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TARMOQDA REAKTIV QUVVATNI KOMPENSATSIYA QILISHNING SAMARALI USULI

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Annotatsiya: Hozirgi vaqtda transformatorning past kuchlanishli tomoni shahar taqsimlash tarmog`ida umumiy hisoblanadi, chunki maishiy texnika induktiv yuklamasi ortib bormoqda, quvvat koeffitsienti pasayganligi sababli, bu umumiy transformatorning past kuchlanishli tomonining katta yo`qotilishiga olib keladi, buni quvvat zo`riqishlarida ko`rishimiz mumkin. Bunday holat foydalanuvchi talablariga javob bermaydi. Shu sababli, reaktiv quvvatni kompensatsiyalash tizimini loyihalash yana bir dolzarb tadqiqotga aylandi. Ushbu maqola reaktiv quvvat kompensatsiyasi tamoyilini taqdim etadi, reaktiv quvvat kompensatsiyasining asosiy texnologiyalarini tahlil qiladi, reaktiv quvvatni avtomatik kompensatsiyalash uskunasining turli kamchiliklarini bartaraf etish uchun reaktiv quvvatni avtomatik kompensatsiya tizimining umumiy dasturini ishlab chiqish to`g`risida fikr yuritiladi.

Kalit so'zlar: reaktiv; avtomatik kompensatsiya; tizimni loyihalash quvvat sistemasi

. ЭФФЕКТИВНЫЙ МЕТОД КОМПЕНСАЦИИ РЕАКТИВНОЙ МОЩНОСТИ В СЕТИ

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Аннотация: В настоящее время низковольтная сторона трансформатора распространена в распределительной сети постоянного тока, т. к. увеличивается индуктивная нагрузка бытовых приборов, при снижении коэффициента мощности это приводит к большим потерям низковольтной стороны трансформатора. общий трансформатор, который мы можем видеть в силовых напряжениях. Эта ситуация не соответствует требованиям пользователя. Поэтому разработка системы компенсации реактивной мощности стала еще одним актуальным исследованием. В данной статье вводится принцип компенсации реактивной мощности, анализируются основные технологии компенсации реактивной мощности, а также рассматривается разработка общей программы системы автоматической компенсации реактивной мощности для устранения различных недостатков аппаратуры автоматической компенсации реактивной мощности.

Ключевые слова: реактивный; автоматическая компенсация; система питания

EFFECTIVE METHOD OF REACTIVE POWER COMPENSATION IN THE NETWORK

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Abstract: At present, low-voltage side of transformer is public in urban distribution network, as inductive load of household appliances is increasing, the power factor decreased, this lead to a large loss of public transformer low voltage side, the supply voltage indicators can not meet user's requirements. Therefore, the design of reactive power compensation system has become another popular research. This paper introduces the principle of reactive power compensation, analyzes key technologies of reactive power compensation, design an overall program of reactive power automatic compensation system to conquer various deficiencies of reactive power automatic compensation equipment.

Keywords: reactive; automatic compensation; system design power system.

1. Introduction

Power system is a typical nonlinear system, together with the social progress and economic development, the entire social demand of electricity increased, this leads to the rapid development of modern power system; it's becoming more and more complex. Large units, heavy duty, high pressure longdistance transmission, development of the large-scale Internet, as well as the power system security, economy and high power quality requirements all these made flexible transmission system technology an important area of research in the current power system. Traditional reactive power compensation equipment can meet a range of reactive power compensation requirements, but has slow response, failure to maintain the difficulties and other shortcomings Static reactive Compensator gained great development in recent years, has been widely used in the compensation of long-distance transmission, and also a large number of load reactive compensation. In addition to improvements in control devices, along with the continuous development of artificial intelligence, it also has great progress in the control method. at present, low-voltage side of transformer is public in urban distribution network, as inductive load of household appliances is increasing, the power factor decreased, this lead to public a large loss of

transformer low voltage side, the supply voltage indicators can not meet user requirements. Therefore, the design of reactive power compensation system has become another popular research. This paper introduces the principle of reactive power compensation, analyzes key technologies of reactive power compensation, design an overall program of reactive power automatic compensation system to conquer various deficiencies of reactive power automatic compensation equipment.

As you know, alternating current flows through a conductor in both directions in a circuit. Ideally, the consumer should fully absorb and process the received energy. If there is a mismatch between the generator and the consumer, the electric current flows simultaneously from the generator to the consumer and from the consumer to the generator (the consumer returns the energy stored in it to the circuit). Such a situation occurs only if there are reactive elements with inductive and capacitive resistance in the alternating current circuit. An inductive reactance element tends to keep the current flowing through it, and a capacitive element tends to keep the voltage constant. In ideal resistive and inductive elements, the current flowing through them reaches its maximum value when the voltage is zero, and vice versa, in capacitive elements, the voltage is maximum when the current is close to zero.

Reactive power is the power generated by electromagnetic fields absorbed by consumers and torques of motors. Reactive power occurs in devices with inductive coupling. For example, electrical devices used in agriculture, water management, construction, food, pharmaceutical, energy and machine-building industries (transformers at all stages of transformation, asynchronous electric motors, stabilizers, which consume 35% of the full power used for household and personal needs, 40% electric furnaces 8%, electric networks 7%, transformers 10%, etc.) magnetic fields are created in devices for their normal operation. These are "Inductively Coupled Consumers". If the consumer (resistor) has an active character in electrical circuits, the phase difference between current and voltage is zero. If the consumer has an inductive connection (motors, transformers are in the operating

mode only), the current lags behind the voltage. When the consumer has capacitive coupling (capacitors), the current leads the voltage.

Economical use of all types of energy, including electricity, issues of improving the efficiency of electrical devices are important. In recent years, great attention has been paid to improving the quality of electricity. The quality of electricity can have a significant impact on the consumption of electricity, the reliability of power supply systems and the technological process of production. Rational reactive power compensation reduces energy losses due to reactive power flows, ensures the quality of consumed electricity by regulating and stabilizing the voltage level in electrical networks, and achieves high technical and economic performance of electrical devices. The problem of reactive power compensation in the country's electrical systems is of great importance for the following reasons:

1) the consumption of reactive power compared to active power in industrial production has increased significantly;

2) consumption of reactive power in city power grids has increased due to the growth of household loads;

3) reactive power consumption in agricultural power networks is increasing.

Currently, due to the increasing demand for electricity, we can save electricity by compensating reactive energy. To compensate for the reactive power of the electric motor, it is necessary to calculate the power of the capacitor device. Most of the electricity produced in our country comes from pumping stations, transmission lines, distribution devices, and electric motors.

2. The Principle of Reactive Power Compensation

In the power system, due to inductance and capacitance components, the power can be active and also reactive. Although reactive power itself does not consume energy and transmission of its energy is only between power and load this kind of energy exchange process will cause the loss of power, it will increase the apparent power, which will have a negative impact on the system following systems. Impacts list as below.

a) Increase in total current will make the capacity power system components such as transformers, electrical equipment, wires and others increase. this will casuse the increase of the size of user's starting control equipment and measurement instruments, thus increasing the initial investment costs. With the same power, the total current increases, the loss of equipment and line increases, all these leads to the line and transformer voltage loss increases.

b) Lack of reactive power capacity will cause low load side of the supply voltage, affecting the normal production and power consumption. On the contrary, excess reactive power capacity will result in high operating voltage and large voltage wave. Low power factor will cause a large number of low power consumption, when the power factor decreased from 0.8 to 0.6, the energy loss nearly doubled.

c) Low power factor will cause a large number of low power consumption, when the power factor decreased from 0.8 to 0.6, the energy loss nearly doubled.

d) To power generation equipment of the power system, reactive current increases will cause the the magnetic effect increase of generator rotor and voltage decrease, excessive increase in excitation current will cause the rotor windings exceed the allowable temperature rise. Now, with the rapid development of power electronics technology, the factory use a large number of high-power switching devices composed of equipment of large, impact loads. This makes power quality a growing problem.

One of the properties of an inductance is that it creates a phase difference between the current and the voltage as it maintains the current flowing through it. The phase difference between the current and the voltage leads to a decrease in the energy of the electromagnetic field supplied by the inductance network. For many industrial consumers, this means that in addition to active energy that does useful work, reactive energy that does not do useful work flows through the networks between the electricity generator and the consumer.

3. The Key Technology of Reactive Power Compensation

In the past, most power compensation devices use SCM; realize group switching of capacitor by mechanical circuit breaker. The disadvantage is the limited life of mechanical contact and easy to be damaged. And the switching series of capacitor is limited. Currently, reactive power compensation device is controlled by thyristor, compared with mechanical circuit breaker, the operating life of thyristor is almost unlimited, and the switching time of thyristor can be precisely controlled to reduce the impact of switching current and operating difficulties. However, the existing reactive power compensation devices with no-contact control are mostly controlling the switching capacity by controlling the trigger angle. This will cause greater impact of current and the introduction of high harmonics, so that the life of thyristor becomes shorter. To overcome these weaknesses, we designed main circuit; the corresponding trigger circuit is designed to eliminate the inrush current generated during non-contact capacitor switching, at the same time, inspired by the resistance furnace temperature control system, on-off rate control is introduced to control the switching capacitor, and achieve the objective of stepless adjustment and reduction of harmonic pollution.

4. Reactive Power Automatic Compensation System Design

We conducted a comprehensive survey on the province power grid factor, and selected current, voltage, load and power factor of 30 public transformers in a certain area randomly to keep on tracking, and analyze the data. Meanwhile, we search a large number of related books and materials, to learn about the status and background of oversea reactive power compensation devices and find out inadequet points to obtain firsthand data and information. According to the investigation, to solve the automatic reactive compensation equipment deficiencies, two-stage control is conducted by Industrial Personal Computer to work together to several stand alone systems according to the information from lower machine, to make the economically and compensation effect of system the best. Regarding to the design of single device, we emphasis on continuous adjustment on reactance compensation. Control of three loads can inhibit the generation of voltage and current harmonics. Referring to performance, we emphasis on the research on high reliability

industrial Intelligent Computer Control System. On hardware and software design, we emphasize the reliability, antiinterference ability and accuracy of detection and control of the system. Module

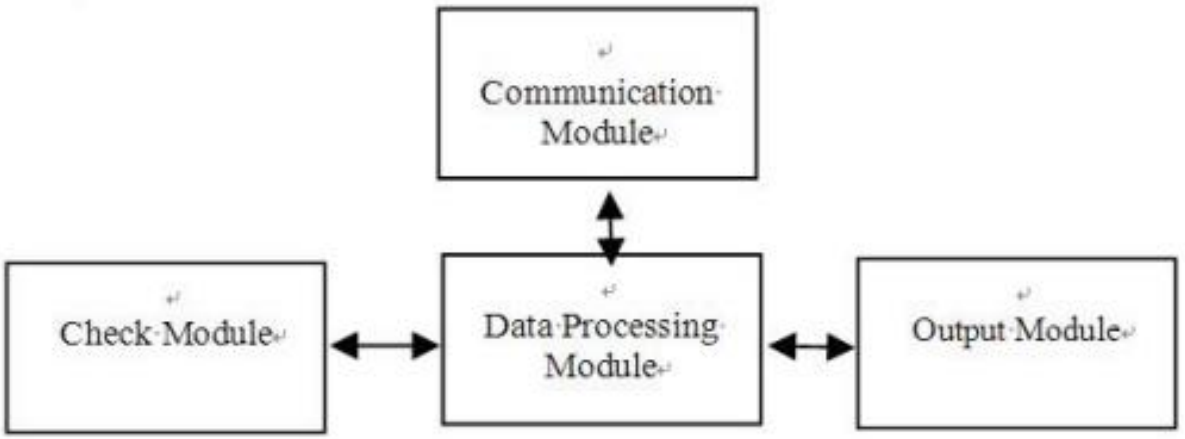

Figure 1. Overall structure diagram

structure of stand-alone system shown in Fig. 1

Data processing module with industrial grade 16-bit microprocessor core, all chips, transmitters and components of check module, data processing module and output module are soldered the same circuit board. Effectively ensure the overall system reliability. Use CAD technology to optimize the whole circuit to achieve the best results of circuit layout and wiring to prevent high frequency interference and ensure the reliability of data transmission. Individually shielded communication module as a separate data interface plug. In software design, the new method of setting potentiometer was introduced, this not only simplify the system hardware, and also turned the parameter intuitive.

Control system diagram shown in Fig. 2. Singe device send the information of its power grid to the host computer, after comprehensive analysis of information from various stand-alone systems, host will coordinate all stand-alone systems to achieve the best performance of the whole system. At the same time, realize easier debugging.

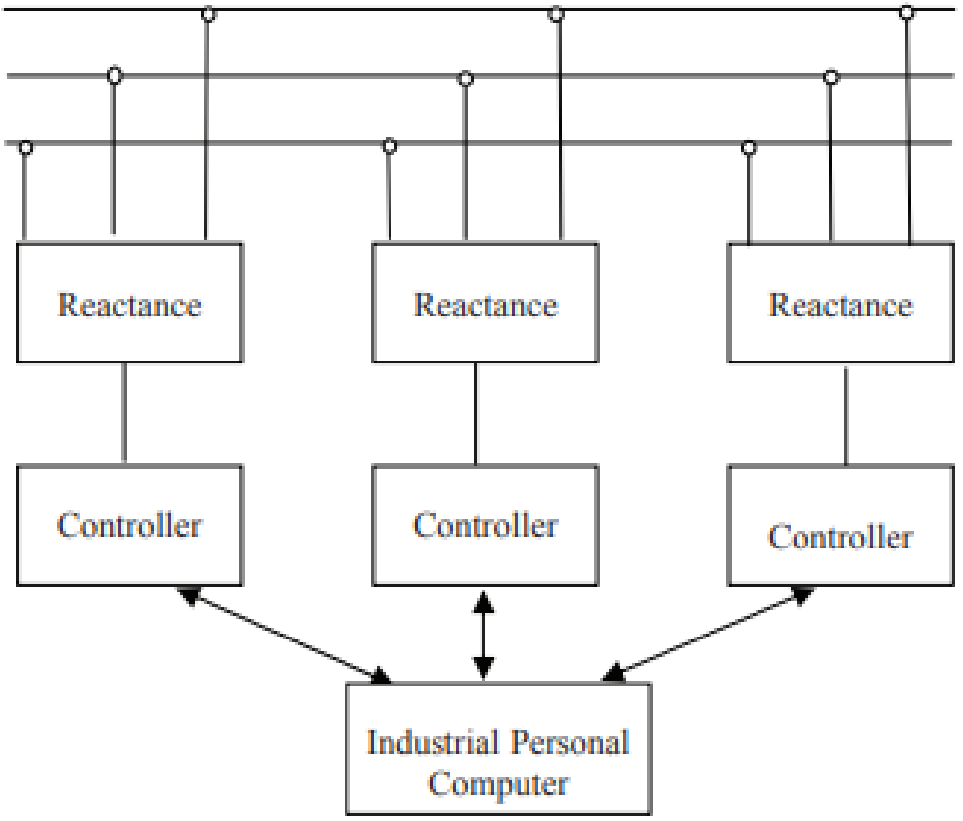

Figure 2. Diagram for the principle of multi-machine cooperative control

Conclusion

At present, the urban distribution network use public transformer low voltage side, As the user continues to increase inductive load appliances, making power factor even lower. Lead to public loss of a large transformer low voltage side of the line, the supply voltage indicators can not meet user requirements. Therefore, the design of reactive power compensation system has become another popular research. This paper introduces the principle of reactive power compensation, analysis the key technology of reactive power compensation, and designed the automatic reactive compensation system overall program according to the current status of lacking of reactive compensation devices.

Proper reactive power compensation will reduce overall electricity costs and heat losses. By reducing the load on the elements of the electric power distribution network

(supply lines, transformers and switchgear, etc.), it extends their service life. In addition, it reduces the level of high harmonics that appear when using certain types of devices, eliminates disturbances that appear in the network, and reduces the phase difference. It provides opportunities to increase the reliability and efficiency of electric power distribution networks.

Currently, reactive power compensation is an important factor that allows solving the problem of energy saving in almost any enterprise. According to the estimates of local and leading foreign experts, the share of energy resources, in particular, electricity, in the cost of production is 30-40 percent. Reactive power compensation is the key to energy conservation. Accordingly, when the reactive power is compensated (using RQAK - automatically controlled capacitor blocks), the current consumed from the network is reduced by 7-35%, depending on the cosph, as well as the heating of the conductive wires and the wear of the insulation.

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