Large scale integration of rooftop solar power generation is transforming traditionally passive power distribution systems into active ones. High penetration of such devices creates new dynamics for which the current power distribution systems are inadequate. The changing paradigm of power distribution system requires them to be operated as cyber-physical systems. A goal-based holonic multi-agent system (HMAS) is presented in this paper to achieve this objective. This paper provides details on design of the HMAS for operation of power distribution systems. Various operating modes and associated goals are discussed. Finally, the role of HMAS is demonstrated for two applications in distribution systems. The first one is associated with control of reactive power at solar photovoltaic installations at individual homes for optimal operation of the system.

Numerous and multi-scale deployment of rooftop solar PV systems is quickly rising worldwide to promote economic and sustainable energy policies. The ad-hoc integration of home level PVs with active/reactive power injection capability in existing unbalanced network may impose several issues such as incremental power losses, voltage violation, voltage fluctuation and other power quality issues. In this context, a holonic architecture is proposed to leverage the integration and well-coordination of PV inverters. A hierarchical optimization algorithm is presented to minimize power losses in a decentralized scheme by finding the optimal reactive rooftop PV generation considering the physical connections and the global constraints in the network. A coordination strategy is used to reduce the computational scale and complexity of the developed model, and deal with scalability issues in future power distribution system. Finally, two distribution networks based on IEEE 37 node test feeder are developed to investigate the performance of proposed holonic architecture. A real time simulation model is proposed to verify the effectiveness and robustness of the proposed HMAS architecture.

Worldwide interest in deployment of rooftop solar PV systems is quickly rising

to meet the targets for electricity production from renewable resources and implement smart-grid technologies.

Over the last decade, worldwide interest in deployment of rooftop solar PV systems has increased. to meet smart grid targets. favoring the loss reduction and voltage profile improvement in distribution systems. However,

Implementing smart grid technology initiative involves a wide range of stakeholders, including utilities, technology providers, researchers, policy makers, and consumers.

Over the last decade, worldwide interest in deployment of rooftop solar PV systems has increased.

The concept of smart grids centers on the use of advanced technology to increase the reliability and efficiency of the electric grid. The move to a smart-grid is a shift from a passive centralized network to one that is more customer-interactive in an automated fashion favoring the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.

The move to a smart-grid is a shift from a passive centralized network to one that is more customer-interactive in an automated fashion favoring the efficiency, reliability, and sustainability of supply. In this context, worldwide interest in deployment of rooftop solar PV systems has increased. However, high penetration of house level PV may result in incremental power losses or voltage regulation issues for utility companies. In addition, smart grid calls for faster algorithms to deal with the scalability issues associated with integration of large number of rooftop PVs. In this paper, a holonic multi-agent system (HMAS) is proposed to address these issues through PV reactive power management using a hierarchical optimization algorithm. Agents introduced are blah, blah, and blah. The simulation of the HMAS by using JADE verifies the performance of the proposed method.

on supply and demand balance by considering both efficiency and economy.

A real time simulation model is proposed to verify the effectiveness and robustness of the proposed HMAS architecture.

the reactive power dispatch facilitate the high penetration of rooftop solar PV systems

A traditional distribution network carries electricity from a central power resource to consumers, and the power dispatch is controlled centrally. Distributed generators (DGs) emerge as an alternative power resource to distribution networks at a smaller and distributed scale, which will bring benefits such as reduced voltage drop and loss. However, because most of high penetration DGs are not utility owned and characterized by high degree of uncertainty such as solar and wind, the distribution network may perform differently from the conventionally expected behaviors. How to dynamically and efficiently manage the power dispatch in a distribution network to balance the supply and demand by considering the variability of DGs and loads becomes a significant research issue. In this paper, a multi-agent system (MAS) was proposed to solve this problem through introducing five types of autonomous agents, the electricity management mechanisms, the agent communication ontology, and the agent cooperation strategy. The simulation of the MAS by using InterPSS, JADE and JUNE well demonstrates the performance of the system on dynamic supply and demand balance by considering both efficiency and economy