

Guest Editorial: Special Section on Identification and Observation Informatics for Energy Generation, Conversion, and Applications

THE SPECIAL section presents relevant research works concerning identification and observation informatics for energy generation, conversion, and applications. It has always been known that high-performance operation of machines and power converters requires fast dynamic response and accurate regulation of controlled variables [1]–[3]. As well as proper design of specific control schemes, accurate acquisition, and knowledge of system information based on parameter identification and state observation is an effective measure to obtain enhanced performances regarding disturbance rejection, sensorless operation, parameter adaption, etc. With the increased emphasis on higher efficiency, effectiveness, reliability, and flexibility in energy generation, conversion, and applications, the level of interest and pace of developments in area of identification and observation have further accelerated and witnessed great breakthrough. Substantial new knowledge has been generated with an ever-increasing number of published research articles. Meanwhile, the continuous development of microprocessing technologies also provides a broad space for the application of identification and observation informatics. New industrial applications have been continuous reported with ever increasing more potential. In this scenario, the special section on identification and observation informatics for energy generation, conversion, and applications, especially for the control of machines and power converters, will be timely and of great interest for all those researchers working in this area and, of course, for industry.

This theme was reflected in the large number of articles submitted. The Guest Editors of this special section accepted 12 articles for publication and included them in the collection on the following pages. We hope these articles will show their value over time, while being immediately helpful for our current readership.

SUMMARIES OF ACCEPTED ARTICLES

The first article entitled “Identification and Control of Electric Elasticity Limit for Electric-Spring-Based Flexible Loads” authored by Zhang *et al.* proposes a new control strategy to improve the absorption capacity of electric-spring-based flexible loads for mains voltage fluctuations and enhance the

stability of the microgrid fed by intermittent renewables by comprehensively analyzing the effective working voltage range of electric springs. This article investigates the impact of key parameters on the electric elasticity limit of electric springs, such as the distribution line, the voltage reference, and the loads. Besides, by adjusting the proportion between the critical and the noncritical loads, this article proposes and implements an electric elasticity limit controller to regulate the absorption capacity of electric-spring-based flexible loads for mains voltage fluctuations.

The second article entitled “Stand-Alone Brushless Doubly Fed Generation Control System With Feedforward Parameters Identification” authored by Su *et al.* proposes an adaptive control system, in which the required feedforward parameters such as compensation coefficients and the transformation angle can be identified online by fully utilizing the control action of the inner loops, overcoming this problem that the performance of brushless doubly fed induction generator highly depends on machine parameters and rotor angle.

The third article entitled “An LCC-Compensated Multiple-Frequency Wireless Motor System” authored by Jiang *et al.* proposes and implements a novel kind of wireless motors, namely, the LCC-compensated wireless switched reluctance motor. The definite advantages are that there is no power converter at the motor side and particularly no switched-capacitor array at the transmitter side to realize the multiple-frequency operation.

The fourth article entitled “Disturbance Rejection Through Adaptive Frequency Estimation Observer for Wind-Solar Integrated AC Microgrid” authored by Singh *et al.* presents the performance enhancement of the wind-solar integrated ac microgrid by implementing the adaptive frequency estimation observer aiming for disturbance rejection. The model uncertainties and unknown disturbances are taken care of by nonlinear active disturbance rejection controller based phase-locked loop in conjunction with the adaptive frequency estimation observer.

The fifth article entitled “Real-Time Adaptive Parameter Estimation for a Polymer Electrolyte Membrane Fuel Cell” authored by Xing *et al.* proposes real-time adaptive parameter estimation methods for a polymer electrolyte membrane fuel cell to facilitate the modeling and the subsequent control synthesis. Different from the well-recognized adaptive parameter estimation methods, the proposed adaptive laws are driven by the extracted estimation errors, so that exponential convergence

of the parameter estimation error can be guaranteed, without using any predictors or observers.

The sixth article entitled “Probabilistic Optimal Power Flow With Correlated Wind Power Uncertainty via Markov Chain Quasi-Monte-Carlo Sampling” authored by Sun *et al.* proposes a new probabilistic optimal power flow framework, which can cope with unknown influences on the power system operation, while taking into account the correlations among the wind generation power in multiple wind farms.

The seventh article entitled “Nonlinear Noncausal Optimal Control of Wave Energy Converters Via Approximate Dynamic Programming” authored by Zhan *et al.* proposes a novel nonlinear receding horizon optimal control algorithm for wave energy converter with nonlinear dynamics. The wave prediction can be explicitly incorporated into the proposed nonlinear noncausal optimal control, which leads to a substantial improvement of energy outputs over the existing approximate-dynamic-programming-based nonlinear causal suboptimal controller.

The eighth article entitled “Novel Current Unbalance Estimation and Diagnosis Algorithms for Condition Monitoring With Wireless Sensor Network and Internet of Things Gateway” authored by Hamici *et al.* presents two novel algorithms for the estimation and diagnosis of the current unbalance factor for three-phase power systems from single period of three-phase acquired data samples, named circular phase shift and circular cross correlation.

The ninth article entitled “Unscented Kalman Filter With Generalized Correntropy Loss for Robust Power System Forecasting-Aided State Estimation” authored by Ma *et al.* develops a novel unscented Kalman filter with the generalized correntropy loss to estimate power system state with forecasting aid, which combines the strength of the generalized correntropy loss developed in robust information theoretic learning for addressing the non-Gaussian interference and the strength of the unscented Kalman filter in handling strong model nonlinearities.

The tenth article entitled “Front-End Parameter Monitoring Method Based on Two-Layer Adaptive Differential Evolution for SS-Compensated Wireless Power Transfer Systems” authored by Yang *et al.* adopts a two-layer adaptive differential evolution algorithm to monitor the parameters of the receiving resonators and the mutual inductances of series-series-compensated wireless power transfer systems, which can always find global optimal solutions by the automatically tuned parameters of the differential weight, the crossover rate, and the generations.

The 11th article entitled “Stability Improvement Methods of the Adaptive Full-Order Observer for Sensorless Induction Motor Drive-Comparative Study” authored by Orlowska-Kowalska *et al.* presents the generalized description of adaptive full-order observer speed estimator with all existing stability improvement methods taken into account, detailed stability analysis of the newest adaptive full-order observer with an auxiliary variable adapted online and verification of its stable operation in open- and closed-loop of vector controlled drive system, especially under very slow reverse with regenerating torque, and comparison of mathematical models, stability analysis, and unstable regions of the classical and four modified adaptive full-order observers.

The 12th article entitled “Off-line Inductance Identification of IPMSM with Sequence-Pulse Injection” authored by Wu *et al.* presents a sequence-pulse voltage signal injection method to overcome the dependence on the rotor position, which utilizes the matrix least-square fitting algorithm to fit the current responses for inductance identification. Furthermore, to reduce the disturbance of the injected signal to the rotor position during the identification process, a double-direction injection position trajectory planning is presented.

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