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*Editorial*

# Computational Science in Smart Grids and Energy Systems

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## 1. Introduction

Computational science for smart grids (SG) and energy systems (EG) pertains to the development of mathematical models, numerical simulations, quantitative analysis, and optimization techniques for large-scale, complex, dynamic, and interconnected systems. As one of the most important integrated energy systems in the future, the "smart grid" allows integration of various renewable energy resources with communication and information technologies to meet spiraling growth of load demands. Smart grids will require new methods to ensure user interaction, measurement and management of massive amounts of data, and cyber security. Rigorous reliability and security operation standards for smart grids will require novel computational science technologies for online modeling, estimation, analysis, control, optimization, decision support, and regulation of different forms of energy generation and storage utilization.

The primary objective of this special issue is to examine and disseminate state-of-the-art research and development in the application of computational science technologies in smart grids and energy systems (SG&ES) and identify future research directions.

## 2. Topics Covered in This Issue

Topics covered in this issue are (1) SG&ES modelling and simulation, (2) SG&ES planning and operation, (3) SG&ES stability and security, and (4) control design. Details are as follows.

### 2.1. SG&ES Modelling and Simulation

*2.1.1. Modelling of Devices, Components, and System Constraints.* X. Zhang et al. provide a new model of ultracapacitors to describe their electrical behaviors; C. Cai et al. propose a novel asynchronous third-order transient machine model with consideration of the frequency characteristic; J. Liu et al. derive a practical approach for power oscillation classification by identifying real-time power oscillation curves; J. Xiao et al. give the model definition of distribution system security region to properly consider security constraints in system planning and operation.

*2.1.2. Forecasting Model and Method.* C. Zhou and X. Chen present adaptive combination forecasting model of China's energy consumption; W. Li and H. Xie propose a geometrical variable weights buffer GM(1,1) model to forecast China's energy consumption.

*2.1.3. Simulation and Analysis.* D. P. Chassin et al. propose an agent-based simulation framework for smart grids and integrated energy systems based on the GridLAB-D platform. J. Zhao et al. present an improved topology-based network model to reflect the structural characteristic of power grid properly. M. A. A. Hamad et al. provide a suitable model to