Analysis of the Impact of New Energy Access on Power Quality

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Abstract

At present, new energy power generation is mainly based on wind energy and photovoltaics, and new energy generation technologies such as photovoltaics and wind power have made great achievements. However, due to the power generation of grid-connected power generation systems led by wind power, solar energy and biomass energy Characteristics of nature and uncertainty, new energy will have a great adverse impact on the power quality of the grid after it is connected to the grid, especially to the voltage and frequency of the grid. In order to promote the sustainable and healthy development of new energy, ensure new Energy is smoothly connected to the grid and the power system is operating safely. We have studied the impact of new energy grid-connected on power quality.

Keywords

Power quality, frequency offset,voltage offset.

1. Introduction

The access to new energy sources in the power grid system will have a great impact on the quality of power. Therefore, it is necessary to conduct a certain study on the power quality caused by the interconnection of new energy sources to ensure that the grid system can be stabilized after the new energy source is connected. Reliable operation. At present, the main form of new energy is photovoltaic and wind energy, because the light intensity of the photovoltaic power system and the wind speed of the wind power system are always in dynamic changes, which makes the new energy source have a certain random fluctuation after the access, and This high power fluctuation will have no small impact on the grid system, and the frequency and voltage of the impact point will have an impact.

2. Photovoltaic power generation model

Photovoltaic power generation is mainly the use of photovoltaics to convert optical energy into electrical energy. The photovoltaic cell is composed of a diode connected in parallel with a constant current source and has the characteristics of a PN junction. Under the influence of factors such as the external environment in the actual work of the power system, it is different from the ideal situation. Here, the series-parallel resistance is used to simulate the operating state of the photovoltaic cell in actual conditions. The actual photovoltaic cell model is shown in Figure1.

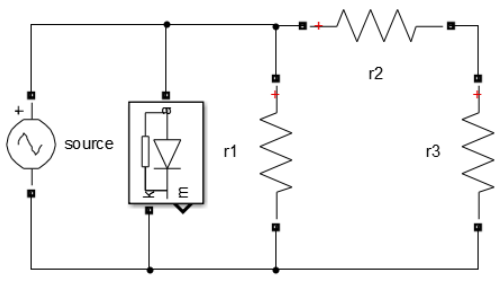

Figure1.Photovoltaic Cell Actual Circuit

Where the direction of I is the forward current direction of its diode, and its expression is:

$$I_D = I_0 \times \left\{ \exp\left[\frac{qU}{KT} \right] - 1 \right\} \tag{1}$$

Where, in the temperature T, I_0 is the reverse saturation current of the diode; $q = 1.6 \times 10^{-9} C$;T is the temperature; $K = 0.86 \times 10^{-4}\ V/K$.

L_i is the photo-generated current, and the value is proportional to the battery area and the illumination intensity above the photovoltaic cell; U is the terminal voltage of the diode, the logarithm of the illumination intensity is proportional, and the external ambient temperature is inversely proportional. According to Kirchhoff's first law, the current equation of the circuit is:

$$I = I_L - I_D - I_r \tag{2}$$

$$I = I_L - I_0 \left\{ \exp\left[\frac{q(U + IR)}{AKT} \right] - 1 \right\} - \frac{U + IR}{R_t} \tag{3}$$

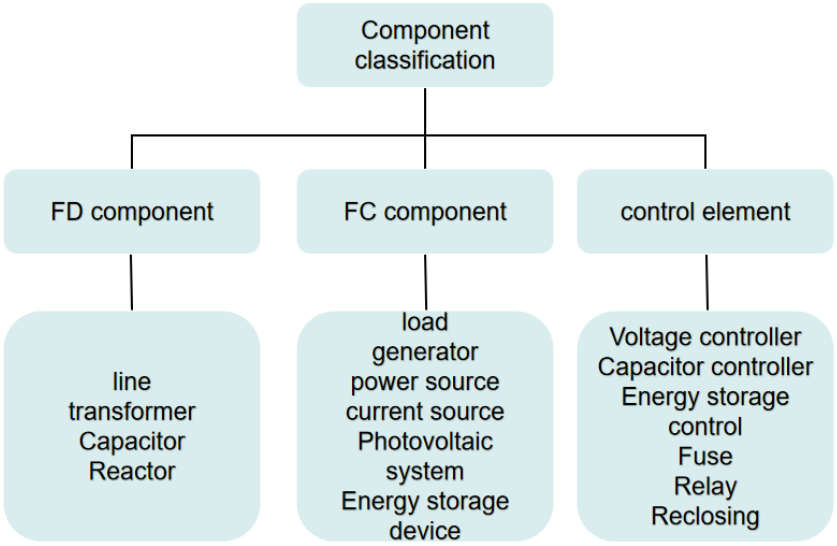

Figure2.Component Model Classification in Distribution Network

3. The impact of the introduction of new energy on the power system

3.1 Grid voltage fluctuation caused by grid integration of wind farms

The voltage fluctuation caused by the grid-connected operation of the wind turbine is due to the change of output power, and the change of output power is mainly caused by the fluctuation of wind speed and wind shearing [2]. The voltage fluctuation value can be expressed as:

$$\Delta V = \frac{\Delta U}{U_N} = \frac{U_{\max} - U_{\min}}{U_N} \times 100\% \tag{4}$$

Where: Umax is the maximum value of voltage fluctuation, Umin is the minimum value of voltage fluctuation, and UN is the rated voltage of the grid.

The randomness of the wind speed will affect the fluctuation of the power output of the wind turbine. At the same time, the wind turbine model and its control system will also have certain influence on the power output. The experiment and experiment show that the output power of the group is close to the rated power when the high wind speed is allowed. When the wind speed is low, the group will capture as much air volume as possible to ensure the active power of the output. This process is in turbulence, and the output power is unbalanced. When the variable speed wind turbine is put into operation, the transient process is long, and gradually increases to the rated value for several tens of

seconds. The reactive power is controlled to ensure the terminal voltage is stable, and the influence of the variable speed wind turbine on the power quality of the grid is reduced.

3.2 Changes in grid frequency caused by new energy sources

If the frequency deviates from the normal range, users, power plants and the system itself will have a great impact. The frequency is related to the active power of the power system. The active power directly affects the frequency change. A photovoltaic power plant is used as an example to illustrate the relationship between frequency and active power. Figure 1 The frequency change when the photovoltaic power generation is small is shown in Figure 1. When the photovoltaic power output active power is small, multiple PV units are switched, and the frequency of the network fluctuates within the allowable 50±0.2 Hz range. After the proportion of capacity to the total capacity of the power grid is gradually increased, the output of the new energy generator set has a certain randomness, which causes the frequency of the power grid to fluctuate frequently.

4. Conclusion

At present, due to the particularity of new energy sources and China's technical capabilities in terms of new energy, there is still a slight lack of new energy. This makes the new energy have a certain impact on grid power quality after grid-connected power generation, and even some people are connected to the grid of new energy. The technology also raises questions, which have a negative impact on the development of China's new energy technology, which also seriously threatens the stable operation of the power grid system. In response to these problems, it is necessary to intensify research, improve and optimize grid-connected technologies, promote the continuous development of new energy power generation, and provide new energy to humans, the normal power demand of people with disabilities, and thus the quality of life of people. Continuous improvement. In general, the integration of new energy sources not only does not bring power quality problems to the power system, but also diversification of energy supply is beneficial, and has a positive effect on improving the structure of the power system and the development of the local economy.

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