# The Application of Power Electronic Technology in Power System Chen-Tao

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**Abstract.** Power system is an important part of power electronic technology application domain. With the rapid development of electronic power components and computer technology, power electronic technology has been widely used in power system. It is of great value and significance in stable operation of power system. This paper studies the application of power electronic devices in power system to provide reference basis for the intelligent development of power system so as to ensure the safe and efficient operation of power system.

Power system is widely used in energy recycling and transportation, and it plays a very important role and has great value in our socialist construction. Global climate change has led power system gradually to get on intelligent development path, which has laid a good foundation for the sustainable development of power system. Large-scale intervention of distributed power and energy storage devices improves the efficiency of electricity transmission, realizes the intelligent development of power distribution and power consumption, and ensures the safe and efficient operation of power system. Power system's safe and efficient operation needs power electronic devices to achieve. With the development of high voltage and high-power power electronic components, electronic power device plays a very important role in the development of intelligent and unitized electronic system.

## I. THE MAIN APPLICATION OF POWER ELECTRONIC DEVICES IN POWER SYSTEM

## A. Power generation link

1. Generator excitation. The application of static excitation technology in large generator can quickly improve the speed of generator, and the control is simpler. It can guarantee the operation of power plants under efficient environment. Ac excitation technology is often used in hydroelectric generator. It regulates the current excitation dynamic frequency and can rapidly implement the dynamic adjustment of water flow in power system and improve the quality of power so as to achieve water use efficiency.

2. Wind power generation. In wind power generation, inverter is the most important core link. In wind power generation, wind energy and electric energy conversion is mainly implemented by adjusting the inverter and the convection and to be consistent with the requirements of the grid by means of wind power voltage and frequency. As constant technology improvement and update, two levels and three levels inverter topology changes into H Joe cascade type, etc., and they are widely used in wind power generation system. They can effectively improve the capacity and voltage of wind power and have very strong ability and function at the loss of the circuit and transmission lines. So for large-scale wind farms, this kind of power electronic devices is often used. According to international new parallel operation rules requirements, access power grid to wind power system. Power generation system needs to have power control and power regulation, etc. to realize fault crossing ability, etc.

3. Photovoltaic power station. Large photovoltaic power station consists of photovoltaic array component and junction stations. In the process of large-scale eagle solar energy, it plays a very important role. Parallel inverters are connected with power grid, and photovoltaic power station can implement free supply and compensation effect on voltage. Large photovoltaic power plant are applied and popularized at present gradually, and photovoltaic array has multiple peak heat and hot spot effect. Therefore in large photovoltaic power station, there is a need for reasonable design of

photovoltaic array, considering the inverter and photovoltaic array arrangement, etc.

## B. Electrical energy storage

Using energy storage technology in power system can meet electricity power supply demand in high load link at peak period, and improve the use efficiency of electric power equipment and power grid operation efficiency. At the peak of electricity use, electrical energy storage technology can prevent the occurrence of electricity failure, and can improve the quality and efficiency of electricity. It makes a very significant contribution and has effects on economic growth. Energy storage technologies like pumped storage and compressed air energy storage can meet the needs of production.

1. Speed adjustable pumped storage. The power generation of pumped storage power station is finally transported to power generation system through step by step transportation. So there is a great water level difference between upper and lower reservoir, and the pumped storage power station under the variable speed working state can improve the efficiency of power generation. Rotor winding excitation method is used in speed adjustable pumped storage units, and use thyristor's frequency converter to form excitation control system. In the process of running, the frequency and amplitude of rotor excitation current can achieve any large independent adjustment of power output through constant adjustment of pumped storage units, so as to achieve uninterrupted switch on the motor in the process of operation. Pumped storage preempts in power system can effectively make frequency modulation, phase modulation, etc. to provide a variety of backup functions for the system.

2. Compressed air energy storage. In the process of power system operation, the working principle of compressed air energy storage is: if there is any electricity tough stage, air compressor uses rich armature and gets the energy stored in the form of high pressure air. At the peak of electricity, electricity load releases the stored high-pressure air to drive generators. In recent years, with the development and application of compressed air energy storage system, the application of this technology is very extensive. In air compression process, use variable frequency drive technology to adjust grid load. Maintain the best state of technology, and the air is compressed more thoroughly. In the process of power generation, control the generator and excitation gas storage system power operating range and power efficiency can be greatly expanded.

3. Battery energy storage. Part of battery energy storage system is battery system, and battery types are diverse. Mainly adopt small power converter for the output between battery and current to ensure the current balance. High power converters constitute battery module, and the output interface is battery of series-parallel group, so in the process of operation, it can improve the voltage level, effectively control the equilibrium, and then play a power regulating role. The other part is power regulation. The connection between battery system and grid power electronic equipment is realized by using voltage type converter, and energy storage system can meet the requirements of the grid.

## C. Micro grid

Distributed power, energy storage devices and power converter complement the main structure of micro grid, and they can form a small power distribution system. Micro grid can implement parallel operation with external power grid, play the role of power balance and adjust energy optimization. If any failure happens in external power grid, solute column converter and independent micro grid can run effectively independently, thus it can supply power in the process. The actual operation shows that distributed power supply and grid interconnection can work together in micro power grid to support each other and to the greatest degree play the effective role of the two.

Distributed power and energy storage device can be implemented by multiple converters in micro grid, and also can connect the converter to multiple interfaces. If the converter is multiple, keep their mutual independence between their converters and realize the parts independence of each other under the condition of communication, thus save resources in the process of running and reduce the cost. Ensure the reliability and safety of operation and improve the use performance of the system. Multiple interface converters can realize input and output and converters'

self-sustaining. Multiple interface converters can be interconnected with equipment and play a maximum value and role of each other. Under arbitrary interface, converter can regulate an interface's dc or ac power. Improve resources recycling, optimize the allocation of resources, and improve the economic benefit of power grid interconnection.

The operation of multiple interface converters is mainly divided into three models. In production mode, the converter can be used in renewable energy. Strengthen energy storage, and at the same time continue to use as a power source during power outages. In emergency mode, it can be used as a power source in the condition of power out. In recovery mode, it can carry on the continuous charging to the energy storage device and ensure system running under the steady state and the performance security of the system. Multiple interface converters adopt integrated control system, which can deliver reference value and control volume in the controller, and it can achieve any mode transition in the process of transmission without any errors.

#### D. Transmission link

1. Dc transmission. Dc transmission mainly includes two categories. One is conventional dc transmission, which mainly uses thyristor inverter. The other is flexible direct current transmission, which mainly uses inverter of all control devices. Compared to conventional dc, flexible direct current transmission has great advantages. It can control active power and reactive power and realize the advantages of constant voltage polarity. Therefore in renewable energy, it can be continuous used. Inverter topology mainly uses two phase and three-phase level in flexible direct current transmission, but with the gradually update of technology, elective level gradually develops to the direction of multiple modular and try to reduce the problems of switching frequency and switching devices stress.

2. Fractional frequency transmission system. Fractional frequency transmission system mainly uses low frequency electric power transmission, and it can reduce the electric distance in the process of communication transmission, improve the ability of electricity transmission and prevent the occurrence of wave circuit pressure. Generator speed is slow in renewable energy power generation system, so we can make use of its advantages in power generation and transmission power. At present, frequency transmission way is mainly adopted to realize the interconnection between switch and transmission line.

3. Solid state transformer. In electronic power technology, solid state transformer is a transformation technology. Electrical energy conversion relies mainly on transformer and electromagnetic coupling. Change the amplitude of voltage or current. Solid state transformer can carry on the control to the current and adjust the quality of electrical energy. In the power system it has the characteristics of stability, flexibility and so on to further improve dc power supply and power quality.

#### E. Power quality

1. Reactive power compensation. System power can use dynamic reactive power compensator for oscillation to ensure the voltage stability and adjust the imbalance between the voltages. When designing chain static synchronous compensator, make optimize design to achieve continuous adjustment of power.

2. Harmonic governance. Harmonic governance mainly has two kinds. One kind is active harmonic governance. Use multiple technology and pulse width modulation technology to inject converter device into the grid to realize the interconnection between the two. In the harmonic grid, harmonic can be greatly reduced. The other is passive harmonic governance. A filter mainly adopts hybrid and cascade power supply, which can effectively make dynamically changing external governance harmonic and reduce net side current harmonic content. The efficiency and utilization of electric power equipment are greatly increased.

3. Voltage sag suppression. In middle and low voltage power system, voltage sag suppression causes great influence to enterprise's production. It not only affects the enterprise production efficiency, also reduces the quality of the products, and it causes a lot of damage to the enterprise. So we can use dynamic voltage restorer to make dynamic compensation to the voltage and control the unbalanced voltage sag. At present the main findings direction of dynamic voltage restorer is to

extract energy from the power grid and realize multilevel inverter without series transformer.

#### **II.** The problems to be solved in the application of power electronic devices

In the face of future demand for the development of power system, power electronic devices need to solve problems of several aspects to effectively promote the healthy and sustainable development of power system. In power system, optimize the converter of energy storage power system and optimize its operation. In wind power plant, improve wind energy conversion efficiency and improve the application efficiency of the inverter. In micro grid, improve the operation efficiency of the inverter and optimize the design to achieve optimal power quality. In the development and utilization of renewable energy, use new technology to update converter design technology to increase power. In large photovoltaic power station, the effective run of grid inverter cluster is one of the problems need to be solved.

## **III.** CONCLUSION

Power electronic technology constantly updates with the development of The Times. Computer provides a reliable technical support for the development of power system. The application of power electronic devices in power system can greatly improve the efficient operation of power system and provide direction and technology for the development of intelligent power system.

#### REFERENCES

[1] Jiang Jianguo, Qiao Shutong, Gao Dengke. The application of power electronic devices in power system [J]. Automation of Electric Power Systems, 2014, (3) : 2-6 + 18.

[2] Huang Zongjian, Wei Hongfei, Wu Huimin. The application exploration of power electronic technology in power system [J]. Journal of Electronic Testing, 2014, (13) : 91-92 + 134.

[3] Wan Xin. The application and development of power electronic technology in power system [J]. Journal of Electronic World, 2012, (03) : 69-71.

[4] Sheng Kuang, Guo Qing, Zhang Junming, Qian Zhaoming. Application prospect of silicon carbide power electronic devices in power system [J]. Proceedings of the CSEE, 2012, (30) : 1-7 + 3.

[5] Li Wei, Lin Li, Xiang Chao. Power electronics technology application in power system [J]. Small and Medium-sized Enterprise Management and Science and Technology, 2015, (03) : 119-120.

[6] Wei Lin, Liao Huixin, Yi Ganhong. The application of power electronic technology in power system [J]. Journal of Digital Technology and Applications, 2012, (10) : 97-98.