VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Shahid Jaman**

The public defense will take place on **Monday 14th October 2024 at 5:00 pm** in room **L.2.03** (Building L, VUB Main Campus)

To join the digital defense, please click here

ADVANCED CHARGING SYSTEMS AND HIERARCHICAL CONTROL STRATEGY ENABLING VEHICLE-TO-X FOR NEXT-GENERATION ELECTRIC VEHICLES

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Abstract of the PhD research

Electric Vehicles are receiving significant attention due to their potential to help reduce the transport sector's high carbon dioxides emissions. The major drawback preventing electric vehicles from populating the roads is the time it takes to charge them in residential and commercial parks. This becomes a greater hassle when going on trips requiring more than one pit stop for recharging, which significantly increases the trip duration.This research focuses on improving the charging infrastructure to make electric vehicle charging faster, more efficient, and accessible to everyone. New ways are explored to improve the onboard chargers by adopting a new charging topology that efficiently transfers the power from the electricity grid to the vehicle. In this way, the charging efficiency and power density can be enhanced without requiring expensive system upgrades. The virtual performance assessment of the proposed onboard charger is performed using MATLAB/Simulink software. Moreover, the new charging method is also tested in the lab environment, validating the efficiency and power quality improvement.This Ph.D. research also investigates the new direct current charging topologies for residential and commercial charging parks. These new direct current charging systems incorporate bidirectional power flow technologies, which provide benefits on the monthly energy bills and enhance the charging station capacity utilization. Additionally, the impact of an optimized charging profile on the proposed direct current charging station is also assessed. The techno-economical advantages are validated through laboratory experiments. The proposed direct current charging systems allow electric vehicle owners to choose between faster and more affordable charging depending on their needs.Overall, the findings of this Ph.D. research contribute to the advancement of electric vehicle charging technologies by making charging faster, safer, and more convenient for users. This research also offers practical solutions to current challenges and paves the way for the widespread adoption of next-generation electric vehicles.