Research on Intelligent Control of Synchronous Generator Excitation System Based on Computer Technology

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Abstract: With the maturity and development of industrial technology, power system is continuously optimized and improved. And rely on the continuous innovation of the computer, the power system is also constantly improving and upgrading. In the power system, whether in thermal power plant, wind power plant, nuclear power plant or hydropower plant, the generator is always an indispensable part of the power system, has a pivotal position. There are many types of generators, including many internal systems. In the electric power system, the generator, without any doubt, is used to convert the mechanical energy into the electric energy, and finally transmits the electric energy to the electric network through the transformer, the main generating set and so on, thus realizing the ultimate goal of power generation. This paper studies the intelligent control of synchronous generator excitation system based on computer technology, which is of great positive significance. It has a great influence on the synchronous transformation of generator, performance improvement and power system optimization.

Keywords: Computer, Synchronous Generator, Excitation System, Intelligent Control

1. Generator

1.1. Generator introduction

Generators play an important role in industry, agriculture, production, national defense and daily life. A generator is a mechanical device that converts other forms of energy into electrical energy, driven primarily by these power machines, such as water turbines, steam turbines, and diesel engines, to convert the flow of water, air, the energy from fuel combustion or nuclear fission is converted into mechanical energy, which is passed to a generator, which in turn converts it into electrical energy [1]. The general rule for the manufacture of generators is that the electromagnetic power is produced by using the magnetic circuit and electric circuit which are made of the proper magnetic and electric conducting materials. Generators come in many forms, but they operate on the basis of the laws of electromagnetic induction and force.
1.2. Generator action
The function of the generator is to supply power both to the battery and to all power-using equipment when the engine is working normally (above idle speed). The output voltage of the generator is determined by the number of turns in the stator windings of the generator and the intensity of the magnetic field generated by the rotor windings [2]. The Voltage regulator controls the strength of the magnetic field by controlling the current flowing through the rotor coil. On the basis of the three-phase stator windings of the alternator, a set of three-phase bridge rectifier is added by increasing the turns of the windings and drawing out the terminals. At low speed, it is output by original winding and increasing winding in series, and at high speed, it is output by original three-phase winding only. In general, the operation principle of synchronous generator can be divided into four steps: What's the difference between a generator and a battery, if you need equipment to store electrical energy, it's a battery. In daily life, all the power consumption that needs to be used, if the equipment is to work properly, it must have a device to maintain the amount of power that is needed for normal operation, and that device is the generator. Such as People's Daily necessities, cars. As long as the generator is running, it will start generating electricity, which is regulated by some important electronic devices to charge the battery and power other electrical devices in the car. As shown in figure 1:

![Figure 1. Generator excitation system](image)

1.3. Type of generator
There are many types of generators, generally can be divided into DC generators, alternator, synchronous generators, asynchronous generators and so on. The alternator can also be classified as a single phase generator and a three phase generator. The quality licensing system for export products has been implemented for generators, and products without export quality licenses are not allowed to be exported. According to the different mode of production can be divided into turbine generators, water turbine generators, diesel generator, gasoline generators and so on [3]. According to the use of energy can be divided into thermal generators, hydroelectric generators.

1.4. Generator set
We generally use three-phase synchronous generators, except for a few special circumstances. Assuming the generator is a four-stage motor, to produce electricity, which requires the prime mover speed of 1500 RPM. In the case of constant speed, the same displacement diesel engine (high-speed) and gasoline engine, diesel engine Torque is much larger, natural generator output power is also much larger. Therefore, the prime mover of high power is basically a diesel engine. Power density, the overall gasoline engine to beat diesel engine, and gasoline engine start performance is better than diesel engine, so in portable occasions, the application of gasoline engine electric generator more.
When the number of generator phase increases, the same frequency of electricity, speed can be reduced, so we can use low-speed diesel engine to do the power, and gasoline engine low-speed performance is generally not good. The reduction of the rotating speed is beneficial to the cooling and lubrication of the machinery, which greatly prolongs the failure period and increases the reliability. Therefore, many military ships use the low-speed machine to do the generator.

2. Computer

With the development of science and technology, people can not live without computer. Not only in life, the computer also plays a very important role in industry and agriculture. This paper focuses on the application of synchronous generator. So this paper mainly introduces the main application of computer in power system. With the formal computer, only greatly reduce the waste of human resources, power enterprises to promote the pace of wisdom.

The application of the generator in the power plant can not be separated from the computer, it can be said that the two are complementary. For example, to ensure the normal operation of the generator, it is necessary to control a number of valves and auxiliary equipment, most of which are controlled by computers [4]. People only need to operate the computer to achieve these valves and equipment start-up and stop and operation, can be said to greatly reduce the intensity of work for people, bringing benefits.

3. Generator excitation system

As for the main power station, there is no excess power in theory. How much electricity a power station can produce is not up to it. In fact, it is the grid that controls and determines the load and hours of access to each plant. The grid also determines how much revenue each plant can generate. Of course, the specific situation is more, for example, if the power station heating, then heating income is also a part [5]. Moreover, heating is subsidized by cash or hours of Internet access (otherwise no one would want to heat it), and it is possible that when the power load drops, the plant can provide more heat without having to worry about excess power. What is a typical electrical change process? 1. If the load distributed by the grid increases, then in an instant, the turbine and generator shaft torque increases and the speed decreases, as if you suddenly have a heavy load on your shoulders, and then the pace slows. Because the frequency of the domestic grid is a fixed 50 Hz, the generator must be 3,000 RPM or 1,500 rpm. At this time speed probe detected that the speed is low, then this signal to the control system, the system after calculation, will give the turbine issued a command signal: GIVE POINT FORCE! So the control valve of the turbine, opens up and lets in more steam. Then the turbine speed is increased, so that the shafting speed recovery. Thus achieves the power generation to increase, the rotational speed invariable effect. 2. Load reduction is the same, the load is reduced, people get high, the steam turbine will turn faster, then the speed probe told the control system [6]. The Steam Turbine Control Valve is turned down, the steam intake is reduced, the steam turbine is calm, the speed is reduced. Thus achieving, reducing power generation, speed constant. For hydro power stations, the water head of the turbine can also be used to regulate the amount of electricity generated. So, in general, there is no more electricity to do, this kind of obsession. Of course, the details are complex, such as nuclear power, biomass, green energy, solar power, wind power and so on have policy incentives or difficult to regulate, may rarely limit their power generation, even if the demand for electricity is reduced. If they produce too much, they may simply cut off some of their load to keep the grid safe. In addition, there are some ways to store electricity, such as pumped storage, batteries and so on. As shown in Table 1:

| 1. PSS Out | Oscillation frequency | Damping ratio |
|------------|-----------------------|--------------|
| Normal parameter range | 0.8-2Hz | 0-0.15 |
| Allowable deviation | 10% | 0.02 |

| 2. PSS engaged | Oscillation frequency | Damping ratio |
|---------------|-----------------------|--------------|
| Normal parameter range | 0.8-2Hz | >0.1 |
| Allowable deviation | 20% | 0.05 |
Reactive power adequacy, refers to the generator excitation system and load factor is less than the installed capacity of a lot of meaning. The excess of active power means that the excitation system and load equal to the factor of infinite equal to the installed capacity means, here is not involved in the apparent power of the stubble. The rated power of the generator is about 0.85, that is to say, 15% of the apparent power is used to maintain its normal operation, which includes the operation of the excitation system. If it is excitation, we are to mobilize the energy of another coaxial generator is another generator reactive power no-load to maintain the normal operation of excitation, then this generator is no problem to regulate the voltage. If the excitation is self-shunt, then the problem comes that the rotor magnetic field directly affects the voltage of the stator winding, so the rotor current must be adjusted to adjust the terminal voltage or reactive power of the generator.

4. Conclusion
With the ever-changing of science and technology, the research on intelligent control of synchronous generator excitation system based on computer technology will be more and more advanced. Synchronous Generator excitation system plays an important role in the national life and has made great contributions to the economic development.

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