
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Ijaz Naqvi, LUMS
Danish Shahzad, APPLE

FINANCE COMMITTEE
Hassan Khan, LUMS

ATTENDEE FACILITATION COMMITTEE
Muhammad Ali Siddiqi, LUMS

INDUSTRY LIAISON COMMITTEE
Zubair Khalid, LUMS
Farrukh Kamran, SKYELECTRIC
Khalid Ghazi, TARAZ TECHNOLOGIES

WOMEN IN ENGINEERING COMMITTEE
Marium Rasheed, FORD
Katherine Kim, NATIONAL TAIWAN UNIVERSITY

PUBLICITY COMMITTEE
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Abdul Majid, COMSATS ABBOTTABAD
Ahmed Hembel, GENERAL MOTORS
Faheem Chachar, SIEMENS ENERGY
Faheem Shaikh, MEHRAN UNIVERSITY
Gab-Su Seo, NREL
Haleema Qamar, HABIB UNIVERSITY
Hanh-Phuc Le, U OF CALIFORNIA SAN DIEGO
Ishtiyaq Makda, HABIB UNIVERSITY
Jibran Ali, USMAN INSTITUTE OF TECHNOLOGY
Kashif Ishaque, MA JINNAH UNIVERSITY
Dehong Xu, ZHEJIANG UNIVERSITY
Mashood Nasir, CISSOID
Muhammad Tahir, UET LAHORE
Peng Fang, U OF MINNESOTA DULUTH
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Saad Qazi, NED UET
Shahid Iqbal, UNIVERSITY OF GUJRAT
Sonny Xue, OAK RIDGE NATIONAL LAB
Syed Kashif, UET LAHORE
Tauseef Tauqeer, INFORMATION TECH U
Zaka-ullah Zahid, UET PESHAWAR

ADVANCEMENT COMMITTEE
Ayesha Fatima, LUMS
Muhammad Ali, LUMS
Tabinda Khan, LUMS

PROGRAM • MONDAY, JUNE 24, 2024

BREAKFAST
7:00 am – 8:30 am (Venue: EDH)

TOUR OF CAMPUS
8:30 am – 10:00 am (Venue: Departure from REDC Lobby)

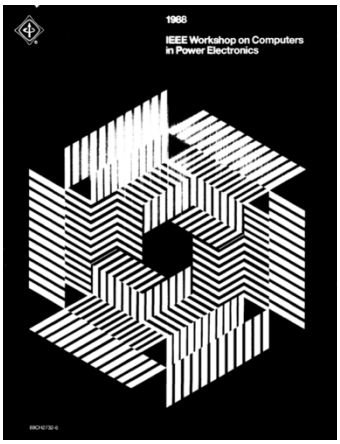
REGISTRATION OPENS
10:00 am – 10:30 am (Venue: SDSB Basement Lobby)

TOUR OF SCHOOL OF SCIENCE AND ENGINEERING, LUMS CENTER FOR ENTREPRENEURSHIP and POWER ELECTRONICS LABORATORY
10:30 am – 12:00 pm (Venue: Departure from SSE Ground Floor Lobby)

WELCOME LUNCH
12:00 pm – 1:30 pm (Venue: EDH)

COMPEL HISTORY: The 25 Editions of COMPEL

1988 – Massachusetts Institute of Technology (Cambridge, MA, USA)
1990 – Bucknell University (Lewisburg, PA, USA)
1992 – University of California Berkeley (Berkeley, CA, USA)
1994 – McGill University (Quebec, Canada)
1996 – Portland State University (Portland, OR, USA)
1998 – Politecnico di Milano (Cernobbio, Italy)
2000 – Virginia Tech (Blacksburg, VA, USA)
2002 – University of Puerto Rico (Mayaguez, Puerto Rico, USA)
2004 – University of Illinois Urbana-Champaign (Urbana, IL, USA)
2006 – Rensselaer Polytechnic Institute (Troy, NY, USA)
2008 – ETH Zurich (Zurich, Switzerland)
2010 – University of Colorado Boulder (Boulder, CO, USA)
2012 – Doshisha University (Kyoto, Japan)
2013 – University of Utah (Salt Lake City, UT, USA)
2014 – University of Cantabria (Santander, Spain)
2015 – University of British Columbia (Vancouver, BC, Canada)
2016 – Norwegian University of Science and Technology (Trondheim, Norway)
2017 – Stanford University (Stanford, CA, USA)
2018 – University of Padova (Padova, Italy)
2019 – University of Toronto (Toronto, Canada)
2020 – Aalborg University (Aalborg, Denmark)
2021 – University of Los Andes (Cartagena de Indias, Columbia)
2022 – Dan Panorama Tel Aviv Hotel (Tel Aviv, Israel)
2023 – University of Michigan Ann Arbor (Ann Arbor, MI, USA)
2024 – Lahore University of Management Sciences (Lahore, Pakistan)



TUTORIAL

1:30 pm – 5:00 pm (Venue: SDSB B3)

Analysis and Design of Switched-Mode Power Converters Using Discrete Time Modeling

Discrete time modeling of power electronics is a useful tool for small signal modeling and control design without requiring spectrum-limiting approximations. These same techniques are useful for the large signal, steady-state modeling and design optimization of power electronics. The modeling approach is general, accurate, and well-suited to numerical design optimization. This tutorial will review state space discrete time modeling of switching power converters with applications to steady-state and dynamic modeling and design optimization, ongoing efforts and resources being developed at the University of Tennessee, as well as application examples.

Daniel Costinett
Associate Professor,
University of Tennessee, Knoxville

Daniel Costinett (Senior Member, IEEE) received the Ph.D. degree in electrical engineering from the University of Colorado Boulder in 2013. He was an instructor at Utah State University in 2013. Since 2013, he has been with the Department of Electrical Engineering and Computer Science at the University of Tennessee, Knoxville (UTK), where he is currently an Associate Professor. Dr. Costinett is Co-Director of Education and Diversity for the National Science Foundation/Department of Energy Engineering Research Center for Ultra-wide-area Resilient Electric Energy Transmission Networks (CURENT). He has coauthored more than 150 peer-reviewed publications. His research interests include resonant and soft switching power converter design, high efficiency wired and wireless power supplies, on-chip power conversion, medical devices, and electric vehicles. Dr. Costinett was a recipient of the National Science Foundation CAREER Award in 2017, the 2022 Richard M. Bass Outstanding Young Power Electronics Engineer Award, the 2016 and 2020 IEEE PELS Transactions Second Place Prize Paper Award, and the 2015 IEEE IAS William M. Portnoy Award. He received the 2022 Moses E. and Mayme Brooks Distinguished Professor Award, 2015 ECE Faculty of the Year Award, and 2020 Chancellor's Award for Professional Promise in Research from UTK. He currently serves as Associate Editor of IEEE Transactions on Power Electronics.

REMOTE ORAL SESSION: Emerging Power Electronic Technologies

5:30 pm – 7:00 pm (Venue: SDSB B3)

#	ID	Title	Authors
RO.1	50	Energy-Based Averaged Switch Modeling Applied on a High-Step Down Quasi-Resonant Soft-Switched Converter	Basil Eleftheriades and Aleksandar Prodic (University of Toronto)
RO.2	109	A Wideband Push-Pull Φ2 Amplifier with PCB Inductors and Rogowski Coils for RF Plasma Generators	Sida Chen, Sanghyeon Park and Lei Gu (University of Pennsylvania)
RO.3	97	Design Procedure for Partial-Power Processing Configurations: Considering Gain, Power Rating, and Operating Region of the Converter	Ahmad Beheshti and S. Ali Khajehoddin (University of Alberta)
RO.4	39	A Low-Complexity Balancing Technique for Flying-Capacitor Odd-Level Converters	Siddharth Iyer, Sayan Paul, Dragan Maksimovic and Luca Corradini (University of Colorado Boulder)

REMOTE KEYNOTE

7:00 pm – 7:40 pm (Venue: SDSB B3)

Transient Behaviors and Reliability of Megawatt Systems

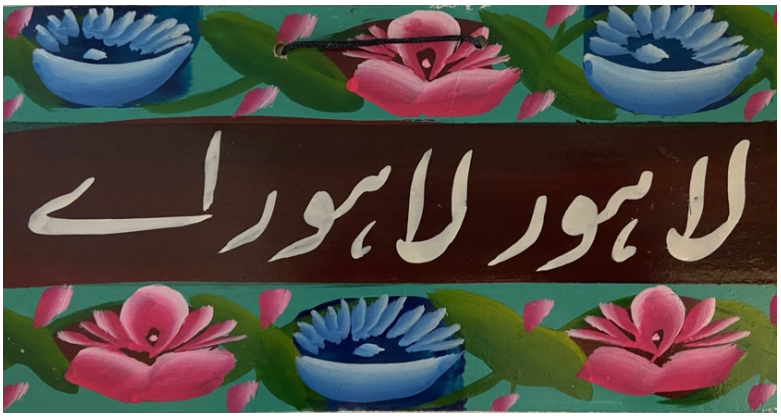
Dong Tan
President,
IEEE Transportation Electrification Council

Dr. Tan has served as Distinguished Engineer, Fellow, Chief Engineer-Power Conversion, Program Manager, Department Manager, and Center Director in a US Fortune 500 corporation. Don earned his PhD from Caltech and is an IEEE fellow. Unusually prolific as a visionary technical leader in ultra-efficient power conversion and electronic energy systems, he has pioneered breakthrough innovations with numerous high-impact industry firsts and record performances that received commendations from the highest level of US Government. He has developed hundreds of designs and thousands of hardware units deployed for space applications without a single on-orbit failure. His suite of world-class electronics performed flawlessly on the James Webb Space Telescope (JWST), located one million miles away, achieving world-record-breaking performances. He is currently the President of IEEE Transportation Electrification Council, Chair of IEEE Fellow Advisory and Oversight Subcommittee, and Vice Chair of IEEE Industry Engagement Committee. Among numerous others, Don has served as Division II Director, IEEE Board of Directors; Fellow Committee Chair, IEEE PELS/PES eGrid Steering Committee Chair, PELS Long Range Planning Committee Chair, Nomination Committee Chair, PELS President, Editor-in-Chief (Founding) for IEEE Journal of Emerging and Selected Topics in Power Electronics, APEC (the fourth largest event in IEEE) General Chair, PELS Vice President-Operations, Guest Editor-in-Chief for IEEE Transactions on Power Electronics and IEEE Transactions on Industry Applications, Fellow Committee, PELS Vice President-Meetings, IEEE Chair for IEEE/Google Little Box Challenge (awarded $1M cash prize), and IEEE/DoD Working Group Chair, developed IEEE/ANSI standards 1515/1573. Don has delivered 80+ keynotes/invited global presentations. He has received more than $30M external customer funding for research and technology development. He also serves on many national and international award, review and selection committees.

IEEE PELS TECHNICAL COMMITTEE 1 (TC1) MEETING AND DINNER

8:00 pm – 9:00 pm (Venue: EDH)

One who has not seen Lahore,
has not been born!

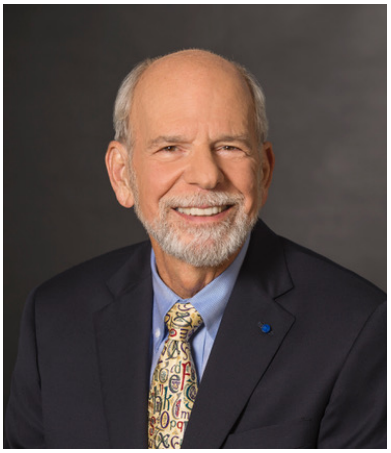


Lahore is Lahore! (*This phrase encapsulates the unique and unparalleled essence of the city, as there is no place like Lahore*)

PROGRAM • TUESDAY, JUNE 25, 2024

BREAKFAST
7:00 am – 8:30 am (Venue: EDH)

REMOTE WELCOMES
8:30 am – 8:40 am (Venue: SDSB B3)



John Kassakian
Professor of Electrical Engineering Emeritus
Massachusetts Institute of Technology
(Founding President, IEEE Power Electronics Society, 1987-1988)

Dr. John G. Kassakian is Emeritus Professor of Electrical Engineering at the Massachusetts Institute of Technology. His fields of expertise is power electronics, power systems, and automotive electrical systems. He received his undergraduate and graduate degrees from MIT, and prior to joining the MIT faculty, he served a two year tour of duty in the US Navy. Dr. Kassakian was the Founding President of the Institute of Electrical and Electronic Engineers (IEEE) Power Electronics Society, served as the US representative to the European Power Electronics Association, and is the recipient of the IEEE Centennial Medal, the IEEE William E. Newell Award, the IEEE Power Electronics Society's Distinguished Service Award, the IEEE Millennium Medal, the European Power Electronics Association Achievement Award, and the Kabakjian Science Award. In 1989 he was elected a Fellow of the IEEE and in 1993 he was elected to the National Academy of Engineering. In 1993 he was also awarded an IEEE Distinguished Lectureship through which he has lectured internationally. He has published extensively in the areas of power electronics, power systems, education and automotive electrical systems, co-chaired the MIT study "The Future of the Electric Grid" and is a co-author of the textbook *Principles of Power Electronics*. Prof. Kassakian is a former member of the Boards of Directors of ISO New England (the independent system operator of the New England electric utility system), Marvell Semiconductor, American Power Conversion Corp., and the Corporate Advisory Boards of Tyco Electronics and Lutron Electronics. He serves as a consultant to government and industry, Dr. Kassakian's interests include sailing, fishing, and gardening. He has two children and resides with his wife in Newton, Massachusetts.

George Verghese
Henry Ellis Warren Professor of Electrical and Biomedical Engineering
Massachusetts Institute of Technology
(General Chair, IEEE COMPEL 1988)

George Verghese earned his BTech from the Indian Institute of Technology, Madras in '74, his MS from Stony Brook University in '75, and his PhD from Stanford in '79, all in electrical engineering. He has been in the EECS Department at MIT ever since, where he is a chaired professor of electrical and biomedical engineering, and has won treasured MIT-wide awards for undergraduate education and for mentoring. He is an IEEE Fellow, and coauthor of Signals, Systems and Inference (2015, with Oppenheim) and Principles of Power Electronics (2nd edition, with Kassakian, Perreault and Schlecht, published last year, a mere 32 years after the 1st edition!).

WELCOME

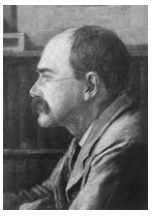
8:30 am – 8:40 am (Venue: SDSB B3)

Syed Babar Ali
Advisor
Packages Limited
(Founder, Lahore University of Management Sciences)

Syed Babar Ali is the founder of Packages Limited and currently serves as its Advisor. He also founded Milkpak (now Nestlé Pakistan), Tetra Pak Pakistan, IGI Insurance, Tri-Pack Films, and IGI Investment Bank. He has served as the chairman of Hoechst Pakistan, Sanofi-Aventis Pakistan, Siemens Pakistan, and Coca-Cola Pakistan. He led the establishment of the Lahore University of Management Sciences (LUMS) in 1985 and founded Ali Institute of Education in 1992. He is a member of the governing body of Aitchison College, and has also served on the board of Kinnaird College, Lahore School of Economics, Layton Rehmatullah Benevolent Trust, and Shalamar Hospital. He was President of World Wide Fund (WWF) International from 1996 to 1999, succeeding HRH Prince Philip, the Duke of Edinburgh. He has received honors from the Governments of Sweden and the Netherlands, and the Order of the British Empire (OBE) from Britain. He has been awarded two Honorary Doctorate Degrees: a Doctor of Laws from McGill University in 1997, and a Doctorate in Education Management from IBA Karachi in 2013. He is an elected member of the American Academy of Arts and Sciences since 2022.

LAHORE HISTORY: Nobel Laureates with Links to Lahore

- Rudyard Kipling (1865-1936) - Nobel Prize in Literature 1907
  - For various works including “Kim”
  - Lived and worked in Lahore as staff of the Civil and Military Gazette during 1880’s
- Arthur Holly Compton (1892–1962) - Nobel Prize in Physics 1927
  - For discovery of the Compton effect
  - Lectured at Forman Christian College Lahore during 1920’s and 30’s
- Har Gobind Khorana (1922-2011) - Nobel Prize in Physiology or Medicine 1968
  - For work on the genetic code
  - Studied at Punjab University Lahore during 1940’s
- Abdus Salam (1926-1996) - Nobel Prize in Physics 1979
  - For work on unification of weak and electromagnetic interactions
  - Studied and taught at Government College Lahore during 1940’s and 50’s
- Subramanyan Chandrasekhar (1910-1995) - Nobel Prize in Physics 1983
  - For work on evolution of stars
  - Born in Lahore on October 19, 1910



KEYNOTE 1

8:40 am – 9:20 am (Venue: SDSB B3)

Next Frontiers in Power Electronics

Johann W. Kolar
Full Professor and Head of Power Electronic Systems Laboratory,
Swiss Federal Institute of Technology (ETH) Zurich

Johann W. Kolar is a Fellow of the IEEE, an International Member of the US NAE and a Full Professor and Head of the Power Electronic Systems Laboratory at the Swiss Federal Institute of Technology (ETH) Zurich. He has proposed numerous novel converter concepts incl. the Vienna Rectifier, has spearheaded the development of x-million rpm motors, and has pioneered fully automated multi-objective power electronics design procedures. He has supervised over 90 Ph.D. students to completion, has published 1000+ IEEE journal and conference papers, 4 book chapters, and has filed 200+ patents in the course of international industry research collaborations incl. 190 granted patents (44 international/WO patents, 28 US patents, 100+ patents in various European countries). He has served as IEEE PELS Distinguished Lecturer from 2012 - 2016. He has received numerous awards incl. 45 IEEE transactions and conference Prize Paper Awards, the 2016 IEEE William E. Newell Power Electronics Award, and 2 ETH Zurich Golden Owl Awards for excellence in teaching. The focus of his current research is on ultra-compact/efficient WBG converter systems, ANN-supported multi-objective design procedures, Solid-State Transformers, ultra-high speed drives, bearingless actuators, and life cycle analyses of power electronics converter systems.

KEYNOTE 2

9:20 am – 10:00 am (Venue: SDSB B3)

Advances in High-Frequency Power Conversion for Industrial Applications

David Perreault
Ford Professor of Engineering,
Massachusetts Institute of Technology

David Perreault received the B.S. degree from Boston University and the S.M. and Ph.D. degrees from the Massachusetts Institute of Technology, all in Electrical Engineering. He is presently the Ford Professor of Engineering at MIT. His research interests include design, manufacturing, and control techniques for power electronic systems and components, and in their use in a wide range of applications. Dr. Perreault is a Member of the National Academy of Engineering, a Fellow of the IEEE and is the recipient of awards for his work in power electronics including the IEEE PELS R. David Middlebrook Achievement Award and the IEEE William E. Newell Award. He is co-author of sixteen IEEE prize papers in the area, and of the second edition of the textbook “Principles of Power Electronics,” (Cambridge University Press, 2023). Dr. Perreault also co-founded startup companies Eta Devices (acquired by Nokia in 2016) and Eta Wireless (acquired by Murata in 2021).

COFFEE BREAK

10:00 am – 10:30 am (Venue: SDSB Basement Lobby)

ORAL SESSION 1: Multilevel Power Converters

10:30 am – 12:00 pm (Venue: SDSB B3)

#	ID	Title	Authors
O1.1	52	Dynamical Modeling and Control of the Flying Capacitor Multilevel Converter Under Quasi-Two-Level Switching for Active Balancing in Light-Load Conditions	Rahul Iyer, Syed Tahmid Mahbub and Robert Pilawa-Podgurski (University of California Berkeley)
O1.2	64	An 8-level Stacked Dual-Active-Half-Bridge Partial Power Processing DC/DC Converter	Matthew Jahnes and Matthias Preindl (Columbia University)
O1.3	24	Scaling Laws for the Magnetic Components in Galvanically Isolated Single-Stage Multi-Level Converter Systems	Jannik Schäfer and Johann Kolar (ETH Zurich)
O1.4	35	An Input Inductor Flying Capacitor Multilevel Converter Utilizing Combined Power Factor Correcting and Active Voltage Balancing Control Technique for Buck-Type AC/DC Grid-Tied Applications	Roderick Bayliss III and Robert Pilawa-Podgurski (University of California Berkeley)

WOMEN IN ENGINEERING (WiE) EVENT AND LUNCH

12:00 pm – 1:30 pm (Venue: EDH)

ORAL SESSION 2: High Frequency Power Conversion

1:30 pm – 3:00 pm (Venue: SDSB B3)

#	ID	Title	Authors
O2.1	15	Series Stacked Φ2 RF Power Amplifier with Hybridized Power Modulation	Calvin Lin and Juan Rivas-Davila (Stanford University)
O2.2	120	Controllable Transformation Matching Networks for Efficient RF Impedance Matching	Khandoker N. Rafa Islam, Xin Zan and David Perreault (MIT)
O2.3	49	Optimization for High-Frequency Power Transformers with Multi-Winding Current Ballasting	Kishalay Datta, Yue Wu, Charles R Sullivan and Jason T Stauth (Dartmouth College)
O2.4	51	Wide Operating Range Bidirectional Impedance Control Network-based AC-DC Converter with Reactive Power Control	Firehiwot Gurara, Dheeraj Etta and Khurram Afridi (Cornell University)

COFFEE BREAK

3:00 pm – 3:30 pm (Venue: SDSB Basement Lobby)

ORAL SESSION 3: Modeling, Control and Optimization

3:30 pm – 5:00 pm (Venue: SDSB B3)

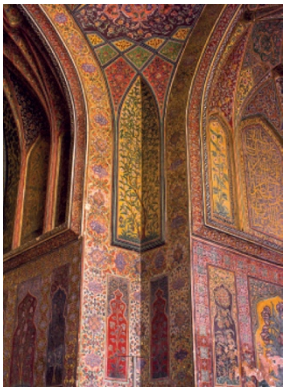
#	ID	Title	Authors
O3.1	106	A Feedforward-Enhanced Feedback Hybrid Hysteretic Charge (HHC) Control for LLC Converters	Maida Farooq, Sanat Poddar, Tim Merkin and Saad Pervaiz (Texas Instruments)
O3.2	110	Control and Modeling of Current-Sourced Hybrid Switched-Capacitor Converters with Dynamic Loads	William Vavrik, Aria Delmar and Andrew Stillwell (University of Illinois Urbana-Champaign)
O3.3	54	Optimization of an Unregulated Low-Q Resonant Isolated DC-DC Stage for Low-Power AC-AC Converters	Allen Nguyen and Charles Sullivan (Dartmouth College)
O3.4	62	Power Electronics Turing Test: Teach Computers to Understand Power Schematics	Minjie Chen and Dak Cheng (Princeton University)

EXCURSION AND DINNER

5:00 pm – 9:00 pm (Venue: Departure from REDC)





PROGRAM • WEDNESDAY, JUNE 26, 2024

BREAKFAST
7:00 am – 8:30 am (Venue: EDH)

ORAL SESSION 4: Single-phase Inverters and Rectifiers
8:30 am – 10:00 am (Venue: SDSB B3)

#	ID	Title	Authors
O4.1	21	A Low-Profile (1U) Server Level High-Power-Density Online Uninterruptible Power Supply (UPS)	Maida Farooq, Asna Altaf and Khurram Afridi (Cornell University)
O4.2	60	Novel Single-Stage High-Frequency-Isolated Four-Switch Bidirectional Single-Phase PFC Rectifier	Rahel Herzog, David Menzi, Michael Leibl, Jonas Huber and Johann Kolar (ETH Zurich)
O4.3	20	Analysis of 240CPWM with Three-Level Neutral-Point-Clamped Inverter	Xiaosa Sui, Hafsa Qamar, Haleema Qamar and Deliang Wu (Shanghai University)
O4.4	22	Beat Frequency Modulated Twice-Line-Frequency Active Energy Buffer	Emmi Wyttenbach, Dheeraj Etta and Khurram Afridi (Cornell University)

COFFEE BREAK
10:00 am – 10:30 am (Venue: SDSB Basement Lobby)

ORAL SESSION 5: Piezoelectric Converters and Components
10:30 am – 12:00 pm (Venue: SDSB B3)

#	ID	Title	Authors
O5.1	87	A Piezoelectric-Resonator-Based "Active Inductor"	Tucker Skinner, Mustapha Touhami and Jessica Boles (University of California Berkeley)
O5.2	115	A Stacked Radial Mode Lithium Niobate Transformer for DC-DC Conversion	Eric Stolt, Clarissa Daniel and Juan Rivas Davila (Stanford University)
O5.3	28	Operation Modes of a Merged Switched-Capacitor Piezoelectric-Resonator Based DC-DC Converter Enabling Fixed Frequency Power Modulation	Abdullah Saboor, Yuetao Hou and Khurram Afridi (Cornell University)
O5.4	76	Simplified Closed-Loop Control of DC-DC Converters Based on Piezoelectric Resonators	Mustapha Touhami, Harrison Liew and Jessica Boles (University of California Berkeley)

NETWORKING LUNCH
12:00 pm – 1:30 pm (Venue: EDH)



POSTER SESSION 1: Varied Topics in Power Electronics

1:30 pm – 3:00 pm (Venue: SDSB)

#	ID	Title	Authors
P1.1	6	Lyapunov-Based Complex Vector Control with Power Tracking Scheme	Hiroki Ogawa, Toshiji Kato and Kaoru Inoue (Doshisha University)
P1.2	59	A Scalable Passive Balancing Approach for Flying-Capacitor Odd-Level Converters	Siddharth Iyer, Sayan Paul, Dragan Maksimovic and Luca Corradini (University of Colorado Boulder)
P1.3	23	Overtone Piezoelectric Resonators for Power Conversion	Wentao Xu, Sourav Naval and Jessica Boles (University of California Berkeley)
P1.4	48	Combined Thermal Monitoring and Multi-state Estimation of Li-ion Batteries using a Control-oriented Integrated Electrothermal framework	Muhammad Saeed, Hassan Abbas Khan, Qadeer Ahmed, Rizwan Azam, Muhammad Jawaad, Lu Shuai, Arash Khalatbarisoltani and Xiaosong Hu (Chongqing University, LUMS, Ohio State University, COMSATS and NUST)
P1.5	96	Large-Signal Stability Analysis of Low-Inertia dynamic Microgrids during black-start	Tariq Jadoon and Talha Hassan (LUMS)
P1.6	11	Comparative Performance Analysis of GaN FET and Silicon MOSFET in Closed-Loop Synchronous Buck Converter for Electric Vehicle Auxiliary Power Module	Ali Asghar Kerai, Syed Jahania Shah, Lakshman Maheshwari, Khuzaima Ali Khan, Ishtiyaq Makda, Haleema Qamar and Ahmad Usman (Habib University)
P1.7	100	Four-Leg Soft-Switched Active Rectifier for Non-Isolated EV Chargers	Manfredi Gangi and Matthias Preindl (Columbia University)
P1.8	37	Evaluating Low-Frequency Effects of Grid Voltage Dips on the Performance of Single-Phase Boost Bridgeless PFCs	Francisco Javier Azcondo, Alberto Pigazo, Christian Branas, Paula Lamo, F. Javier Diaz and Rosario Casanueva (Universidad de Cantabria)
P1.9	83	Time and Frequency Analysis of Circulating Currents on Input-Parallel-Output-Parallel Dual Active Bridge Converters	Adam Ruszczyk, Thales Queiroz Fonseca and Douglas Nascimento (Hitachi Energy)
P1.10	80	An Improved Li-ion Battery Architecture for UPS Applications	Asad Nawaz Khan, Taha Moaz and Nauman Ahmad Zafar (LUMS)
P1.11	33	A Full-Load Range ZVS Control Scheme of an Inverting Resonant Four-Switch Buck-Boost DC/DC Converter for 5G-RF Power Amplifier	Muhammad Faheem and Xinke Wu (Zhejiang University)
P1.12	118	Look Ahead Information-Based Optimal Control of Traction Electric Machine for Energy-Efcient Operations	Ahmad Hussain Safder, Athar Hanif and Qadeer Ahmed (Ohio State University)
P1.13	102	Efficient High-Frequency GaN-Based Phase Shifted Full Bridge (PSFB) Converter for Electric Vehicle Auxiliary Power Modules	Lakshman Maheshwari, Ali Asghar Kerai, Syed Jahania Shah, Khuzaima Ali Khan, Ishtiyaq Makda, Haleema Qamar and Ahmad Usman (Habib University)
P1.14	107	4-kW GaN-Based 0.1-10 MHz RF Class-D Inverter	Avdit Kohli and Patrick Pribyl (UCLA)
P1.15	73	Nonlinear Control of An Improved Three-Port DC-DC Converter for Multi-directional Energy Exchange in Microgrids	Pengwei Li, Ali Bazzi and Hasnain Nisar (University of Connecticut)
P1.16	104	Design of Highly Integrated GaN Low-Inductance Paralleled Half-Bridge Module Based on PCB/DBC Hybrid Package	Yiping Zhao (Xi'an Jiaotong University)

COFFEE BREAK

3:00 pm – 3:30 pm (Venue: SDSB Basement Lobby)

ORAL SESSION 6: Wireless Power Transfer

3:30 pm – 5:00 pm (Venue: SDSB B3)

#	ID	Title	Authors
O6.1	30	Study of Pavement-Embedded Multi-MHz Capacitive Wireless Power Transfer Systems	Syed Saeed Rashid, Dheeraj Etta, Sophia Lin and Khurram Afridi (Cornell University)
O6.2	111	CC-CV Control of Wireless Battery Charger Based on Discrete-Time Small-Signal Model	Anwesha Mukhopadhyay, Kody Froehle, Arka Basu and Daniel Costinett (University of Tennessee Knoxville)
O6.3	101	Modeling and Optimization of a Through-metal Acoustic Wireless Power Transfer System	Kody Froehle, Daniel Costinett, Victor Farm-Guoo Tseng and Sarah Bedair (University of Tennessee Knoxville and Army Research Labs)
O6.4	26	An Intelligent Control Methodology for In-motion Dynamic Capacitive Wireless Power Transfer Systems	Sounak Maji, Yuqian Cao, Dheeraj Etta and Khurram Afridi (Cornell University)

HISTORY BY NIGHT AND GALA DINNER AT THE LAHORE FORT

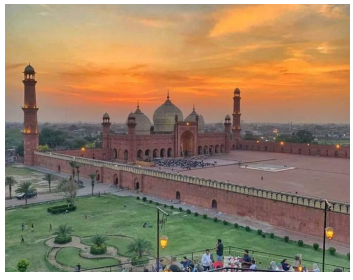
5:00 pm – 10:00 pm (Venue: Departure from REDC)









PROGRAM • THURSDAY, JUNE 27, 2024

BREAKFAST
7:00 am – 8:30 am (Venue: EDH)

ORAL SESSION 7: Grid Interfaced Power Converters
8:30 am – 10:00 am (Venue: SDSB B3)

#	ID	Title	Authors
O7.1	90	Design and Control of a Multi-port EV Charger Powered by Grid and PV	Hafsa Qamar (LUMS)
O7.2	5	Stability Analysis with PLL Effects for a Grid-Following Inverter Based on Complex Vector Control	Yoshio Tamari, Toshiji Kato and Kaoru Inoue (Doshisha University)
O7.3	63	Evaluation of Active Zero Switch PWM for Interleaved Dual Inverter Systems	Akbar Ali Khan, Nauman Ahmad Zaffar and Muhammad Jahangir Ikram (LUMS)
O7.4	121	A Grid-Autonomous Inverter: Aggregating Strengths and Distributing Weaknesses	Inhwi Hwang and Al-Thaddeus Avestruz (University of Michigan Ann Arbor)

COFFEE BREAK
10:00 am – 10:30 am (Venue: SDSB Basement Lobby)

ORAL SESSION 8: Electric Vehicle Power Converters
10:30 am – 12:00 pm (Venue: SDSB B3)

#	ID	Title	Authors
O8.1	42	Input Impedance and Stability Analysis of VSC in Integrated On-Board Chargers for Electric Vehicles	Muhammad Talib Faiz, Junwei Liu, Ka Hei Leung, Muhammad Mansoor Khan and K H Loo (Hong Kong Polytechnic University)
O8.2	71	Strategic Current Control for DC Bias Mitigation in Dual Active Bridge Converters for Enhanced EV Charging Infrastructure	Moneeba Gulzar, Ramish Majeed Raja, Regan Zane and Hongjie Wang (Utah State University)
O8.3	46	Implementation and Validation of a Simplified Dead Time Compensation Scheme for a High-Power Space Vector Controlled SiC Inverter PMSM Drive	Teddy Bonnin, Mashood Nasir, Pierre Delatte and Mostafa El Mokadem (CISSOID and Silicon Mobility)
O8.4	25	Unraveling the Potential of Matrix Transformers in High-Current Low-Voltage EV Applications	Jannik Schäfer and Johann Kolar (ETH Zurich)

ALWADAI LUNCH
12:00 pm – 1:30 pm (Venue: EDH)



POSTER SESSION 2: Varied Topics in Power Electronics

1:30 pm – 3:00 pm (Venue: SDSB Basement Lobby)

#	ID	Title	Authors
P2.1	18	Intelligent Li-ion Battery Management System	Muhammad Sarib Zafar, Muhammad Abdullah Nisar, Abdullah Wahid and Nauman Ahmad Zaffar (LUMS)
P2.2	12	Enhancing Power Generation in Photovoltaic Systems: A Comparison of AI Algorithms	Rukhsar, Aidha Muhammad Ajmal, Bikash Gyawali and Yongheng Yang (Zhejiang University)
P2.3	57	Multi-Phase Current-Mode Power Amplifier Architecture	Xin Zan (University of Maryland)
P2.4	66	Indoor Panel-Based Photovoltaic Emulation Method Implementation and Evaluation	To-Lei Huang, F. Selin Bagci and Katherine A. Kim (National Taiwan University)
P2.5	119	Linear Parameter Varying Control for Permanent Magnet Synchronous Motor-Based Electrified Powertrain	Athar Hanif, Ahmad Hussain Safder, Hassam Muazzam and Qadeer Ahmed (Ohio State University and TEVTA)
P2.6	13	GWO-tuned Supertwisted Integral Synergetic Control of Buck Converter feeding Resistive and Constant Power Load in DC Microgrid	Hafiz Mian Muhammad Adil, Hassan Abbas Khan and Irfan Khan (LUMS and Texas A&M University)
P2.7	36	Performance Improvement of SiC Based Electric Vehicle Charger with an Advanced PWM Method	Hafsa Qamar and Haleema Qamar (LUMS and Habib University)
P2.8	77	Impact of the voltage profiles of CHB vs MW-type inverters on torque and speed ripples for 3-phase induction motors	Muhammad Ayyaz Tariq and Syed Abdul Rahman Kashif (UET Lahore)
P2.9	86	Performance Evaluation of Vector Control Induction Motor Drive with Reduced Common Mode Voltage based PWM Schemes	Akbar Ali Khan, Nauman Ahmad Zaffar and Muhammad Jahangir Ikram (LUMS)
P2.10	40	A New Quadratic Isolated Step-Up DC-DC Converter	Hazem Meshael, Ahmad Elkhateb and Robert Best (Queen's University Belfast)
P2.11	47	Rapid Prototyping of Efficient FPGA-Based High-Frequency Synchronous DC-DC Buck Converter Control for Electric Vehicle Auxiliary Power Module	Syed Jahania Shah, Khuzaima Ali Khan, Lakshman Maheshwari, Ali Asghar Kerai, Ishtiyaq Makda, Ahmad Usman and Haleema Qamar (Habib University)
P2.12	65	Temperature Control for Automated High Frequency Core Loss Testing	Nick Kirkby and Mike Ranjram (Arizona State University)
P2.13	70	Search Space Reduction for Fast Multi-Objective Optimization of Inverter LCL Filters	Mohammed Karooyee and Seyed Ali Khajehoddin (University of Alberta)
P1.14	94	A Novel Multifunctional Single-Stage Three Port AC/DC Converter for Light Electric Vehicles	Tuan Nguyen Manh, Dai-Van Vo, Binh Pho and Phuong Vu (National Taiwan University of Science and Technology, Chonnam National University and Hanoi University of Science and Technology)
P2.15	75	Characterizing High Frequency Power Magnetics under Arbitrary Waveform Excitations with a Low Loss L-C Branch	Hanyu Liu, Haoran Li, Shukai Wang, Kai Sun and Minjie Chen (Princeton University)

COFFEE BREAK

3:00 pm – 3:30 pm (Venue: SDSB Basement Lobby)

ORAL SESSION 9: Magnetics Modeling and Design

3:30 pm – 5:00 pm (Venue: SDSB B3)

#	ID	Title	Authors
O9.1	14	Class-D Amplifier-Based Core Loss Measurements for High Frequency Magnetic Materials	Jacob Anderson, Nick Kirkby and Mike Ranjram (Arizona State University)
O9.2	55	Design of Low-Loss Magnetic-Core Toroidal Inductor for Multi-MHz Wireless Power Transfer Systems	Dheeraj Etta, Syed Saeed Rashid, Souank Maji and Khurram Afridi (Cornell University)
O9.3	117	Orthogonally Variable Inductors with Poloidal AC Currents and Axial DC Fields	Peter Tawiah-Mensah and Al-Thaddeus Avestruz (University of Michigan Ann Arbor)
O9.4	88	Unified Framework for the Passive Volume Comparison of Power Converter Topologies	Logan Horowitz, Rose Abramson and Robert Pilawa-Podgurski (University of California Berkeley)

AWARDS DINNER

5:00 pm – 8:00 pm (Venue: EDH)