Preface

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In the recent years there has been growing interest in industrial systems and in particular in electric power systems and in robotic systems. This has resulted in the rapid development of modeling and control methods for industrial systems and robots, of fault detection and isolation methods for the prevention of critical situations in industrial environments, of optimization methods aiming at a more profitable operation of industrial installations and of machine intelligence methods aiming at reducing human intervention in industrial systems operation. The focus has now been more in supplying industrial systems with intelligence, which means providing such systems with learning and uncertainty handling features. To this end, the first issue of the journal presents recent and significant results in the design of industrial systems with adaptive and fault diagnosis capabilities as well as with intelligent decision making skills.

1. In “*Nonlinear feedback control of three-phase inverter systems using the Derivative-free nonlinear Kalman Filter*” by G. Rigatos, P. Siano, N. Zervos and C. Cecati a nonlinear feedback control method is proposed for three-phase inverters, which is based on differential flatness theory and on a new nonlinear filtering method under the name Derivative-free nonlinear Kalman Filter. By exploiting differential flatness properties it is shown that the inverter’s model can be transformed to the linear canonical

form. For the latter description, the design of a state feedback controller becomes possible. Moreover, to estimate the non-measurable state variables of the inverter as well as external perturbations affecting it, the Derivative-free nonlinear Kalman Filter is redesigned as a disturbance observer.

2. In “*Fuzzy Kalman Filter validation using the local statistical approach*” by G. Rigatos and P. Siano a method is proposed for the validation of the local models which constitute distributed filtering schemes, such as the Fuzzy Kalman Filter. Using the local statistical approach to fault diagnosis a tool is developed which can detect incipient changes in the parameters of the Fuzzy Kalman Filter (changes that are of magnitude of less than 1 % of the nominal value of the models’ parameters). Fuzzy Kalman Filter validation can find numerous applications in sensor networks, navigation systems, industrial and production systems etc.
3. In “*Kalman Filters for Dynamic and Secure Smart Grid State Estimation*” by J. Zhang, G. Welch, N. Ramakrishnan and S. Rahman it is shown that combining dynamic state estimation methods such as adaptive Kalman Filters with real-time data generated/collected by digital meters such as Phasor Measurement Units (PMU) can lead to advanced techniques for improving the quality of monitoring and events detection in smart grids.
4. In “*Multi String Grid-Connected PV System with LLC Resonant DC/DC Converter*” by C. Buccella, C. Cecati, H. Latafat and K. Razi, a double closed loop control strategy is developed for multi string photovoltaic systems connected to the grid through three level voltage source converters. The outer DC voltage control loop regulates the DC bus voltage while the inner current control loop synchronizes the output current with the grid voltage, thus ensuring unity power factor.

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The efficiency of the proposed control scheme is confirmed.

5. In “*Impact of Electric Vehicle Charging on Voltage Unbalance in an Urban Distribution Network*” by A. Ul-Haq, C. Cecati, K Strunz, and A. Ehsan an analysis is presented about the problem of Voltage unbalance in the low voltage distribution network, which is due to the deployment of the use of electric vehicles. The presented results show that an uneven electric vehicle charging can cause significant voltage unbalance that goes beyond its allowed limit.
6. In “*Optimal operation of a residential microgrid: The role of Demand Side Management*” by G. Ferruzzi, G. Graditi, F. Rossi and A. Russo the problem of demand side management and the shifting of loads in electricity microgrids has been treated through the formulation of an efficient optimization model and the use of computer optimiza-

tion packages. This approach results in more profitable exploitation of microgrids.

The articles included in this issue have been selected after a meticulous review procedure and have been approved by the journal’s Editors-in-Chief after confirming the validity and the accuracy of the results and methods presented therein. The above articles are indicative of the rapid growth of intelligent industrial systems and of their potential use in electric power generation and industrial production. The proposed methods are of assured performance and capable of functioning in a reliable manner under variable operating conditions. These are significant properties that intelligent industrial systems should possess and which will be further analyzed in the subsequent issues of the journal.