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IMPLEMENTATION OF FUZZY-P&O METHOD FOR THE EXTRACTION OF MAXIMUM POWER FROM SOLAR PHOTOVOLTAIC CELL

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Abstract: The article presents the extraction of maximum power from solar photo voltaic cell. It begins with the mathematical modeling of solar photo voltaic9SPV) cell. The main challenge with the solar photovoltaic cell is extract the peak power from SPV due to high material and thermal losses. Conventionally, perturb and observ(P&O) are used for extracting the maximum power from SPV but this method has issues like high voltage deviation, more power deviation due to which output load requirement is unable to met. In order to overthrown these issues, fuzzy-P&O method has been proposed which is able to provides least voltage deviation and minimum power deviation in comparison to conventional P&O method. It is also able to meet the load requirement under the different solar irradiations.
Keywords: SPV, voltage deviation, fuzzy, power, P&O

1. INTRODUCTION

Resolving a range of problems that may have an impact on the reliability and effectiveness of the electricity provided to customers is necessary to improve power quality in a power system. These problems include harmonics, fluctuations, light up, sags, swells, and pauses in the voltage. The following techniques and tools are frequently employed to improve power quality: Voltage regulation, correction of power factors, harmonic reduction, voltage sag and swelling mitigation, distributed energy production and storage, grid advancement, and infrastructure improvements are some of the power quality monitoring and control techniques.

Due to the scarcity of fossil fuels and the requirement to minimize pollution, centrally generated power systems are limited. As a result, the network's integration of sources of clean energy has made dispersed generation sources even more crucial. A significant focus of studies are power quality difficulties in disadvantaged and medium-voltage transmission lines due to the increasing incorporation of sources of clean energy into networks. Electrical power converter gadgets, whose primary function is to link

distributed generation (DG) to the infrastructure in order to meet safety requirements, are necessary to link the great majority of renewable energy sources to the electricity supply. If inverters switching frequency isn't done properly, there will be major power quality issues.

Conversely, a decrease in power quality leads to serious issues with power networks, such as improper operation, a decline in the lifespan and effectiveness of the network's electronic and electrical appliances, the formation of parallel and series resonance in certain harmonics because of the presence of inductors and capacitors, and ultimately, increased distortion in the transmission network's voltage. In fact, this work offers academics a roadmap for exploring power quality problems. Stated differently, the aforementioned examples highlight the need of doing research and offering solutions to enhance power quality in distributing systems[1–5].

In this research, methods of reinforcement learning are applied to study decentralised internet financial distribution from sequential information. Understanding operation operations in high-dimension settings with limits when models fail to build complex regulations due to limited explorations is a significant difficulty for the DOED of network microgrids . The present research addresses the DOED problem by developing a hierarchical learning reinforcement approach that generates norms in an ongoing space using the radial basis function assumptions. The HRL algorithms reduce processing expenses while increasing training efficacy because of their hierarchy nature. With fewer connected elements, the online HRL enables improved real-time dispatching effectiveness & global adapting itself.

Furthermore, the HRL method prevents training beyond the feasible course space and baseline infraction, both of which are influenced by domain expertise. We confirm via simulation that the suggested hierarchy of learning can lower over time repair costs and improve operational reliability in the context of a real connected MG clusters in Qingdao with genuine operational data [6–9]. To go deeper into the learning process, we also offer a state of equilibrium of the learning parameters and examine how they are sensitive.

A data-driven Stackelberg market method is recommended for distribution market operators (DMOs) to manage power dispatching amongst several demand response (DR) aggregators additionally referred to as virtual power plants. The framework of the recommended plan consists of two phases. Initially the complex price-response features of consumer loads are estimated using a data-driven approach that utilizes noisy inverse optimization. The subsequent stage receives the load data that the DRAs calculated. In this instance, the actual market interplay among the DMO & the DRAs is modeled utilizing a one-leader multiple-follower unanticipated Stackelberg game, taking operational safety & energy supply unpredictability into account.

A novel penalty method and a modified networked hybrid dual decomposition-gradient descending technique are used to address the suggested data-driven game concept. The usefulness of the suggested approach is illustrated by instances focusing on the distribution evaluation system and a real-world DR operation in China[10–14].

2. IEEE 14 bus system

A basic estimate of the American Electric Power system as of February 1962 is represented by the IEEE 14-bus scenario [15]. There are 11 loads, 5 generators, and 14 buses on it . The structure of IEEE 14 bus system is shown in Fig.1 [15]

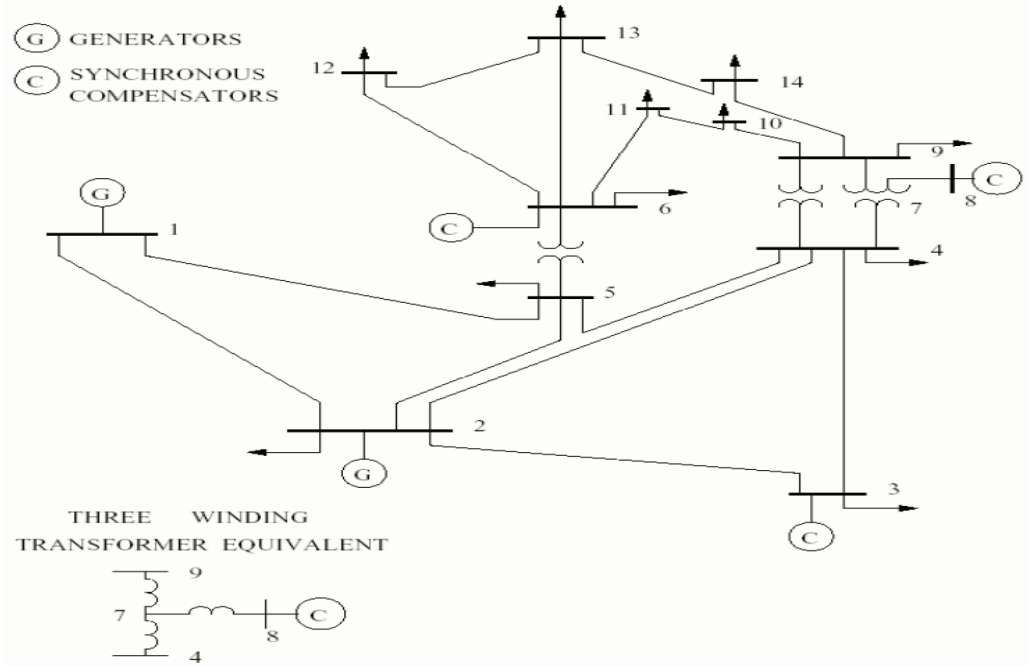

Figure 1. Structure of IEEE 14 bus system[15]

3. Materials and methods (Design of fuzzy logic controller(FLC))

The two inputs of FLC are error(e) and change in error(Δe) which are shown in Eq.1 and Eq.2

$$e=V-Vref \quad (1)$$

$$\Delta e=e(t)-e(t-1) \quad (2)$$

The rules between two inputs is shown in Table.1

Table 1. Table Label

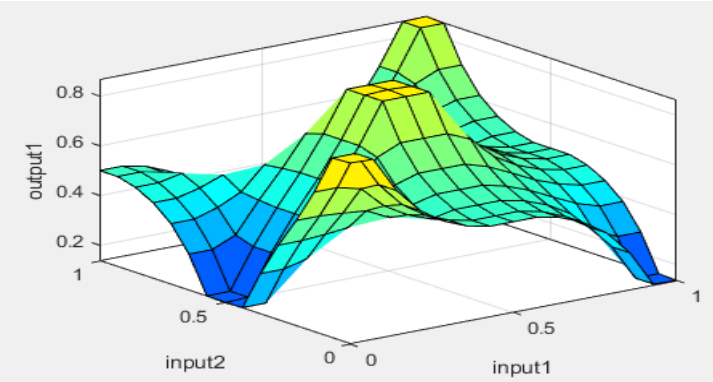

Figure 2 Surface view of FLC

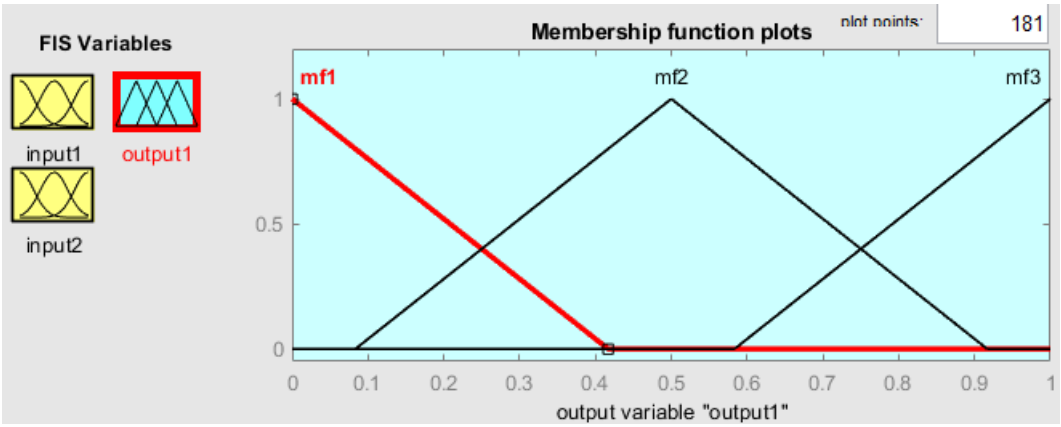

Figure 3 Inputs and output mapping

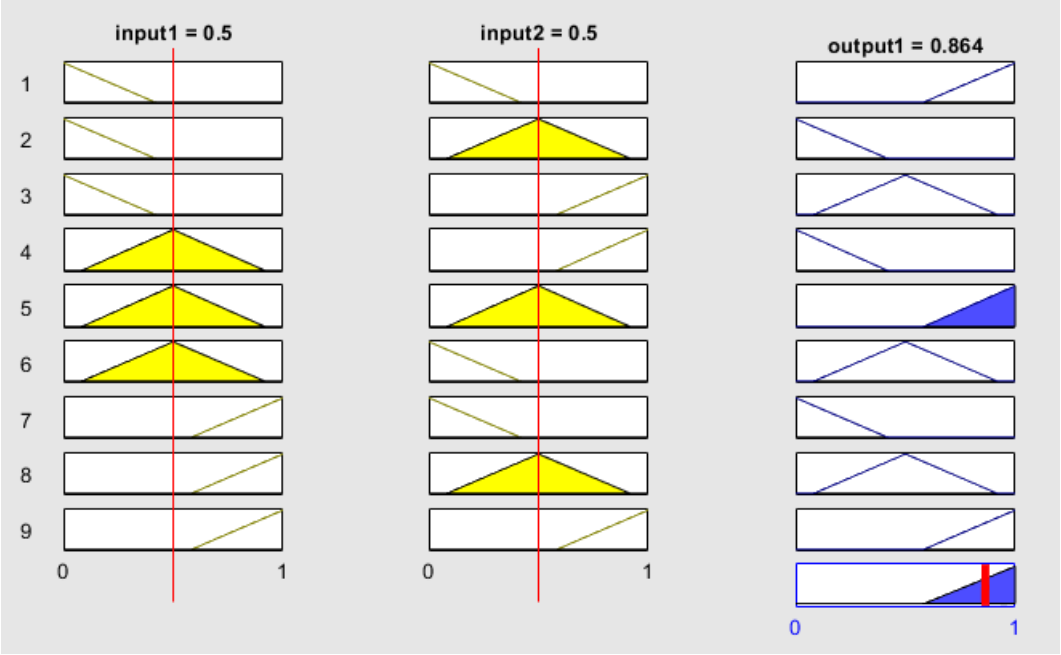

Figure 4 Rules view of FLC

The rules view, mapping between two inputs and output, rule view are shown in Fig.2, Fig.3 and Fig.4

4. Results and Discussion

THD (%) and voltage deviation are the performance parameters for the assessment of power quality in power system network i.e IEEE 14 bus system under 10 % loading conditions and 20% loading conditions which are shown in Table.2 and Table.3

Table 2. performance parameters at 10% loading

	) (%)	age ation

Table 3. performance parameters at 20% loading

	) (%)	age ation

From Table.2 and Table.3, it is observed that THD(%) and voltage deviation has been reduced a lot with FLC under 10% and 20% loading conditions.

5. Conclusion

The article presents the extraction of maximum power from solar photo voltaic cell. It begins with the mathematical modeling of solar photo voltaic9SPV) cell. The main challenge with the solar photovoltaic cell is extract the peak power from SPV due to high material and thermal losses. Conventionally, perturb and observ(P&O) are used for extracting the maximum power from SPV but this method has issues like high voltage deviation, more power deviation due to which output load requirement is unable to met. In order to overthrown these issues, fuzzy-P&O method has been proposed which is able to provides least voltage deviation and minimum power deviation in comparison to conventional P&O method. It is also able to meet the load requirement under the different solar irradiations.

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