Di Wu
Ph.D.
Electrical Engineering
Major Professor: Dionysios Aliprantis

Integrating Plug-in Electric Vehicles into the Electric Power System

ABSTRACT:
This dissertation contributes to our understanding of how plug-in hybrid electric vehicles (PHEVs) and plug-in battery-only electric vehicles (EVs)—collectively termed plug-in electric vehicles (PEVs)—could be successfully integrated with the electric power system. The research addresses issues at a diverse range of levels pertaining to light-duty vehicles, which account for the majority of highway vehicle miles traveled, energy consumed by highway travel modes, and carbon dioxide emissions from on-road sources. Specifically, the following topics are investigated: (i) On-board power electronics topologies for bidirectional vehicle-to-grid and grid-to-vehicle power transfer; (ii) The estimation of the electric energy and power consumption by fleets of light-duty PEVs; (iii) An operating framework for the scheduling and dispatch of electric power by PEV aggregators; (iv) The pricing of electricity by PHEV aggregators and how it affects the decision-making process of a cost-conscious PHEV owner; (v) The impacts on distribution systems from PEVs under aggregator control; (vi) The modeling of light-duty PEVs for long-term energy and transportation planning at a national scale.