

EV Charging: Power Conversion, Quality, and Digitalization

Name(s) and Affiliation(s) of the Lecturer(s):

<p>Lin Ma Autel Netherlands B.V. 2497 GL, Den Haag the Netherlands merlin@autel.com +31 6 11836974</p>	<p>Zian Qin Delft University of Technology Building 36, LB03.640, Mekelweg 4 2628 CD Delft, the Netherlands z.qin-2@tudelft.nl +31 15 27 86584</p>
---	---

Tutorial Objectives:

E-mobility is an essential part of the global carbon-neutral program. Besides batteries, EV charging is another enabling technology in E-mobility, which determines the charging time as well as the impact on the utility grid. Although EV chargers with power ratings from 1 kW to hundreds kW exist to fulfill the various charging demands, the charging power is going up and their installation is increasing quickly. To tackle these challenges, on one hand, advanced power electronics technologies are being developed to handle the high charging power, on the other hand, digitalization is introduced into EV charging to properly manage the charging networks with massive installations. Another challenge that has been overlooked for years but is creating more and more problems is the power quality issues of EV charging, including flickers, harmonics, supraharmonics, etc. In this tutorial, the state of the art of the above-mentioned topics will be reviewed and discussed.

Target Audience:

Anyone from industry or academia working on EV charging

Topical Outline:

1. Introduction (Lin Ma, 40 mins)
 - AC & DC chargers
 - Onboard chargers (OBC)
 - Standards and requirements
 - Technical trends
2. Theme 1 - Power conversion techniques (40 mins)
 - DC/DC power conversion (Zian Qin)
 - AC/DC power conversion (Lin Ma)
 - V2G and islanding technique (Lin Ma)
3. Theme 2 - Power quality of EV charging (Zian Qin, 40 mins)
 - Power quality issues
 - IEEE, IEC standards
 - Current practices and challenges

4. Theme 3 - Digital charging (Lin Ma, 30 mins)

- Power management
- Data management
- Cyber Security

5. Conclusions (Lin Ma, 10 mins)

Provisional Schedule of the Tutorial:

09:00 - 10:20 : Introduction / Theme 1

10:20 - 10:40 : Coffee break

10:40 - 12:15: Theme 2 / Theme 3 / Conclusions/Q&A

About the Lecturers:



Lin Ma is currently the European R&D Managing Director of AUTEL New Energy, which is located in Den Haag, the Netherlands. He received his B.Eng. and Ph.D. degree in Power electronics from Beijing Jiaotong University, Beijing, China, in 2005 and 2011 respectively. From 2008 to 2010, he was a guest Ph.D. at Aalborg University, Denmark. From 2011 to 2014, he was a Research Scientist at Siemens Corporate Technology department. From 2014 to 2020, he was a Senior Research Scientist and System Architect at ABB Research Center and ABB E-mobility B.V.

His research interests include photovoltaic and wind power inverters grid connection control/topologies, EV motor control and EV chargers. He architected the first generation of AUTEL DC fast and V2G chargers, and published more than 20 patents and 20 journals/conference papers in PV inverter, EV motor drive and EV chargers areas. Meanwhile, He served as the section chair of ECCE Asia 2012, IECON 2014 and 2015.



Zian Qin is currently an Assistant Professor at Delft University of Technology, Delft, Netherlands. He received his B.Eng. degree in Automation from Beihang University, Beijing, China, in 2009, M.Eng. degree in Control Science and Engineering from Beijing Institute of Technology, Beijing, China, in 2012, and Ph.D. degree from Aalborg University, Aalborg, Denmark, in 2015. In 2014, he was a Visiting Scientist at Aachen University, Aachen, Germany. From 2015 to 2017, he was a Postdoctoral Research Fellow at Aalborg University. His research interests include power quality and stability of power electronics-based grids, solid state transformers, and wide bandgap devices. He has published more than 100 journals/conference papers, 4 book chapters, and 2 international patents in these areas. He has also worked on several European and Dutch national projects regarding the power quality of wind farms and EV charging.

He is an IEEE senior member, an associate editor of IEEE Trans Industrial Electronics, and a guest associate editor of IEEE Journal of Emerging and Selected Topics and IEEE Trans Energy Conversion. He is a Distinguished Reviewer for 2020 of IEEE Transactions of Industrial Electronics. He served as a technical program co-chair of IEEE-PEDG 2023, a tutorial co-chair of IEEE-PEDG 2022, a session chair in IEEE-ECCE 2022, a technical program chair of IEEE-ISIE 2020, a technical program co-chair of IEEE-COMPEL 2020, etc.

He is an IEEE senior member, an associate editor of IEEE Trans Industrial Electronics, and a guest associate editor of IEEE Journal of Emerging and Selected Topics and IEEE Trans Energy Conversion. He is a Distinguished Reviewer for 2020 of IEEE Transactions of Industrial Electronics. He served as a technical program co-chair of IEEE-PEDG 2023, a tutorial co-chair of IEEE-PEDG 2022, a session chair in IEEE-ECCE 2022, a technical program chair of IEEE-ISIE 2020, a technical program co-chair of IEEE-COMPEL 2020, etc.