## Tutorial Title

**Latest Development and New Technology Trends in Solid State Transformer**

## Instructor Team

Team Chair: Zhicheng Guo, Arizona State University
Co-Speakers: Alex Huang, The University of Texas at Austin
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## Abstract

The Solid-state transformer (SST) technology has been involved considerably in the last years thanks to the new semiconductors technology, the large efforts to improve magnetics designs, and intensive research in power converter design optimization. Moreover, new applications and trends have emerged for SST

This tutorial will cover the latest developments in SST from the system level (power converter topologies and architectures) to the components level (power semiconductor technology, and magnetic components), in which the technology status and the actual state of the art will be emphasized. Besides, the latest work about IEEE standards for SST and the SST projects utilized in clean energy and next-generation flexible and adaptable large power transformers will be discussed.

## Instructor Team Biographies

Dr. Alex Huang is the Dula D. Cockrell Centennial Chair in Engineering at the Department of Electrical and Computer Engineering at UT Austin. Dr. Huang received a bachelor's degree in electrical engineering from Zhejiang University, China in 1983 and his M.S. degree from the University of Electronic Science and Technology of China in 1986. He received his Ph.D. in electrical engineering from the University of Cambridge, UK in 1992. Before joining UT Austin, Dr. Huang has been a faculty member at Virginia Tech (1994-2004) and NC State University (2004-2017). At NC State, Dr. Huang has established several internationally renowned public-private partnerships such as the NSF FREEDM ERC in 2008, NCSU's Advanced Transportation Energy Center (ATEC) in 2008, and the DOE PowerAmerica Institute in 2014. Dr. Huang is a world-renowned expert in power semiconductor devices, power electronics, smart grids, and renewable energy systems. He has published more than 550 papers in journals and conferences and is the inventor of more than 20 US patents including several patents on the Emitter turn-off (ETO) thyristor technology that received a prestigious R&D 100 award in 2003. Dr. Huang is also widely credited for his contribution in developing the Energy Internet concept and the Solid State Transformer (SST) based Energy Router technology. His work on the SST has been named by MIT Technology Review as one of the world's 10 most important emerging technologies in 2011. He has graduated more than 80 Ph.D. students and master students. Dr. Huang is a fellow of IEEE and the general chair of the IEEE ECCE Conference in 2012. He is also a fellow of the National Academy of Inventors. Dr. Huang is the recipient

of the 2019 IEEE IAS Gerald Kliman Innovator Award.

Dr. Marco Liserre obtained the MSc and PhD degrees in Electrical Engineering from the Politecnico di Bari in 1998 and 2002 respectively. He has been an Associate Professor at the Politecnico di Bari and, since 2012, a Professor of Reliable Power Electronics at Aalborg University (Denmark). Since 2013 he is a Full Professor and holds the Chair of Power Electronics at the University of Kiel (Germany). He has been offered and declined professorships at several universities. He has published more than 700 technical papers (1/3 of them in international refereed journals), one book and 7 granted patents (4 with companies). These works have received more than 50,000 citations. Marco Liserre was selected as a Highly Cited Researcher in the field of Engineering (Clarivate Web of Science) from 2014 to 2021. Several of his students (MSc, PhD, and post-docs) are in leading positions in industry and universities worldwide. In 2023, he joined the Fraunhofer ISIT on a part-time basis as deputy director and director of the new division ”Electronic Energy Systems”, as well as of the Kiel branch of the Fraunhofer ISIT. He is a member of IAS, PELS, PES and IES. He has served all these societies in various capacities. In PELS, he is Co-Editor of the IEEE Open Access Journal in Power Electronics and Technical Committee Chairman of the Committee on Electronic Power Grid Systems. He has co-chaired several IEEE conferences being several times Chairman. He has received 16 awards from IEEE, PCIM and EPE-PEMC, including the prestigious 2018 IEEE-IES Mittelmann Achievement Award and the 2023 IEEE-PELS R. David Middlebrook Achievement Award. In 2023, he was awarded the title of ”Ufficiale” by the President of the Italian Republic. In 2025 he will be Chairman of Powertech 2025 in Kiel.

Dr. Levy Costa received the B.Sc. degree in electrical engineering from the Federal University of Ceara, (Fortaleza, Brazil) in 2010, the M.Sc. degree from the Federal University of Santa Catarina, (Florianopolis, Brazil) in 2013, and PhD degree in electrical engineering from the Christian-Albrecht-University of Kiel (Kiel, Germany) in 2019.
From 2013 to 2014, he was a Power Electronics R&D Engineer with Schneider Electric, where he worked with uninterruptible power supply systems (UPS). During this period, he was also an assistant lecturer (part-time) at Federal University of Ceara (Brazil). From 2014 to 2018, he was a Research Assistant with the Chair of Power Electronics, Christian-Albrechts University of Kiel (Kiel, Germany). During this time, his research focused on Solid-State Transformer, particularly in highly efficient converter design and novel architectures. In 2018, he joined the ABB Corporate Research Center in Switzerland as an R&D Scientist working on different power electronics topics. Since 2021, Levy Costa is an Assistant Professor of the Power Electronics Lab at TU/e.

Dr. Zhicheng Guo joined Arizona State University as an assistant professor in January 2024. He was a postdoctoral fellow at the Semiconductor Power Electronics Center, UT Austin. Zhicheng Guo received his Ph.D. degree in power electronics and power systems from the University of Texas at Austin in 2023. Zhicheng Guo is the recipient