Microgrid Computer Distributed Voltage Control Strategy for Multi-inverters

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Abstract. We always emphasize the shortage of some domestic resources. In our cognitive field, it seems that electricity is an inexhaustible energy. In fact, power resources are also renewable resources produced with the assistance of the power system. The micro-grid we often say is a protective measure with auxiliary functions that can solve the problem of electronic failure[1]. In addition, for the distribution of distributed energy, microgrid technology can also help it to connect in a wide range. However, looking at some of the system structures, we will find that the main and most difficult problem is that it is difficult to mobilize the integrated control of the power generated by multiple distributed inverters through the computer. From this point of view, the research on the distributed voltage control of the microgrid computer oriented to multiple or multiple inverters is imminent.

Keywords: Inverter, Microgrid, Voltage Control

1. Introduction

Nowadays, people's lives have become more beautiful and harmonious with the control and growth of power resources. Indeed, from a fundamental point of view, the use of resources in our country is more effective. However, in the use of power resources, we should also accelerate the pace of innovation in power generation processes and principles. If we say that my country's human and financial resources in the power system in recent years are very small. This must be a great lie. At present, my country has spent a lot of money and manpower on various power generation mechanical facilities and long-distance transmission power resources projects. However, with the popularity of power resources and the increase in usage, the coverage of many power grids is no longer suitable for the distribution of the current social masses. In order to effectively alleviate this phenomenon, the well-known power generation mechanism should be innovatively improved. Also on this basis, people put forward the principle of distributed power generation.

However, unfortunately, the emergence of microgrid technology has helped people expand the area of electricity consumption. However, its power supply is unstable. In some cases, the power station will stop power supply or the power supply is interrupted. At this time, smart scholars proposed the use of inverters. According to foreign research, we can find that the use of inverter control can help the micro-grid system to provide a stable power supply. However, in the process of inverter research,
people have gradually discovered that the use of parallel or series control of multiple inverters can control the power grid at different levels. Nowadays, the voltage control of a computer-based distributed power supply for a microgrid with multiple inverters should be a topic that scholars rush to complete.

2. Observe the stratification of microgrid from the perspective of computer control

2.1. The control level of the voltage sag generators of different sets
According to the principle of information exchange, different levels of communication can be realized in the generator. According to the layered structure of the microgrid, the purpose of each layer is also different. But for the number of layers, it is usually divided into three or four layers. In academia, it is habitually divided into three-tier structure. Among them, its first layer is the control interface of the generator that manages the voltage drop. It is mainly used to control the voltage when networking (see Fig 1).

![Figure 1. General situation of computer model distribution of microgrid.](image)

2.2. Undifferentiated voltage frequency control based on the structure of the system
The function of the control interface of the first layer is to adjust the voltage measurement. For the second layer, according to the basic theory of electric power, it should be called the interface for the undifferentiated voltage frequency control of the system[2]. It can dynamically adjust the power of the entire power system and the imbalance of power generated by the load. In other words, it can improve the power balance problem by adjusting the frequency of the voltage.

2.3. Optimization of all aspects of the system based on the above two layers
In fact, the role of the third layer in the operation of the entire power system is relatively small. The main reason is that the third layer is not a mandatory interface. However, its appearance can be used to optimize the operation of the system. In other words, the use of the third-tier structure can take into account various issues of system security and economy. In terms of power loss, it can even calculate useless power and power consumption.

2.4. Internal relations of hierarchical structure
If we look at the adjustment period, the adjustment time of the first layer generator should be the shortest. The adjustment of the voltage frequency without difference in the second layer takes longer than the first layer. There is no doubt that the adjustment cycle of the third-tier optimization measures is the longest. From the inside and outside distribution of the system, the first layer is mainly used to
control the outside of the system. The second and third layers are mainly used to control the interior of the system. The three are mutually independent and mutually help to help the system achieve optimization.

3. Analysis of the control method of the inverter in the computer-supported microgrid

3.1. The form of PQ control based on inverter
Anyone who has studied electric power knows that the calculation of useful and useless work of DG is more complicated. Moreover, the calculation of the two must also take into account the scope of PQ control can be applied. In fact, the given value of the inverter-based PQ control should be the specific value of the useless and useful work given by the DG algorithm. During the calculation, the power output of the inverter must be set as a constant to save.

3.2. Droop control based on inverter
The principles of some power generation equipment in the old power grid are relatively traditional. However, we can rationalize and innovate the original principles. The droop control of the inverter is operated by imitating the principle of a traditional generator. It can change the output voltage according to the change of the system output power to achieve balance. Generally speaking, people usually combine a controller that manages frequency droop and a control that manages voltage levels.

3.3. Control method based on reverse droop of inverter
Here, we need to put forward the concept of a voltage source inverter. Through this kind of inverter, the form of reverse droop control can control the output of useless and useful power according to various parameters of the voltage calculated or measured by the computer. However, the reason it is called the reverse droop control method is that its operation is completely opposite to the traditional droop control.

3.4. Compound control form based on inverter
In some specific cases, each of the three inverter control modes described above meets the requirements of system voltage control. In order to effectively solve such a special voltage control problem. Experts suggest that two or three of the three should be properly integrated to control the system voltage with multiple control modes. Learning from each other's strengths has always been the most user-friendly part of inverter control.

4. The basic algorithm of one-off voltage control based on multiple inverters and computer applications

4.1. Shortcomings in generator-based voltage control
From the perspective of electric power, each main circuit in the principle structure of the generator and the controller is a three-phase full-bridge inverter. If we say that we do not consider the impedance of the circuit, the generator will still be affected by changes in reactance and power under the limitation of the droop control characteristics of the inverter. Moreover, under the restriction of the droop characteristics of different types of inverters, the useless power will also be affected to cause the deviation of the distribution. This is the lack of voltage control of the generator.

4.2. The innovation of the algorithm based on the limitation of the generator to improve the controller
For a long time, people have been studying how to improve the algorithm of the controller[3]. This is not a form of blind modification. What it needs is the cancellation of the output impedance of the generator and the voltage drop on the line. Regardless of the impedance of the line and the limitation of the sagging characteristics, according to the cancellation form of the voltage drop, we can calculate the output voltage formula according to the name value formula of voltage control.
4.3. Secondary control of voltage parameters in island mode of microgrid

From the perspective of power economics, using the generator's useless power as the reserve for voltage control should be the most cost-saving method that can be thought of in current grid control. From this point of view, the means to set the secondary voltage control is also a step that must be performed in the island mode. Its basic principle is to use the power generation unit in the primary voltage control bus to maintain the bus voltage to complete the secondary improvement of the voltage.

Table 1. Computer distributed voltage control strategy for microgrid based on multi-inverters.

| Control Strategy          | Main features                                |
|--------------------------|----------------------------------------------|
| Parallel PQ control      | Ensure inverter stability                    |
| Signal generator addition| There is a chance that the system is stable  |
| Main energy operation droop control | Prevent shortening of the life of the energy storage device |
| Low voltage droop control | Low voltage operation                        |

4.4. Analysis of simulation results based on voltage primary and secondary control

According to some of the above-mentioned voltage control theories, we can construct its theoretical thinking into an island simulation model of a microgrid. Of course, this model can be built on the basis of computer simulation software. Through a control simulation, we can find that the difference between the level of the synchronous reactance and the actual power is the main reason that affects the power adjustment accuracy of the voltage. Through the simulation of the secondary control, we can find that after the compensation of the reactance, the accuracy of the voltage power has been significantly improved.

5. Analysis of the distributed voltage control strategy of microgrid computer for multi-inverter

5.1. PQ control method of inverter grid connection status

In the state of parallel network, the stability of the inverter is better. Then, at this stage, if we use the voltage controller to control the power of the voltage in the form of PQ control. During this period, since the grid frequency and voltage magnitude are controlled by the main grid combined with the inverter control, in this scheme, the PQ control of the grid-connected state can basically guarantee the frequency of the output voltage in the grid The range of change becomes smaller (see Table 1).

5.2. Addition of a signal generator for reverse droop control

In the process of reverse droop control, the original generator can even produce a form of power oscillation with almost no loss when its voltage is about to be placed in the microgrid. However, one of the disadvantages is that external voltage assistance must be used when it is operating in isolation. If we say that we add a signal generator during the reverse droop control of the inverter, which can also increase the stability of the system.

5.3. Innovation of droop control under multiple main energy operating modes

The emergence of this program is entirely to help improve the stability of the microgrid system. In the droop control process, the combination of the controller and the reverse droop controller can improve the stability of the microgrid system[4]. However, this situation usually increases the time constant. This is to avoid the shortening of the service life of the energy storage device caused by sudden changes in the network structure and load.

5.4. Droop control means using low voltage control

The proposal of this scheme is only a hypothesis in the literature. Its implementation is basically impossible or people cannot agree with. However, considering the comprehensiveness of the control strategy, this article will also describe it. When the grid is in an isolated operation mode, the controller can switch to the droop control limit, and according to the power compensation of the micro grid, the
voltage can be controlled within the range allowed by the conditions. If it is a low voltage, this situation can also operate stably.

6. The practical significance of the proposed multi-inverter microgrid computer distributed voltage control strategy

6.1. The unbalanced distribution of power resources in my country
Looking at the distribution of my country's power grids, we will find that more power grid nodes will be located in some highly developed areas. Although the amount of electricity used in these areas is very large, the mismatch in the distribution of electricity resources in some small areas will inevitably lead to differences in the cost and use of electricity resources. It is even said that because of the unbalanced distribution of power resources, some people's geographical discrimination will be caused.

6.2. The coverage of microgrids should be expanded
With the progress of our society and the renewal of some unique electric power techniques, the process of urbanization is also expanding[5]. Some areas have also escaped from basic poverty. Areas that were not covered by the power grid will also increase their electricity consumption due to economic prosperity and population growth. In this case, what we need to do is to expand the coverage area of the grid as much as possible.

6.3. Various problems in the concentration of electric power talents
Due to the uneven distribution of power resources, power talents in some power-poor areas will be forced to rush to big cities to seek a livelihood. The population of the original big city has approached the saturation of the city. In this case, the gradual increase in population will also increase various prices and housing prices in big cities. It can even cause a reverse population loss.

6.4. Insufficiency of control skills related to inverter
On the whole, my country's theoretical research on the application of inverters in power resources is not thorough. This is because my country's implementation of the grid is relatively late. However, after the research in this article, the author believes that many puzzles about inverter research can be solved.

7. Conclusion
Through the above analysis, we can see that our country does not have a deep understanding of the theory of voltage control of distributed power generation[6]. On this basis, what we need is to do our best to carry out the actual multi-inverter microgrid computer distributed voltage control research instead of being limited to only simulation research.

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