Preface

The wide penetration of renewable energy sources and plug-in electric vehicles (PEVs) has imposed significant challenges to the design and operation of the power grid. In particular, the increase in the intermittent renewable sources, such as solar and wind power, seriously affects the provision of system services that balance supply and demand. Such services include frequency regulation, voltage control, and the control and management in day-ahead, hour-ahead, and real-time operation. Utilizing the energy storage system (ESS) in power grids is considered an effective mechanism for absorbing the fluctuation of energy generation and consumption. Besides traditional ESSs, such as pump hydro, the increasing number of PEVs can be viewed as an emerging type of battery energy storage systems (BESSs) that are widely available at the distribution level. This book studies the optimal online charging control of BESS and PEVs, with the aim to absorb the random fluctuation in the power supply as well as demand and reduce the additional burden on the grid due to massive EV penetration. Both the theoretic analysis and numerical results show the effectiveness and efficiency of the proposed online control techniques.

This book not only provides researchers with the latest research results timely and extensively but also presents a comprehensive overview of the online charging control techniques. In particular, the online control techniques have strong practicability since they do not rely on any noncausal knowledge of future information. The researchers, operators of power grid, and EV users will find this to be an exceptional resource.

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