Microgrid Reinforcement Learning

Can reinforcement learning improve microgrid energy management?
Also,uses reinforcement learning framework to design a multiagent system that aims to optimize the microgrid energy management. Although,aforementioned works present novel ways to handle the energy management problem,they struggle with high dimensional state variables due the curse of dimensionality.

What is deep reinforcement learning (DRL) in microgrids?
Microgrid systems play a pivotal role in the integration of renewable energy sources and enhancing electrical grid resilience. Deep Reinforcement Learning (DRL),a subset of artificial intelligence,holds the potential to revolutionize the control and management of microgrids.

How to manage energy resources within a microgrid?
This paper proposes a deep reinforcement learning-based approach to optimally manage the different energy resources within a microgrid. The proposed methodology considers the stochastic behavior of the main elements,which include load profile,generation profile,and pricing signals.

Can deep reinforcement learning be used in MG energy management?
In this context,despite deep reinforcement learning (DRL) constitutes a well-suited model-free and data-driven methodological framework,its application to MG energy management is still challenging,driven by their limitations on environment status perception and constraint satisfaction.

Can deep reinforcement learning solve energy management problem formulation?
Conclusion This paper proposed the use of deep reinforcement learning methodology based on deep Q-network algorithm to solve the energy management problem formulation of a given microgrid.

Can RL control energy storage devices in microgrids?
Furthermore, recent findings in microgrid control systems have led to the use of RL application techniques to control energy storage devices in microgrids , . In some cases, microgrids may include different types of energy storage systems to better respond to changes in energy supply , , .

Hybrid energy systems (HESs) are gaining prominence as a practical solution for powering remote and rural areas, overcoming limitations of conventional energy generation methods, and offering a blend of technical and economic benefits. This study focuses on optimizing the sizes of an autonomous microgrid/HES in the Kingdom of Saudi Arabia, ...

The microgrid performance depends on the efficiency of the reinforcement learning algorithm. Usually the performance of the learning algorithm is analysed by representing the evolution of the Q -values of the actions [24], like in Section 4.3 (Fig. 6), or the reward or penalty functions [23], [50] .

Reinforcement learning is used as a method to develop optimal strategies for energy management and the authors show that the proposed game converges to the Nash equilibrium. ... Reinforcement learning for microgrid energy management. Energy, 59 (2013), pp. 133-146, 10.1016/j.energy.2013.05.060.

However, the stochastic and intermittent nature of RES have caused difficulties in the economic energy dispatching of MG. Inspired by reinforcement learning (RL) algorithms, this paper ...

Challenges and opportunities coexist in microgrids as a result of emerging large-scale distributed energy resources (DERs) and advanced control techniques. In this paper, a comprehensive review of microgrid control is presented with its fusion of model-free reinforcement learning (MFRL). A high-level research map of microgrid control is developed from six distinct ...

A pioneering technique for optimizing the functionality of a Photovoltaic-Unified Power Quality Conditioner (PV-UPQC) is proposed in this work by replacing conventional synchronous reference frame (SRF)-based control with deep reinforcement learning (DRL). The PV-UPQC is integrated with a microgrid to improve power quality and system efficiency. In this ...

This paper proposes a deep reinforcement learning-based approach to optimally manage the different energy resources within a microgrid. The proposed methodology considers the stochastic behavior ...

on the user''s demand side and uses reinforcement learning for optimal control of energy-saving scheduling. Reference [7] simulates the microgrid environment of battery energy storage combined with hydrogen storage devices and uses the deep Q-network (DQN) reinforcement learning method to complete energy scheduling optimization. Components

Nowadays, microgrid has given scope to significant role in smart grid cities. In microgrid [1, 2], complex energy storage system (ESS) is often installed to address the renewable energy uncertainty, and optimal operation of microgrid is an essential problem.However, the long-step optimization solving for microgrid operation is a complex problem, due to large numbers ...

With dynamic renewable energy generation and power demand, microgrids (MGs) exchange energy with each other to reduce their dependence on power plants. In this article, we present a reinforcement learning (RL)-based MG energy trading scheme to choose the electric energy trading policy according to the predicted future renewable energy generation, ...

Abstract: Challenges and opportunities coexist in microgrids as a result of emerging large-scale distributed energy resources (DERs) and advanced control techniques. In this paper, a ...

Renewable energy integration and microgrid energy trading using multi-agent deep reinforcement learning Daniel J. B. Harrolda,, Jun Caob, Zhong Fana aSchool of Computing and Mathematics, Keele University, Keele, United Kingdom bEnvironmental Research and Innovation Department, Sustainable Energy Systems

Group, Luxembourg Institute of Science and ...

Reinforcement learning (RL) is one of the most promising approaches to achieve this goal because it enables an agent to learn optimal behavior in a microgrid by executing specific actions that maximize the long-term reward signal/function.

As an efficient way to integrate multiple distributed energy resources (DERs) and the user side, a microgrid is mainly faced with the problems of small-scale volatility, uncertainty, intermittency and demand-side ...

Management for Microgrids: a Reinforcement Learning Approach. ISGT-Europe 2019 - IEEE PES Innovative Smart Grid Technologies Europe, Sep 2019, Bucharest, France. pp.1-5, ?10.1109/ISGTEu-rope.2019.8905538?. ?hal-02382232? ...

Deep reinforcement learning is a data-driven method and can be used in high-dimensional sequential decision-making problem. The deep reinforcement learning model can be trained offline and applied online . Thus, deep reinforcement learning is suitable for the application of the optimal operation of the microgrid.

2.2 Reinforcement Learning. Reinforcement learning was developed to solve Markov decision problems without explicit specification of the state transition function. The agent learns how to optimize his cumulative reward by interacting with the environment: at each time step t, it observes the environment state (s_t), chooses an action (a_t), receives an immediate ...

Reinforcement learning-based microgrid energy trading with a reduced power plant schedule. IEEE Internet of Things J, 6 (6) (2019), pp. 10728-10737, 10.1109/JIOT.2019.2941498. View in Scopus Google Scholar [19] S Wang, AF Taha, J Wang, K Kvaternik, A Hahn.

Due to the uncertainty and randomness of clean energy, microgrid operation is often prone to instability, which requires the implementation of a robust and adaptive optimization scheduling method. In this paper, a model-based reinforcement learning algorithm is applied to the optimal scheduling problem of microgrids. During the training process, the current learned ...

PDF | In this paper, we study the performance of various deep reinforcement learning algorithms to enhance the energy management system of a microgrid.... | Find, read and cite all the research ...

The microgrid inverter converts the input DC power into AC power for the transmission system or microgrid, providing the flexibility. It is the main challenge of microgrid coordination to achieve fast and accurate power distribution while maintaining stable voltage amplitude and frequency, and to keep disturbance oscillations within acceptable ...

deep learning, deep reinforcement learning, microgrid, reinforcement learning. 1 | INTRODUCTION. Microgrid is a cluster of distributed generators (DG), stored energy system, local loads along with ...

Deep reinforcement learning (DRL) is a model-free approach and has the advantages to deal with complex nonlinear model, in addition, it can deal with uncertainties by large amounts of data training. ... Sizing Grid-Connected Microgrids Based on Deep Reinforcement Learning. In: Cai, C., Qu, X., Mai, R., Zhang, P., Chai, W., Wu, S. (eds) The ...

Driven by the recent advances and applications of smart-grid technologies, our electric power grid is undergoing radical modernization. Microgrid (MG) plays an important role in the course of modernization by providing a flexible way to integrate distributed renewable energy resources (RES) into the power grid. However, distributed RES, such as solar and wind, can ...

Deep reinforcement learning method is used to solve this dynamic and stochastic optimization problem by taking into account various uncertainties and constraints for the long-range planning. Case studies of 20-year microgrid expansion planning using actual data are conducted. ... Deep reinforcement learning based microgrid expansion planning ...

This method leverages predictive information on photovoltaic power generation, load power, and other factors to simulate energy management strategies for hydrogen-coupled microgrids using deep neural networks and obtains the optimal strategy through reinforcement learning, ultimately achieving optimized operation of hydrogen-coupled microgrids under ...