Guest Editorial: Special Issue on Modern Optimization Techniques for Power System Operation and Planning

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In recent years, power systems worldwide undergo dramatic changes in many respects of system operation, control and planning. With growing penetration of renewable energies and other emerging technologies, power grids today are facing various uncertainties and risks. Meanwhile, rapid development of smart grids demands innovative solutions to coordinate and optimize many new and old technologies of different properties to ensure overall system security and efficiency at large. To fulfill the need, this special issue is focused on applications of classical and emerging optimization techniques applied to solve the difficulties and challenges facing power system operation and planning in smart grid environments. Quite a number of high quality papers have been received. The covered topics are topical and broad and they are briefly outlined in the following:

A comprehensive review on modern heuristic methods applied to optimal power flow (OPF) problem has been conducted by Ming Niu, Zhao Xu et al. The mathematical formulation of OPF and necessities of applying heuristic methods are summarized. Several heuristic methods such as genetic algorithm (GA), particle swarm optimization (PSO), etc, and their OPF applications reported in mainstream journals are briefly introduced. Discussions on the status and trend of heuristic optimization methods application on OPF are given.

Two algorithms based on self-learning teaching-learning based optimization (TLBO) and group search optimizer have been proposed for active power dispatching considering EVs by Zhile Yang, Kang Li et al, and for reactive power dispatching with wind power by Yuanzheng Li, Mengshi Li, Qinghua Wu, respectively.

Based on multi-objective genetic algorithm, Miguel Juamperez, Guangya Yang et al propose an advanced volt-var control strategy for low voltage distribution grids considering photovoltaic penetration, which has been tested using the practical distribution grid of Bornholm island in Denmark.

To assess the reliability of wind penetrated power grids in context of electricity markets, an operational reliability amassment using reliability network equivalent and time-sequential simulation is proposed by Yi Ding, Lin Cheng et al. In addition, Chengxin Li, Guo Chen et al develop a new DC model and sensitivity index based approach for reliability enhancement in transmission planning or maintenance scheduling.

Hong Zhang, Dongmei Zhao et al propose a new economic optimization model for smart distribution

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grids based on real-time pricing (RTP) demand response, which is resolved using an interior point method. A binary glowworm swarm optimization (BGSO) based unit commitment model is developed by Mingwei Li, Xu Wang et al, where comparisons to several other methods quantum evolutionary algorithm (QEA), improved binary particle swarm optimization (IBPSO) and mixed integer programming (MIP) have been made to demonstrate the effectiveness and superior performance of the proposed method. Yanbo Chen and Jin Ma propose a robust state estimation method using mixed integer linear programming, which can guarantee the global optimum and reliable convergence.

The paper by Dong Yang, Yutian Liu et al report a model of limiting short circuit current in multi-infeed DC system through coordinated optimization considering the cost and effect of current limiting measures. The new model is solved using the famous NSGA II. Fengji Luo, Junhua Zhao et al develop a direct load control model based on the distributed imperialist competitive algorithm, where coordination with unit commitment (UC) and economic dispatch (ED) are implemented to schedule interruptible air conditioner loads (ACLs).

The paper by Cheshta Jain and H. K. Verma proposes a statistically tracked particle swarm optimization method for automatic generation control in power system, which can explore the global optimum with an improved convergence. Lastly, a cascading failure analysis model for wind penetrated power system based complex network theory is proposed by Yushu Sun and Xisheng Tang, which sheds lights on revealing the profound mechanism governing cascading phenomena in power grids.

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