Power Electronics Technology Considering Rough Set Attribute Reduction Algorithm Application of Electric Braking in Large Power Grid

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Abstract. How to apply the advanced power electronic technology to the large power grid effectively, and improve the power electronic technology for meeting the future actual development needs of the large power grid, which is also one of the main research tasks at present. In this paper, the actual demand of power electronic technology is discussed in detail in the process of the development of our country's large power grid, and the actual development direction of power electronic technology in the process of the construction of large power grid is simply analyzed, and the main development goals in the later stage are further proposed.

Keywords: Power Electronics, Large Power Grid, Power Quality

1. Introduction
The rapid development of high voltage grid, grid pattern and power supply structure have changed significantly[1-2]; One of the current risks is the power oscillation of regional tie lines and the large-scale off grid problem of new energy caused by the huge energy impact caused by DC commutation failure[3-4]. In addition, if the DC terminal and drop point are too concentrated, the three-phase permanent fault of the AC line will lead to the failure of multiple DC commutation at the same time. It will spread to the whole power grid connected with the disturbance point [5], and there will be voltage or frequency stability problems. The electric braking technology with high-voltage switch electric operating mechanism is applied to the motor parking. The energy consumption braking is used to change the motor into other driven motor, and the braking energy generated makes the motor complete the parking in a short time. The application of electric braking technology in the left bank power station, the right bank power station and the right bank underground power station of the Three Gorges project is introduced respectively, with the emphasis on single machine braking. Based
on the phase plane analysis, two kinds of generator speed difference are proposed. Control strategy to suppress system oscillation\(^{[6]}\). The relationship between the rise of bus voltage and the surplus reactive power and the short circuit capacity of the system is pointed out.

Especially in recent years, the construction speed and scale of our country’s large-scale power grid are increasing, which can effectively meet people’s more and more high demand for power. Advanced power electronic technology is a relatively new technology in the whole power industry, which can be better used in power exchange. Because the use of this technology can greatly improve the utilization rate of electric energy, this technology has been widely used in many industries. Therefore, the relevant staff must conduct in-depth research on the advanced power electronic technology, so that it can be effectively applied in the later construction of large power grid.

2. Application significance of power electronic technology electric braking in large power grid

In today’s stage, our country’s power grid structure is still relatively weak, in terms of power transmission and distribution, we need to continue to improve. Advanced power electronic technology can realize the regulation of the system, and also can effectively regulate the distribution of power flow. Therefore, the power grid can always be kept in a relatively safe operating environment. In the process of application of renewable energy, the use of advanced power electronic technology can more effectively achieve the generation control and effective scheduling of renewable energy, and also can make these energy access large-scale and distributed, laying a solid foundation for the use of energy. In the process of power quality management, the use of advanced power electronic technology can effectively strengthen the interaction between users and power suppliers, better realize the great improvement of power grid power quality, so as to get better quality and more stable power supply.

3. Attribute reduction algorithm of rough set

Large power grid refers to the intelligent power grid, which is a relatively new type of power grid, which can effectively improve efficiency, greatly reduce the waste of energy, and the loss of power, better guaranteeing the safety of power consumption. With the rapid development of economy, the application scope of large power grid is more extensive. Although the large power grid in the United States has been very mature, it is still unable to effectively meet the actual needs of our country. Although our country’s large power grid is still in the early stage of development, it has achieved very good results in the whole large power grid field.

For the sake of simplicity, this paper only discusses the attribute reduction of rough sets

\[
S = \{(x_i, y_i) | (x_j, y_j) \in R^n \times \{-1, 1\}\}
\]  

Among them, \((x_i, y_i)\) the optimization problem of attribute reduction function of regularized rough set can be expressed as follows

\[
\min_{w \in \mathbb{R}} \Phi(w) = r(w) + \frac{1}{n} \sum_{i=1}^{n} f_i(w)
\]

Among them, \(w \in R^n\), \(r(w)\) is the regularization term, the attribute reduction function of rough set \(f_i(w)\) is caused by data \(x_i\).

It is assumed that the attribute reduction function of rough set is the objective function of attribute
reduction of rough set $\Phi(w)$ it has strong convexity. Many researchers have studied the solution of optimization problem (2). Among them, the attribute reduction algorithm of rough set is the simplest first-order optimization method

$$w_{n+1} = w_n - \eta g(w_n)$$

(3)

4. Application of power electronic technology electric brake in large power grid

The model has been tested on the test platform ieee37, which is the actual part of the 4.8kv power system located in California. The load bus is a mixture of constant power, constant current and constant impedance load, the total power demand is close to 2MW active power and 1mvar reactive power. However, the inductance / resistance ratio shows a small change, ranging from $X/r = 0.5$ to 0.67. This proves hypothesis 1, Among them, it is claimed that $\angle Ze$ is constant in the whole network. The situation that 5 power systems are deployed in this part of the power system is considered (see Figure 1)

![Figure 1. Schematic diagram of test feeder](image)

Suppose that each power system and PCC correspond to the reactive power optimization in the network layer. Use $C$ (use $|C| = m$) to represent this subset of G nodes. Each reactive power optimization has some computing power and some sensing power, in the form of phasor measurement unit, reactive power optimization corresponding to power system can also start the set value of reactive power injected by power system through command (see Figure 2). Finally, reactive power optimization can communicate through some communication channels (through power line communication) that may be the same power line.

In order to complete the power electronic technology braking task, the intelligent power electronic technology braking system first needs to collect the data required for the recommended task through social perception, and then perform data storage and data analysis and mining. Finally, in order to enable users to quickly access services on their mobile and desktop systems, the system needs to have service publishing capabilities. Figure 2 shows the braking process of power electronics technology appliances.
In the process of power transmission, there will be a lot of related technical parameters, mainly including: HVDC and flexible HVDC, etc. The application of advanced power electronics technology can better ensure the stability of HVDC transmission. In the process of combining advanced power electronics technology with power system, we must control the power system according to the actual situation.

At present, the research and application of electrical braking, with more emphasis on single-machine control or increasing power plant delivery capacity, has not been used to solve the large grid stability and system transient overvoltage situation. Based on power electronics technology, high capacity electric braking has the characteristics of fast response (response time is less than 20 ms) and flexible switching. Based on theoretical analysis and simulation, electric braking can reduce the power oscillation of inter-grid tie-line, and can effectively suppress transient overvoltage and frequency of power supply-side network. Type A electrical system design.

In view of the possible risks caused by the power grid fault impact, this paper puts forward the technical scheme of "absorbing" the instantaneous energy for large capacity electric braking based on power electronics technology. The theory of reducing the fault impact of electric braking is expounded from the theoretical analysis point of view. Simulation results show that a reasonable braking scheme can reduce the system stability level.

The rapid development of UHV power grid, large-scale grid-connected new energy sources such as wind power and photovoltaic, and large-capacity AC-DC long-range trans-regional transmission have continued to grow. The regional tie-line power oscillation caused by the huge energy impact caused by the failure of DC commutation and the large-scale de-networking of new energy are one of the current
risks. In addition, the DC transmission end and the drop point are too concentrated, and the three-phase permanent fault of the AC line will lead to the simultaneous commutation failure of the multi-circuit DC.

The transient energy of the power system is usually caused by the instantaneous power imbalance caused by the disturbance of the system, which will spread to the whole power network connected to the disturbance point, and there will be voltage or frequency stability problems. The electric braking technology of electric operating mechanism with high voltage switch is applied to motor parking. The energy consumption brake is used to turn the motor into other excitation generator, and the braking energy produced makes the motor stop in a short time.

5. Conclusions
In view of the possible risks under the impact of power grid fault, a technical scheme based on power electronic technology to "absorb" the instantaneous energy of high-capacity electric braking is proposed; Aiming at the problems of power angle stability, frequency stability and transient over-voltage of the system, the principle of reducing fault impact by electric braking is expounded from the theoretical analysis point of view, and the influence of different braking capacity and braking time on braking effect is analyzed in detail. All in all, advanced power electronic technology can effectively strengthen the power grid, better ensure the security and stability of power grid supply, and greatly help power enterprises to effectively improve energy saving and emission reduction technology, so that resources can be used more effectively.

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