



ICIT 2023 Special Session Proposal

Title of the Proposal: Design, Modelling, Simulation and Validation of High-performance Electric Vehicle Powertrains

Technical Outline of the Session and Topics:

Outline of the Session:

The Electric Vehicles (EV) is one of the most reliable and prominent solutions to reduce the carbon foot-footprints. In the process of building sustainable systems the EVs have achieved a significantly high share of the market. At present, most of the research work reported in the state-of-art work is focused on the topic related to motors, power electronic converters, and storage devices. However, efficient utilization of the storage systems (in terms of density, recycle, cost and disposal) high density machines, efficient power converters, reliable and robust control structures are still a challenging tasks and requires extensive research. Especially the machines with high density, magnet less design, optimization of the overall size, volumes, weight and cost for an EV powertrain have not been reported. Multiphase drives are considered a good choice in the case of an EV which facilitates the reduced per phase power to torque ratio, higher fault survivability, minimized ratings of power semiconductors, enhanced efficiency, and torque enhancement feasibility. Replacement of mechanical gearbox used EV with gearless design for EVs is a good choice for attaining better efficiency, reduce the size of the drive and maintenance. However, the efficient techniques used to implement gearless power drive trains are

required to be investigated. Apart from the machines, the power converters and battery systems with respect to design, charging, control, etc., need to be investigated. Therefore, the objective of this special session is to address the above-mentioned issues which are associated with high-performance EV powertrains and review the state-of-the-art techniques used to design EV powertrains. This special issue is intended to cover the area of EV powertrain. The topics of interest are listed below and that are not limited (any topic related to EV powertrain).

Topics of the Session:

- *Various architectures of powertrains and advancements*
- *Techniques used to implement gearless powertrains*
- *Multiphase (more than 3) drives used in EV powertrains*
- *Validation approaches used in EV powertrains*
- *Power electronic converters used in with inverters and dc-dc converters in on-board chargers*
- *Estimation of reliability and lifetime of various components of EV powertrains*
- *Thermal arrangement provided in the battery and power electronic component.*
- *Battery degradation and its solutions*
- *Wideband Gap drives*
- *Various charging techniques used in onboard chargers.*
- *Protection issues in EV powertrains and solutions.*
- *Pole-phase Modulation Techniques used in EV applications*

IEEE IES Technical Committee Sponsoring the Special Session (if any):

Short bio, contact details and IEEE IES membership of the Session Organizers

- *Organizer 1: Prof. Atif Iqbal, Dept. of Electrical Engineering, Qatar University, Doha, Qatar.*

ATIF IQBAL (Senior Member, IEEE, Fellow IET, Fellow IE) received the B.Sc. and M.Sc. degrees in engineering (power system and drives) from Aligarh Muslim University (AMU), Aligarh, India, in 1991 and 1996, respectively, and Ph.D. degree from Liverpool John Moores University, Liverpool, U.K., in 2006, and the D.Sc. degree (Habilitation) in control, informatics, and electrical engineering from the Gdansk University of Technology, in 2019. He is a Full Professor with the Department of Electrical Engineering, Qatar University, Doha, Qatar, and a former Full Professor with the Department of Electrical Engineering, AMU, Aligarh, India. He has been a Lecturer with the Department of Electrical Engineering, AMU, since 1991, where he has served as a Full Professor, until August 2016. Dr. Iqbal has been listed in top 2% highly cited scientists of the world (data released by Stanford University, USA). The world ranking in 2019 was #649, and in 2020 it was #622 and the current ranking is #457 (Year 2021) (whole career data). The ranking in #258 for one year data (2021). He has published widely in international journals and conferences on his research findings related to power electronics, variable speed drives, and renewable energy sources. He has authored or co-authored more than 540 research articles and four books and several chapters in edited books. He is head of the design team of Power Electronics and Drives equipment at Powerlab Instruments, Chennai, India His research interests include smart grid, complex energy transition, active distribution

network, electric vehicles drivetrain, sustainable development and energy security, distributed energy generation, and multiphase motor drive systems

- *Organizer 2: Dr. Mohammed Al-Hitmi, Department of Electrical Engineering, Qatar University, Doha-Qatar.*

Mohammed A. Al-Hitmi received his B.Sc. degree in electrical engineering in 1992 from Qatar University, and his M.S. and Ph.D. in 1994 and 2002 respectively from The University of Sheffield in control engineering. He is currently an Associate Professor of Electrical Engineering at Qatar University, Doha-Qatar. He is serving as Head of the Dept. of Electrical Engineering, Qatar University. He has conducted many research projects funded by national and industrial funding agencies. He has authored more than 50 research papers in top peer reviewed journals and conferences. Dr. Al-Hitmi is involved in several administrative committees in leadership roles in Qatar University. He is also serving as reviewers of many top journals. His research interests include control systems theory, neural networks, fuzzy control, and electric drive systems.

- *Organizer 3: Dr. Prathap Reddy, Department of Electronic Systems Engineering, Indian Institute of Science, Bengaluru, India.*

B PRATHAP REDDY (Member IEEE, INAE Young Associate), received the B.Tech. degree in Electrical and Electronics Engineering from Jawaharlal Nehru Technological University, Anantapur, in 2014, M.Tech. degree in Power Electronics and Drives from Lovely Professional University, Punjab, India in 2016 and Ph.D. degree in Power Electronics and Drives from Indian Institute of Technology Hyderabad, India in 2019. He received Gold Medal for scoring the highest CGPA and Academic Honour award in M.Tech. for year 2016 at Lovely Professional University Punjab. During his Ph.D., received the Excellence in Research Award, Appreciation in Research Awards for the year 2018 and 2019, respectively at IIT Hyderabad, India. He worked as a Postdoctoral Research Fellow in the Department of Electrical Engineering at Qatar University, Qatar from May 2019 to July 2021. He received the INAE Young Engineer Award for the year 2022, from INAE, India. He is also inducted as an INAE young Associate from 2022. He is currently working as a DST Inspire Faculty at the Department of Electronic System Engineering at IISC, Bengaluru. His research interests include magnet less machine design, multiphase machines for gearless electric vehicle design, pole phase modulation techniques, multilevel inverters, charging solutions, gearless or hybrid gear system-based powertrain designs for wind energy systems, power converters and pulse width modulation techniques.

- *Organizer 4: Dr. Shirazul Islam, Dept. of Electrical Engineering, Qatar University, Doha, Qatar.*

Dr. Shirazul Islam received his B.E. (Electrical) and M.Tech. (Power System and Electrical Drives) degree in 2008 & 2010 respectively from Aligarh Muslim University, Aligarh, India. He received his PhD degree from the Indian Institute of Technology, Kanpur (IIT, Kanpur) India in 2021. Currently, he is working as a research associate in the Department of Electrical Engineering, Qatar University, Doha, Qatar. He also served IIT Kanpur as a Senior Research Fellow in the Department of Electrical Engineering. He has also worked as a lecturer in the Department of Electrical Engineering in Aligarh Muslim University, in 2010. He has been a topper student of

his master course. He is the recipient of best Renewable Energy Research Project award from Tarsheed, Qatar on 02 June, 2022. He has published several papers in IEEE Transactions, various reputed Journals and International Conferences. He has been a reviewer for various international journals that include IEEE Transactions of Industrial Electronics, Power Electronics and Industry Applications. He is a member of IEEE, and a life member of IETE. His research area is electric vehicles, multilevel converters, high-gain dc-dc converters, hierarchical control of ac and dc microgrids, compensation of instability in microgrids due to constant power loads (CPLs), sliding mode control and consensus control of microgrids.

- *Organizer 5: Dr Obrad Dordevic, School of Engineering, Faculty of Engineering and Technology, Liverpool John Moores University, Liverpool, U.K.*

OBRAD DORDEVIC (Member IEEE, IES) received the Dipl. Ing. degree in Electronic Engineering from the University of Belgrade, Serbia, in 2008. He joined Liverpool John Moores University in December 2009 as a PhD student. Dr Dordevic received his PhD degree in April 2013 and was appointed a Lecturer at the Liverpool John Moores University in May 2013. In 2018, he was promoted to a Reader in Power Electronics. He has authored or co-authored more than 40 research papers in top peer-reviewed journals and flagship conferences. He is also serving as a reviewer in several journals. His main research interests include power electronics, electrostatic precipitators, and advanced variable speed multiphase drive systems.