



Tutorial Title

Advanced Power Electronics for Health-Conscious Fast Charging and Wireless Charging for Future E-Mobility

Instructor Team

Team Chair: Sheldon Williamson, Ontario Tech University

Co-Speakers: Deepak Ronanki, IIT-Madras

Rick Szymczyk, Upstartz Energy

Abstract

This tutorial will comprehensively explore the pivotal role of advanced power electronics in revolutionizing fast charging and wireless charging technologies with a primary focus on ensuring the health and longevity of EV batteries. Beginning with an overview of the significance of advanced power electronics in the e-mobility landscape, the tutorial will unravel the fundamentals of fast charging, detailing key components and their impact on charging efficiency and battery health. Wireless charging technologies will be comprehensively examined, emphasizing the principles of wireless power transfer and the integration of advanced power electronics in optimizing wireless charging systems. The tutorial will also shed light on health-conscious charging practices, elucidating the importance of battery health and presenting innovative solutions provided by advanced power electronics to strike a balance between rapid charging and prolonged battery life. Through case studies, practical applications, and discussions on future developments, participants will gain insights into the evolving landscape of advanced power electronics, shaping the trajectory of health-conscious fast charging and wireless charging for the future of e-mobility.

Instructor Team Biographies

Sheldon S. Williamson received the Ph.D. degree (Hons.) in electrical engineering from the Illinois Institute of Technology, Chicago, IL, USA, in 2006. He is currently a Professor with the Department of Electrical, Computer and Software Engineering, and the Director of the Smart Transportation Electrification and Energy Research (STEER) Group, within the Faculty of Engineering and Applied Sciences, at Ontario Tech University, in Oshawa, Ontario, Canada. His current research interests include advanced power electronics, electric energy storage systems, and motor drives for transportation electrification and autonomous e-mobility. Prof. Williamson is also an NSERC Canada Research Chair (CRC) in electric energy storage systems for transportation electrification and is a Fellow of the IEEE.

Rick is a Professional Engineer with extensive experience in Automotive and Energy industries. He has a Systems Engineering and Masters of Business degree and has been awarded multiple patents across industries for his innovative work. Sensing a shift towards Electrified vehicles and renewable energy, Rick established Upstartz in 2007 and incorporated Upstartz energy in 2017 helping develop and deploy



IEEE ENERGY CONVERSION CONGRESS & EXPO PHOENIX, ARIZONA, USA ☀️ OCT. 20-24

novel EV Charging technologies across Canada while collaborating with partners locally and globally. Rick's current focus under Upstartz energy is on developing the enormous potential for distributed intelligent Solar based charging systems that are more efficient, effective and provide opportunities particularly for smaller participants in our power distribution system. In addition, Rick serves as Senior Manager at the Ontario Tech. Automotive Centre of Excellence and Software team collaborating with Industry and research partners to advance development and learning at every opportunity.

Deepak Ronanki (Senior Member, IEEE) received the Ph.D. degree in electrical and computer engineering from the University of Ontario Institute of Technology, Oshawa, ON, Canada, in 2019. He is currently an Assistant Professor with the Department of Engineering Design, Indian Institute of Technology (IIT) Madras, Chennai, India. Prior to joining IIT Madras, he was an Assistant Professor with the Department of Hydro and Renewable Energy, IIT Roorkee, Roorkee, India, from 2020 to 2022, and an Assistant Professor with the Department of Energy Science and Engineering, IIT Delhi, Delhi, India, from 2022 to 2023. He has authored or coauthored more than 85 peer-reviewed technical papers, four patents (filed/issued) and ten book chapters. His current research interests include power conversion systems for renewable energy, electric vehicle power trains, electric vehicle charging infrastructure, electric energy storage systems, and transportation electrification. Dr. Ronanki was the recipient of 2021 IEEE Transportation Electrification Community Best 3-min Ph.D. Thesis Award, 2019 IEEE Transactions on Power Electronics Outstanding Reviewer Award, and 2020 University of Ontario Institute of Technology Outstanding Doctoral Thesis Award. He is currently an Associate Editor for IEEE Transactions on Industry Applications, IEEE Transactions on Transportation Electrification, and IEEE Transportation Electrification Community (TEC) eNewsLetter.