Alternating Direction Method of Multipliers for Decentralized Electric Vehicle Charging Control

Abstract:
The integration of Electric Vehicles (EVs) into the power grid is a challenging task. From the control perspective, one of the main challenges is the definition of a comprehensive control structure that is scalable to large EV numbers. This paper makes two key contributions: (i) It defines the EV ADMM framework for decentralized EV charging control. (ii) It evaluates EV ADMM using actual data and various EV fleet control problems. EV ADMM is a decentralized optimization algorithm based on the Alternating Direction Method of Multipliers (ADMM). It separates the centralized optimal fleet charging problem into individual optimization problems for the EVs plus one aggregator problem that optimizes fleet goals. Since the individual problems are coupled, they are solved consistently by passing incentive signals between them. The framework can be parameterized to trade-off the importance of fleet goals versus individual EV goals, such that aspects like battery lifetime can be considered. We show how EV ADMM can be applied to control an EV fleet to achieve goals such as demand valley filling and minimal-cost charging. Due to its flexibility and scalability, EV ADMM offers a practicable solution for optimal EV fleet control.
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Occurences:

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