***“The construction and simulation of V2G system in micro-grid”***

Vehicle-to-Grid (V2G) technology has caught people’s attention. Applications of V2G in general Power Grid face some challenges. It is complicated to control, in need of large amounts of EVs and hard to realize in the short term. In this paper V2G is applied to micro-grid and V2G system is constructed based on a parking lot. The structure is proposed in which bidirectional AC/DC and bidirectional DC/DC converters share one common DC bus, and also the coordination control strategy is given. Meanwhile this paper presents a general microsource model as well as a V2G model. Simulation of voltage regulation and renewable energy support is conducted and results prove the availability of proposed structure and control strategy. The work is meaningful to the control and operation for micro-grid and V2G.

***“Single-phase on-board bidirectional PEV charger for V2G reactive power operation,”***

This paper presents the design and implementation of a single-phase on-board bidirectional plug-in electric vehicle (PEV) charger that can provide reactive power support to the utility grid in addition to charging the vehicle battery. The topology consists of two-stages: 1) a full-bridge ac–dc boost converter; and 2) a half-bridge bidirectional dc–dc converter. The charger operates in two quadrants in the active-reactive power (PQ) power plane with five different operation modes (i.e., charging-only, charging-capacitive, charging-inductive, capacitive-only, and inductive-only). This paper also presents a unified controller to follow utility PQ commands in a smart grid environment. The cascaded two-stage system controller receives active and reactive power commands from the grid, and results in line current and battery charging current references while also providing a stable dynamic response. The vehicle’s battery is not affected during reactive power operation in any of the operation modes. Testing the unified system controller with a 1.44 kVA experimental charger design demonstrates the successful implementation of reactive power support functionality of PEVs for future smart grid applications.

***“Modeling of an electric vehicle charging station for fast DC charging,”***

The proposed model of an electric vehicle charging station is suitable for the fast DC charging of multiple electric vehicles. The station consists of a single grid-connected inverter with a DC bus where the electric vehicles are connected. The control of the individual electric vehicle charging processes is decentralized, while a separate central control deals with the power transfer from the AC grid to the DC bus. The electric power exchange does not rely on communication links between the station and vehicles, and a smooth transition to vehicle-to-grid mode is also possible. Design guidelines and modeling are explained in an educational way to support implementation in Matlab/Simulink. Simulations are performed in Matlab/Simulink to illustrate the behavior of the station. The results show the feasibility of the model proposed and the capability of the control system for fast DC charging and also vehicle-to-grid.

***“Bidirectional battery charger for electric vehicle,”***

Increase in electric vehicle mobility has encouraged the growth of vehicle to grid technology. Vehicle to grid technology allows bidirectional power flow between the battery of electric vehicle and the power grid. This allows peak load shaving, load leveling, voltage regulation and improvements of power system stability. Implementation of the vehicle to grid technology requires dedicated electric vehicle battery charger, which allows bidirectional power flow between power grid and electric vehicle battery. In this paper, a new control strategy for bidirectional battery charger is proposed. The proposed control strategy can charge and discharge an electric vehicle battery in both slow and fast mode. The performance of the bidirectional controller is verified by simulation in PSCAD/EMTDC software under different operating modes, which include fast charging, fast discharging, slow charging and slow discharging. The results show that the proposed control strategy performs well in all four modes.